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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                         |                        |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                         | Application Number     |              |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |                                         |                        |              |

## Secrecy Order 37 CFR 5.2

|                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## Inventor Information:

|                                                                                                                                                                                 |                   |                       |                    |                               |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|--------------------|-------------------------------|---------------|
| <b>Inventor 1</b>                                                                                                                                                               |                   |                       |                    |                               | <b>Remove</b> |
| <b>Legal Name</b>                                                                                                                                                               |                   |                       |                    |                               |               |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>    | <b>Family Name</b> | <b>Suffix</b>                 |               |
|                                                                                                                                                                                 | Jefferey          | C.                    | Solomon            |                               |               |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                       |                    |                               |               |
| <b>City</b>                                                                                                                                                                     | Irvine            | <b>State/Province</b> | CA                 | <b>Country of Residence i</b> | US            |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                   |                       |                    |                               |               |
| <b>Address 1</b>                                                                                                                                                                |                   | 16 Silver Fir         |                    |                               |               |
| <b>Address 2</b>                                                                                                                                                                |                   |                       |                    |                               |               |
| <b>City</b>                                                                                                                                                                     | Irvine            | <b>State/Province</b> | CA                 |                               |               |
| <b>Postal Code</b>                                                                                                                                                              | 92604             | <b>Country i</b>      | US                 |                               |               |
| <b>Inventor 2</b>                                                                                                                                                               |                   |                       |                    |                               | <b>Remove</b> |
| <b>Legal Name</b>                                                                                                                                                               |                   |                       |                    |                               |               |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>    | <b>Family Name</b> | <b>Suffix</b>                 |               |
|                                                                                                                                                                                 | Jayesh            | R.                    | Bhakta             |                               |               |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                       |                    |                               |               |
| <b>City</b>                                                                                                                                                                     | Cerritos          | <b>State/Province</b> |                    | <b>Country of Residence i</b> | US            |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                   |                       |                    |                               |               |
| <b>Address 1</b>                                                                                                                                                                |                   | 12220 Rose Street     |                    |                               |               |
| <b>Address 2</b>                                                                                                                                                                |                   |                       |                    |                               |               |
| <b>City</b>                                                                                                                                                                     | Cerritos          | <b>State/Province</b> | CA                 |                               |               |
| <b>Postal Code</b>                                                                                                                                                              | 90703             | <b>Country i</b>      | US                 |                               |               |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button.                                     |                   |                       |                    |                               | <b>Add</b>    |

## Correspondence Information:

|                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Enter either Customer Number or complete the Correspondence Information section below.</p> <p>For further information see 37 CFR 1.33(a).</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------|

|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

☐ An Address is being provided for the correspondence information of this application.

|                 |                 |                                          |                                             |
|-----------------|-----------------|------------------------------------------|---------------------------------------------|
| Customer Number | 79141           |                                          |                                             |
| Email Address   | jz@jzpatent.com | <input type="button" value="Add Email"/> | <input type="button" value="Remove Email"/> |

### Application Information:

|                                         |                                         |                                           |                                     |
|-----------------------------------------|-----------------------------------------|-------------------------------------------|-------------------------------------|
| Title of the Invention                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                                           |                                     |
| Attorney Docket Number                  | NETL.018P2C7                            | Small Entity Status Claimed               | <input checked="" type="checkbox"/> |
| Application Type                        | Nonprovisional                          |                                           |                                     |
| Subject Matter                          | Utility                                 |                                           |                                     |
| Suggested Class (if any)                |                                         | Sub Class (if any)                        |                                     |
| Suggested Technology Center (if any)    |                                         |                                           |                                     |
| Total Number of Drawing Sheets (if any) | 23                                      | Suggested Figure for Publication (if any) | 8D                                  |

### Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

**Request Not to Publish.** I hereby request that the attached application not be published under

☐ 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

|                    |                                                  |                                              |                                                         |
|--------------------|--------------------------------------------------|----------------------------------------------|---------------------------------------------------------|
| Please Select One: | <input checked="" type="radio"/> Customer Number | <input type="radio"/> US Patent Practitioner | <input type="radio"/> Limited Recognition (37 CFR 11.9) |
| Customer Number    | 79141                                            |                                              |                                                         |

### Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

|                          |                 |                                       |                          |
|--------------------------|-----------------|---------------------------------------|--------------------------|
| Prior Application Status | Pending         | <input type="button" value="Remove"/> |                          |
| Application Number       | Continuity Type | Prior Application Number              | Filing Date (YYYY-MM-DD) |
|                          | Continuation of | 13287081                              | 2011-11-01               |

|                                           |  |                                         |  |              |  |
|-------------------------------------------|--|-----------------------------------------|--|--------------|--|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number                  |  | NETL.018P2C7 |  |
|                                           |  | Application Number                      |  |              |  |
| Title of Invention                        |  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |  |              |  |

|                          |                         |                          |                          |                        |                         |
|--------------------------|-------------------------|--------------------------|--------------------------|------------------------|-------------------------|
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 13287081                 | Continuation of         | 13032470                 | 2011-02-22               | 8081536                | 2011-12-20              |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 13032470                 | Continuation of         | 12955711                 | 2010-11-29               | 7916574                | 2011-03-29              |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12955711                 | Continuation of         | 12629827                 | 2009-12-02               | 7881150                | 2011-02-01              |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12629827                 | Continuation of         | 12408652                 | 2009-03-20               | 7636274                | 2009-12-22              |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12408652                 | Continuation of         | 11335875                 | 2006-01-19               | 7532537                | 2009-05-12              |
| Prior Application Status |                         | Expired                  |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11335875                 | non provisional of      | 60645087                 | 2005-01-19               |                        |                         |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 11335875                 | Continuation in part of | 11173175                 | 2005-07-01               | 7289386                | 2007-10-30              |
| Prior Application Status |                         | Expired                  |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11173175                 | non provisional of      | 60588244                 | 2004-07-15               |                        |                         |
| Prior Application Status |                         | Patented                 |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 11173175                 | Continuation in part of | 11075395                 | 2005-03-07               | 7286436                | 2007-10-23              |
| Prior Application Status |                         | Expired                  |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11075395                 | non provisional of      | 60550668                 | 2004-03-05               |                        |                         |
| Prior Application Status |                         | Expired                  |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type         | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11075395                 | non provisional of      | 60575595                 | 2004-05-28               |                        |                         |

|                                                                                                                       |                                         |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------|--------------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                             |                                         | Attorney Docket Number   | NETL.018P2C7             |
|                                                                                                                       |                                         | Application Number       |                          |
| Title of Invention                                                                                                    | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                          |                          |
| Prior Application Status                                                                                              | Expired                                 | <a href="#">Remove</a>   |                          |
| Application Number                                                                                                    | Continuity Type                         | Prior Application Number | Filing Date (YYYY-MM-DD) |
| 11075395                                                                                                              | non provisional of                      | 60590038                 | 2004-07-21               |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. |                                         |                          | <a href="#">Add</a>      |

### Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

|                                                                                                        |           |                          |                                                               |
|--------------------------------------------------------------------------------------------------------|-----------|--------------------------|---------------------------------------------------------------|
|                                                                                                        |           |                          | <a href="#">Remove</a>                                        |
| Application Number                                                                                     | Country i | Filing Date (YYYY-MM-DD) | Priority Claimed                                              |
|                                                                                                        |           |                          | <input checked="" type="radio"/> Yes <input type="radio"/> No |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button. |           |                          | <a href="#">Add</a>                                           |

### Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

### Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.



|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                |                                                                        |                                       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------|-------|
| <b>Applicant 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |                                                                |                                                                        | <input type="button" value="Remove"/> |       |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> |  |                                                                |                                                                        |                                       |       |
| <input type="button" value="Clear"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |                                                                |                                                                        |                                       |       |
| <input checked="" type="radio"/> Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | <input type="radio"/> Legal Representative under 35 U.S.C. 117 |                                                                        | <input type="radio"/> Joint Inventor  |       |
| <input type="radio"/> Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                                | <input type="radio"/> Person who shows sufficient proprietary interest |                                       |       |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |                                                                |                                                                        |                                       |       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                                |                                                                        |                                       |       |
| Name of the Deceased or Legally Incapacitated Inventor : <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |                                                                |                                                                        |                                       |       |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                |                                                                        |                                       |       |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | Netlist, Inc.                                                  |                                                                        |                                       |       |
| <b>Mailing Address Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |                                                                |                                                                        |                                       |       |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  | 51 Discovery, #150                                             |                                                                        |                                       |       |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                                |                                                                        |                                       |       |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | Irvine                                                         | State/Province                                                         |                                       | CA    |
| Country <sup>i</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | US                                                             | Postal Code                                                            |                                       | 92618 |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 949-435-0025                                                   | Fax Number                                                             |                                       |       |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  | gsasaki@netlist.com                                            |                                                                        |                                       |       |
| Additional Applicant Data may be generated within this form by selecting the Add button. <input type="button" value="Add"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                                                                |                                                                        |                                       |       |

## Non-Applicant Assignee Information:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.                                                                                                                                                                                                                                                                       |  |  |  |
| <b>Assignee 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |
| <p>Complete this section only if non-applicant assignee information is desired to be included on the patent application publication in accordance with 37 CFR 1.215(b). Do not include in this section an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest), as the patent application publication will include the name of the applicant(s).</p> |  |  |  |
| <input type="button" value="Remove"/>                                                                                                                                                                                                                                                                                                                                                                                                                     |  |  |  |
| If the Assignee is an Organization check here. <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |

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|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

|        |            |             |             |        |
|--------|------------|-------------|-------------|--------|
| Prefix | Given Name | Middle Name | Family Name | Suffix |
|        |            |             |             |        |

**Mailing Address Information:**

|               |  |                |  |
|---------------|--|----------------|--|
| Address 1     |  |                |  |
| Address 2     |  |                |  |
| City          |  | State/Province |  |
| Country i     |  | Postal Code    |  |
| Phone Number  |  | Fax Number     |  |
| Email Address |  |                |  |

Additional Assignee Data may be generated within this form by selecting the Add button.

Add

**Signature:**

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

|            |                  |           |                   |                     |
|------------|------------------|-----------|-------------------|---------------------|
| Signature  | /Jamie J. Zheng/ |           | Date (YYYY-MM-DD) | 2013-08-20          |
| First Name | Jamie            | Last Name | Zheng             | Registration Number |
|            |                  |           |                   | 51167               |

Additional Signature may be generated within this form by selecting the Add button.

Add

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

## LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

### CROSS-REFERENCE TO RELATED APPLICATIONS

**[0001]** The present application is a continuation of U.S. Pat. Appl. No. 13/287,081, filed November 1, 2011, which is a continuation of U.S. Pat. Appl. No. 13/032,470, filed February 22, 2011 and issued as U.S. Pat. No. 8,081,536, which is a continuation of U.S. Pat. Appl. No. 12/955,711, filed November 29, 2010 and issued as U.S. Pat. No. 7,916,574, which is a continuation of U.S. Pat. Appl. No. 12/629,827, filed December 2, 2009 and issued as U.S. Pat. No. 7,881,150, which is a continuation of U.S. Pat. Appl. No. 12/408,652, filed March 20, 2009 and issued as U.S. Pat. No. 7,636,274, which is a continuation of U.S. Pat. Appl. No. 11/335,875, filed January 19, 2006 and issued as U.S. Pat. No. 7,532,537, which claims the benefit of U.S. Provisional Appl. No. 60/645,087, filed January 19, 2005 and which is a continuation-in-part of U.S. Pat. Appl. No. 11/173,175, filed July 1, 2005 and issued as U.S. Pat. No. 7,289,386, which claims the benefit of U.S. Provisional Appl. No. 60/588,244, filed July 15, 2004 and which is a continuation-in-part of U.S. Pat. Appl. No. 11/075,395, filed March 7, 2005 and issued as U.S. Pat. No. 7,286,436, which claims the benefit of U.S. Provisional Appl. No. 60/550,668, filed March 5, 2004, U.S. Provisional Appl. No. 60/575,595, filed May 28, 2004, and U.S. Provisional Appl. No. 60/590,038, filed July 21, 2004. U.S. Pat. Appl. Nos. 13/287,081, 13/032,470, 12/955,711, 12/629,827, 12/408,652, 11/335,875, 11/173,175, and 11/075,395, and U.S. Provisional Appl. Nos. 60/550,668, 60/575,595, 60/590,038, 60/588,244, and 60/645,087 are each incorporated in its entirety by reference herein.

### BACKGROUND OF THE INVENTION FIELD OF THE INVENTION

**[0002]** The present invention relates generally to memory modules of a computer system, and more specifically to devices and methods for improving the performance, the memory capacity, or both, of memory modules. Description of the Related Art

**[0003]** Certain types of memory modules comprise a plurality of dynamic random-access memory (DRAM) devices mounted on a printed circuit board (PCB). These memory modules are typically mounted in a memory slot or socket of a computer system (e.g., a server system or a personal computer) and are accessed by the processor of the

computer system. Memory modules typically have a memory configuration with a unique combination of rows, columns, and banks which result in a total memory capacity for the memory module.

**[0004]** For example, a 512-Megabyte memory module (termed a “512-MB” memory module, which actually has  $2^{29}$  or 536,870,912 bytes of capacity) will typically utilize eight 512-Megabit DRAM devices (each identified as a “512-Mb” DRAM device, each actually having  $2^{29}$  or 536,870,912 bits of capacity). The memory cells (or memory locations) of each 512-Mb DRAM device can be arranged in four banks, with each bank having an array of  $2^{24}$  (or 16,777,216) memory locations arranged as  $2^{13}$  rows and  $2^{11}$  columns, and with each memory location having a width of 8 bits. Such DRAM devices with 64M 8-bit-wide memory locations (actually with four banks of  $2^{27}$  or 134,217,728 one-bit memory cells arranged to provide a total of  $2^{26}$  or 67,108,864 memory locations with 8 bits each) are identified as having a “64Mb x 8” or “64M x 8-bit” configuration, or as having a depth of 64M and a bit width of 8. Furthermore, certain commercially-available 512-MB memory modules are termed to have a “64M x 8-byte” configuration or a “64M x 64-bit” configuration with a depth of 64M and a width of 8 bytes or 64 bits.

**[0005]** Similarly, a 1-Gigabyte memory module (termed a “1-GB” memory module, which actually has  $2^{30}$  or 1,073,741,824 bytes of capacity) can utilize eight 1-Gigabit DRAM devices (each identified as a “1-Gb” DRAM device, each actually having  $2^{30}$  or 1,073,741,824 bits of capacity). The memory locations of each 1-Gb DRAM device can be arranged in four banks, with each bank having an array of memory locations with  $2^{14}$  rows and  $2^{11}$  columns, and with each memory location having a width of 8 bits. Such DRAM devices with 128M 8-bit-wide memory locations (actually with a total of  $2^{27}$  or 134,217,728 memory locations with 8 bits each) are identified as having a “128Mb x 8” or “128M x 8-bit” configuration, or as having a depth of 128M and a bit width of 8. Furthermore, certain commercially-available 1-GB memory modules are identified as having a “128M x 8-byte” configuration or a “128M x 64-bit” configuration with a depth of 128M and a width of 8 bytes or 64 bits.

**[0006]** The commercially-available 512-MB (64M x 8-byte) memory modules and the 1-GB (128M x 8-byte) memory modules described above are typically used in

computer systems (e.g., personal computers) which perform graphics applications since such “x 8” configurations are compatible with data mask capabilities often used in such graphics applications. Conversely, memory modules with “x 4” configurations are typically used in computer systems such as servers which are not as graphics-intensive. Examples of such commercially available “x 4” memory modules include, but are not limited to, 512-MB (128M x 4-byte) memory modules comprising eight 512-Mb (128Mb x 4) memory devices.

[0007] The DRAM devices of a memory module are generally arranged as ranks or rows of memory, each rank of memory generally having a bit width. For example, a memory module in which each rank of the memory module is 64 bits wide is described as having an “x 64” organization. Similarly, a memory module having 72-bit-wide ranks is described as having an “x 72” organization.

[0008] The memory capacity of a memory module increases with the number of memory devices. The number of memory devices of a memory module can be increased by increasing the number of memory devices per rank or by increasing the number of ranks. For example, a memory module with four ranks has double the memory capacity of a memory module with two ranks and four times the memory capacity of a memory module with one rank. Rather than referring to the memory capacity of the memory module, in certain circumstances, the memory density of the memory module is referred to instead.

[0009] During operation, the ranks of a memory module are selected or activated by address and command signals that are received from the processor. Examples of such address and command signals include, but are not limited to, rank-select signals, also called chip-select signals. Most computer and server systems support one-rank and two-rank memory modules. By only supporting one-rank and two-rank memory modules, the memory density that can be incorporated in each memory slot is limited.

[0010] Various aspects of the design of a memory module impose limitations on the size of the memory arrays of the memory module. Certain such aspects are particularly important for memory modules designed to operate at higher frequencies. Examples of such aspects include, but are not limited to, memory device (e.g., chip) densities, load fan-out, signal integrity, available rank selects, power dissipation, and thermal profiles.

## SUMMARY OF THE INVENTION

**[0011]** In certain embodiments, a circuit is mountable on a memory module that includes a plurality of memory devices and operable in a computer system to perform memory operations in response to memory commands from a memory controller. The circuit comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of output control/address signals are provided to the plurality of memory devices. The circuit further comprises logic to monitor the memory commands from the memory controller and to selectively isolate one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

**[0012]** In certain embodiments, the circuit further comprises DQ-DQS paths, and the logic selectively isolates one or more first memory devices by disabling at least one first group of DQ-DQS paths so as to isolate the one or more first memory devices. In certain embodiments, the logic is further configured to enable at least one second group of DQ-DQS paths in response to the respective memory command so as to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals. In certain embodiments, the logic element includes a buffer circuit to electrically and selectively isolate the one or more first memory devices from the memory controller and to selectively allow one or more second memory devices to communicate data with the memory controller, the buffer circuit adding a time delay (e.g., one clock cycle) to a data signal from the one or more second memory devices to the memory controller. In certain embodiments, the logic provides functions of a data path multiplexer/demultiplexer using the time delay. In certain embodiments, the logic is further configured to translate between a system memory domain and a physical memory device domain by generating a greater number of output control/address signals than the number of input control/address signals in response to the respective memory command. In certain embodiments, the logic

receives one or more input chip select signals associated with the respective memory command, the one or more input chip select signals being less in number than chip-select signals in the output control/address signals.

**[0013]** In certain embodiments, a method of operating a circuit in a memory module comprises receiving a set of input control/address signals associated with a respective memory command from the memory controller, generating a set of output control/address signals in response to the set of input control/address signals, and providing the set of output control/address signals to a plurality of memory devices operable to perform memory operations in response to memory commands from a memory controller. The method further comprises monitoring the memory commands from the memory controller, and selectively isolating one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the memory controller while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals. In certain embodiments, the method further comprises disabling at least one first group of DQ-DQS paths to isolate the one or more first memory devices and selectively enabling at least one second group of DQ-DQS paths to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals. In certain embodiments, the set of input control/address signals include at least one chip-select signal and the set of output control/address signals include a greater number of chip-select signals.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0014]** Figure 1 schematically illustrates an example memory module in accordance with certain embodiments described herein.

**[0015]** Figure 2 schematically illustrates a circuit diagram of two memory devices of a conventional memory module.

**[0016]** Figure 3A and 3B schematically illustrate example memory modules having a circuit which selectively isolates one or both of the DQ data signal lines of the two



memory devices from the computer system in accordance with certain embodiments described herein.

[0017] Figures 4A and 4B schematically illustrate example memory modules having a circuit which selectively isolates one or both of the DQ data signal lines of the two ranks of memory devices from the computer system in accordance with certain embodiments described herein.

[0018] Figures 5A-5D schematically illustrate example memory modules having a circuit comprising a logic element and one or more switches operatively coupled to the logic element in accordance with certain embodiments described herein.

[0019] Figure 6A shows an exemplary timing diagram of a gapless read burst for a back-to-back adjacent read condition from one memory device.

[0020] Figure 6B shows an exemplary timing diagram with an extra clock cycle between successive read commands issued to different memory devices for successive read accesses from different memory devices.

[0021] Figure 7 shows an exemplary timing diagram in which the last data strobe of memory device "a" collides with the pre-amble time interval of the data strobe of memory device "b."

[0022] Figures 8A-8D schematically illustrate circuit diagrams of example memory modules comprising a circuit which multiplexes the DQS data strobe signal lines from one another in accordance with certain embodiments described herein.

[0023] Figure 9A schematically illustrates an example memory module with four ranks of memory devices compatible with certain embodiments described herein.

[0024] Figure 9B schematically illustrates an example memory module with two ranks of memory devices compatible with certain embodiments described herein.

[0025] Figure 9C schematically illustrates another example memory module in accordance with certain embodiments described herein.

[0026] Figure 10A schematically illustrates an exemplary memory module which doubles the rank density in accordance with certain embodiments described herein.

[0027] Figure 10B schematically illustrates an exemplary circuit compatible with embodiments described herein.

[0028] Figure 11A schematically illustrates an exemplary memory module which doubles number of ranks in accordance with certain embodiments described herein.

[0029] Figure 11B schematically illustrates an exemplary circuit compatible with embodiments described herein.

[0030] Figure 12 schematically illustrates an exemplary memory module in which a data strobe (DQS) pin of a first memory device is electrically connected to a DQS pin of a second memory device while both DQS pins are active.

[0031] Figure 13 is an exemplary timing diagram of the voltages applied to the two DQS pins due to non-simultaneous switching.

[0032] Figure 14 schematically illustrates another exemplary memory module in which a DQS pin of a first memory device is connected to a DQS pin of a second memory device.

[0033] Figure 15 schematically illustrates an exemplary memory module in accordance with certain embodiments described herein.

[0034] Figures 16A and 16B schematically illustrate a first side and a second side, respectively, of a memory module with eighteen 64M x 4 bit, DDR-1 SDRAM FBGA memory devices on each side of a 184-pin glass-epoxy printed circuit board.

[0035] Figures 17A and 17B schematically illustrate an exemplary embodiment of a memory module in which a first resistor and a second resistor are used to reduce the current flow between the first DQS pin and the second DQS pin.

[0036] Figure 18 schematically illustrates another exemplary memory module compatible with certain embodiments described herein.

[0037] Figure 19 schematically illustrates a particular embodiment of the memory module schematically illustrated by Figure 18.

#### Detailed Description of Example Embodiments

##### Load Isolation

[0038] Figure 1 schematically illustrates an example memory module 10 compatible with certain embodiments described herein. The memory module 10 is connectable to a memory controller 20 of a computer system (not shown). The memory module 10 comprises a plurality of memory devices 30, each memory device 30 having a

corresponding load. The memory module 10 further comprises a circuit 40 electrically coupled to the plurality of memory devices 30 and configured to be electrically coupled to the memory controller 20 of the computer system. The circuit 40 selectively isolates one or more of the loads of the memory devices from the computer system. The circuit 40 comprises logic which translates between a system memory domain of the computer system and a physical memory domain of the memory module 10.

**[0039]** As used herein, the term “load” is a broad term which includes, without limitation, electrical load, such as capacitive load, inductive load, or impedance load. As used herein, the term “isolation” is a broad term which includes, without limitation, electrical separation of one or more components from another component or from one another. As used herein, the term “circuit” is a broad term which includes, without limitation, an electrical component or device, or a configuration of electrical components or devices which are electrically or electromagnetically coupled together (e.g., integrated circuits), to perform specific functions.

**[0040]** Various types of memory modules 10 are compatible with embodiments described herein. For example, memory modules 10 having memory capacities of 512-MB, 1-GB, 2-GB, 4-GB, 8-GB, as well as other capacities, are compatible with embodiments described herein. Certain embodiments described herein are applicable to various frequencies including, but not limited to 100 MHz, 200 MHz, 400 MHz, 800 MHz, and above. In addition, memory modules 10 having widths of 4 bytes, 8 bytes, 16 bytes, 32 bytes, or 32 bits, 64 bits, 128 bits, 256 bits, as well as other widths (in bytes or in bits), are compatible with embodiments described herein. In certain embodiments, the memory module 10 comprises a printed circuit board on which the memory devices 30 are mounted, a plurality of edge connectors configured to be electrically coupled to a corresponding plurality of contacts of a module slot of the computer system, and a plurality of electrical conduits which electrically couple the memory devices 30 to the circuit 40 and which electrically couple the circuit 40 to the edge connectors. Furthermore, memory modules 10 compatible with embodiments described herein include, but are not limited to, single in-line memory modules (SIMMs), dual in-line memory modules (DIMMs), small-outline DIMMs (SO-

DIMMs), unbuffered DIMMs (UDIMMs), registered DIMMs (RDIMMs), fully-buffered DIMM (FBDIMM), rank-buffered DIMMs (RBDIMMs), mini-DIMMs, and micro-DIMMs.

[0041] Memory devices 30 compatible with embodiments described herein include, but are not limited to, random-access memory (RAM), dynamic random-access memory (DRAM), synchronous DRAM (SDRAM), and double-data-rate DRAM (e.g., SDR, DDR-1, DDR-2, DDR-3). In addition, memory devices 30 having bit widths of 4, 8, 16, 32, as well as other bit widths, are compatible with embodiments described herein. Memory devices 30 compatible with embodiments described herein have packaging which include, but are not limited to, thin small-outline package (TSOP), ball-grid-array (BGA), fine-pitch BGA (FBGA), micro-BGA ( $\mu$ BGA), mini-BGA (mBGA), and chip-scale packaging (CSP). Memory devices 30 compatible with embodiments described herein are available from a number of sources, including but not limited to, Samsung Semiconductor, Inc. of San Jose, California, Infineon Technologies AG of San Jose, California, and Micron Technology, Inc. of Boise, Idaho. Persons skilled in the art can select appropriate memory devices 30 in accordance with certain embodiments described herein.

[0042] In certain embodiments, the plurality of memory devices 30 comprises a first number of memory devices 30. In certain such embodiments, the circuit 40 selectively isolates a second number of the memory devices 30 from the computer system, with the second number less than the first number.

[0043] In certain embodiments, the plurality of memory devices 30 are arranged in a first number of ranks. For example, in certain embodiments, the memory devices 30 are arranged in two ranks, as schematically illustrated by Figure 1. In other embodiments, the memory devices 30 are arranged in four ranks. Other numbers of ranks of the memory devices 30 are also compatible with embodiments described herein.

[0044] In certain embodiments, the circuit comprises a logic element selected from a group consisting of: a programmable-logic device (PLD), an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), a custom-designed semiconductor device, and a complex programmable-logic device (CPLD). In certain embodiments, the logic element of the circuit 40 is a custom device. Sources of logic elements compatible with embodiments described herein include, but are not limited to,

Lattice Semiconductor Corporation of Hillsboro, Oregon, Altera Corporation of San Jose, California, and Xilinx Incorporated of San Jose, California. In certain embodiments, the logic element comprises various discrete electrical elements, while in certain other embodiments, the logic element comprises one or more integrated circuits.

[0045] In certain embodiments, the circuit 40 further comprises one or more switches which are operatively coupled to the logic element to receive control signals from the logic element. Examples of switches compatible with certain embodiments described herein include, but are not limited to, field-effect transistor (FET) switches, such as the SN74AUC1G66 single bilateral analog switch available from Texas Instruments, Inc. of Dallas, Texas.

[0046] Figure 2 schematically illustrates a circuit diagram of two memory devices 30a, 30b of a conventional memory module showing the interconnections between the DQ data signal lines 102a, 102b of the memory devices 30a, 30b and the DQS data strobe signal lines 104a, 104b of the memory devices 30a, 30b. Each of the memory devices 30a, 30b has a plurality of DQ data signal lines and a plurality of DQS data strobe signal lines, however, for simplicity, Figure 2 only illustrates a single DQ data signal line and a single DQS data strobe signal line for each memory device 30a, 30b. The DQ data signal lines 102a, 102b and the DQS data strobe signal lines 104a, 104b are typically conductive traces etched on the printed circuit board of the memory module. As shown in Figure 2, each of the memory devices 30a, 30b has their DQ data signal lines 102a, 102b electrically coupled to a common DQ line 112 and their DQS data strobe signal lines 104a, 104b electrically coupled to a common DQS line 114. The common DQ line 112 and the common DQS line 114 are electrically coupled to the memory controller 20 of the computer system. Thus, the computer system is exposed to the loads of both memory devices 30a, 30b concurrently.

[0047] In certain embodiments, the circuit 40 selectively isolates the loads of at least some of the memory devices 30 from the computer system. The circuit 40 of certain embodiments is configured to present a significantly reduced load to the computer system. In certain embodiments in which the memory devices 30 are arranged in a plurality of ranks, the circuit 40 selectively isolates the loads of some (e.g., one or more) of the ranks of the memory module 10 from the computer system. In certain other embodiments, the circuit 40

selectively isolates the loads of all of the ranks of the memory module 10 from the computer system. For example, when a memory module 10 is not being accessed by the computer system, the capacitive load on the memory controller 20 of the computer system by the memory module 10 can be substantially reduced to the capacitive load of the circuit 40 of the memory module 10.

[0048] As schematically illustrated by Figures 3A and 3B, an example memory module 10 compatible with certain embodiments described herein comprises a circuit 40 which selectively isolates one or both of the DQ data signal lines 102a, 102b of the two memory devices 30a, 30b from the common DQ data signal line 112 coupled to the computer system. Thus, the circuit 40 selectively allows a DQ data signal to be transmitted from the memory controller 20 of the computer system to one or both of the DQ data signal lines 102a, 102b. In addition, the circuit 40 selectively allows one of a first DQ data signal from the DQ data signal line 102a of the first memory device 30a or a second DQ data signal from the DQ data signal line 102b of the second memory device 30b to be transmitted to the memory controller 20 via the common DQ data signal line 112 (see, e.g., triangles on the DQ and DQS lines of Figures 3A and 3B which point towards the memory controller). While various figures of the present application denote read operations by use of DQ and DQS lines which have triangles pointing towards the memory controller, certain embodiments described herein are also compatible with write operations (e.g., as would be denoted by triangles on the DQ or DQS lines pointing away from the memory controller).

[0049] For example, in certain embodiments, the circuit 40 comprises a pair of switches 120a, 120b on the DQ data signal lines 102a, 102b as schematically illustrated by Figure 3A. Each switch 120a, 120b is selectively actuated to selectively electrically couple the DQ data signal line 102a to the common DQ signal line 112, the DQ data signal line 102b to the common DQ signal line 112, or both DQ data signal lines 102a, 102b to the common DQ signal line 112. In certain other embodiments, the circuit 40 comprises a switch 120 electrically coupled to both of the DQ data signal lines 102a, 102b, as schematically illustrated by Figure 3B. The switch 120 is selectively actuated to selectively electrically couple the DQ data signal line 102a to the common DQ signal line 112, the DQ data signal line 102b to the common DQ signal line 112, or both DQ signal lines 102a, 102b to the

common DQ signal line 112. Circuits 40 having other configurations of switches are also compatible with embodiments described herein. While each of the memory devices 30a, 30b has a plurality of DQ data signal lines and a plurality of DQS data strobe signal lines, Figures 3A and 3B only illustrate a single DQ data signal line and a single DQS data strobe signal line for each memory device 30a, 30b for simplicity. The configurations schematically illustrated by Figures 3A and 3B can be applied to all of the DQ data signal lines and DQS data strobe signal lines of the memory module 10.

[0050] In certain embodiments, the circuit 40 selectively isolates the loads of ranks of memory devices 30 from the computer system. As schematically illustrated in Figures 4A and 4B, example memory modules 10 compatible with certain embodiments described herein comprise a first number of memory devices 30 arranged in a first number of ranks 32. The memory modules 10 of Figures 4A and 4B comprises two ranks 32a, 32b, with each rank 32a, 32b having a corresponding set of DQ data signal lines and a corresponding set of DQS data strobe lines. Other numbers of ranks (e.g., four ranks) of memory devices 30 of the memory module 10 are also compatible with certain embodiments described herein. For simplicity, Figures 4A and 4B illustrate only a single DQ data signal line and a single DQS data strobe signal line from each rank 32.

[0051] The circuit 40 of Figure 4A selectively isolates one or more of the DQ data signal lines 102a, 102b of the two ranks 32a, 32b from the computer system. Thus, the circuit 40 selectively allows a DQ data signal to be transmitted from the memory controller 20 of the computer system to the memory devices 30 of one or both of the ranks 32a, 32b via the DQ data signal lines 102a, 102b. In addition, the circuit 40 selectively allows one of a first DQ data signal from the DQ data signal line 102a of the first rank 32a and a second DQ data signal from the DQ data signal line 102b of the second rank 32b to be transmitted to the memory controller 20 via the common DQ data signal line 112. For example, in certain embodiments, the circuit 40 comprises a pair of switches 120a, 120b on the DQ data signal lines 102a, 102b as schematically illustrated by Figure 4A. Each switch 120a, 120b is selectively actuated to selectively electrically couple the DQ data signal line 102a to the common DQ data signal line 112, the DQ data signal line 102b to the common DQ data signal line 112, or both DQ data signal lines 102a, 102b to the common DQ data signal line

112. In certain other embodiments, the circuit 40 comprises a switch 120 electrically coupled to both of the DQ data signal lines 102a, 102b, as schematically illustrated by Figure 4B. The switch 120 is selectively actuated to selectively electrically couple the DQ data signal line 102a to the common DQ data signal line 112, the DQ data signal line 102b to the common DQ data signal line 112, or both DQ data signal lines 102a, 102b to the common DQ data signal line 112. Circuits 40 having other configurations of switches are also compatible with embodiments described herein.

[0052] In the example embodiments schematically illustrated by Figures 3A, 3B, 4A, and 4B, the circuit 40 comprises a logic element which is integral with and comprises the switches 120 which are coupled to the DQ data signal lines and the DQS data strobe signal lines. In certain such embodiments, each switch 120 comprises a data path multiplexer/demultiplexer. In certain other embodiments, the circuit 40 comprises a logic element 122 which is a separate component operatively coupled to the switches 120, as schematically illustrated by Figures 5A-5D. The one or more switches 120 are operatively coupled to the logic element 122 to receive control signals from the logic element 122 and to selectively electrically couple one or more data signal lines to a common data signal line. Example switches compatible with embodiments described herein include, but are not limited to field-effect transistor (FET) switches, such as the SN74AUC1G66 single bilateral analog switch available from Texas Instruments, Inc. of Dallas, Texas. Example logic elements 122 compatible with certain embodiments described herein include, but are not limited to, programmable-logic devices (PLD), application-specific integrated circuits (ASIC), field-programmable gate arrays (FPGA), custom-designed semiconductor devices, and complex programmable-logic devices (CPLD). Example logic elements 122 are available from Lattice Semiconductor Corporation of Hillsboro, Oregon, Altera Corporation of San Jose, California, and Xilinx Incorporated of San Jose, California.

[0053] In certain embodiments, the load isolation provided by the circuit 40 advantageously allows the memory module 10 to present a reduced load (e.g., electrical load, such as capacitive load, inductive load, or impedance load) to the computer system by selectively switching between the two ranks of memory devices 30 to which it is coupled. This feature is used in certain embodiments in which the load of the memory module 10 may



otherwise limit the number of ranks or the number of memory devices per memory module. In certain embodiments, the memory module 10 operates as having a data path rank buffer which advantageously isolates the ranks of memory devices 30 of the memory module 10 from one another, from the ranks on other memory modules, and from the computer system. This data path rank buffer of certain embodiments advantageously provides DQ-DQS paths for each rank or sets of ranks of memory devices which are separate from one another, or which are separate from the memory controller of the computer system. In certain embodiments, the load isolation advantageously diminishes the effects of capacitive loading, jitter and other sources of noise. In certain embodiments, the load isolation advantageously simplifies various other aspects of operation of the memory module 10, including but not limited to, setup-and-hold time, clock skew, package skew, and process, temperature, voltage, and transmission line variations.

[0054] For certain memory module applications that utilize multiple ranks of memory, increased load on the memory bus can degrade speed performance. In certain embodiments described herein, selectively isolating the loads of the ranks of memory devices 30 advantageously decreases the load on the computer system, thereby allowing the computer system (e.g., server) to run faster with improved signal integrity. In certain embodiments, load isolation advantageously provides system memory with reduced electrical loading, thereby improving the electrical topology to the memory controller 20. In certain such embodiments, the speed and the memory density of the computer system are advantageously increased without sacrificing one for the other.

[0055] In certain embodiments, load isolation advantageously increases the size of the memory array supported by the memory controller 20 of the computer system. The larger memory array has an increased number of memory devices 30 and ranks of memory devices 30 of the memory module 10, with a corresponding increased number of chip selects. Certain embodiments described herein advantageously provide more system memory using fewer chip selects, thereby avoiding the chip select limitation of the memory controller.

[0056] An exemplary section of Verilog code corresponding to logic compatible with a circuit 40 which provides load isolation is listed below in Example 1. The exemplary

code of Example 1 corresponds to a circuit 40 comprising six FET switches for providing load isolation to DQ and DQS lines.

[0057] Example 1:

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//===== declarations
reg          rasN_R, casN_R, weN_R;
wire         actv_cmd_R, pch_cmd_R, pch_all_cmd_R, ap_xfr_cmd_R_R;
wire         xfr_cmd_R, mrs_cmd, rd_cmd_R;
//-----DDR 2 FET
reg          brs0N_R;           // registered chip sel
reg          brs1N_R;           // registered chip sel
reg          brs2N_R;           // registered chip sel
reg          brs3N_R;           // registered chip sel
wire         sel;
wire         sel_01;
wire         sel_23;
wire         rd_R1;
wire         wr_cmd_R, wr_R1;
reg          rd_R2, rd_R3, rd_R4, rd_R5;
reg          wr_R2, wr_R3, wr_R4, wr_R5;
reg          enfet1, enfet2, enfet3, enfet4, enfet5, enfet6;
wire         wr_01_R1, wr_23_R1;
reg          wr_01_R2, wr_01_R3, wr_01_R4;
reg          wr_23_R2, wr_23_R3, wr_23_R4;
wire         rodt0_a, rodt0_b;
//===== logic
always @(posedge clk_in)
begin
    brs0N_R <= brs0_in_N; // cs0
    brs1N_R <= brs1_in_N; // cs1
    brs2N_R <= brs2_in_N; // cs2
    brs3N_R <= brs3_in_N; // cs3
    rasN_R <= brras_in_N;
    casN_R <= brcas_in_N;
    weN_R <= bwe_in_N;

end
assign sel = ~brs0N_R | ~brs1N_R | ~brs2N_R | ~brs3N_R;
assign sel_01 = ~brs0N_R | ~brs1N_R;
assign sel_23 = ~brs2N_R | ~brs3N_R;
assign actv_cmd_R = !rasN_R & casN_R & weN_R; // activate cmd
assign pch_cmd_R = !rasN_R & casN_R & !weN_R; // pchg cmd
assign xfr_cmd_R = rasN_R & !casN_R; // xfr cmd
assign mrs_cmd = !rasN_R & !casN_R & !weN_R; // md reg set cmd
assign rd_cmd_R = rasN_R & !casN_R & weN_R; // read cmd
assign wr_cmd_R = rasN_R & !casN_R & !weN_R; // write cmd
//-----
assign rd_R1 = sel & rd_cmd_R; // rd cmd cyc 1
assign wr_R1 = sel & wr_cmd_R; // wr cmd cyc 1
//-----
always @(posedge clk_in)
begin
    rd_R2 <= rd_R1;
    rd_R3 <= rd_R2;
```

```

        rd_R4 <= rd_R3;
        rd_R5 <= rd_R4;
//      rd0_o_R6 <= rd0_o_R5;
        wr_R2 <= wr_R1;
        wr_R3 <= wr_R2;
        wr_R4 <= wr_R3;
        wr_R5 <= wr_R4;
    end

//-----
assign wr_01_R1 = sel_01 & wr_cmd_R; // wr cmd cyc 1 for cs 2 & cs3
assign wr_23_R1 = sel_23 & wr_cmd_R; // wr cmd cyc 1 for cs 2 & cs3
always @(posedge clk_in)
    begin
        wr_01_R2 <= wr_01_R1;
        wr_01_R3 <= wr_01_R2;
        wr_01_R4 <= wr_01_R3;
        wr_23_R2 <= wr_23_R1;
        wr_23_R3 <= wr_23_R2;
        wr_23_R4 <= wr_23_R3;
    end
assign rod0_ab = (rod0) // odt cmd from sys
    | (wr_23_R1) // wr 1st cyc to other rnks (assume single dimm per channel)
    | (wr_23_R2) // wr 2nd cyc to other rnks (assume single dimm per channel)
    | (wr_23_R3) // wr 3rd cyc to other rnks (assume single dimm per channel)
    ;
assign rod1_ab = (rod1) // odt cmd from sys
    | (wr_01_R1) // wr 1st cyc to other rnks (assume single dimm per channel)
    | (wr_01_R2) // wr 2nd cyc to other rnks (assume single dimm per channel)
    | (wr_01_R3) // wr 3rd cyc to other rnks (assume single dimm per channel)
    ;
//-----
always @(posedge clk_in)
    begin
        if (
            | (rd_R2) // pre-am rd
            | (rd_R3) // 1st cyc of rd brst (cl3)
            | (rd_R4) // 2nd cyc of rd brst (cl3)
            | (wr_R1) // pre-am wr
            | (wr_R2) // wr brst 1st cyc
            | (wr_R3) // wr brst 2nd cyc
        ) begin
            enfet1 <= 1'b1; // enable fet
            enfet2 <= 1'b1; // enable fet
            enfet3 <= 1'b1; // enable fet
            enfet4 <= 1'b1; // enable fet
            enfet5 <= 1'b1; // enable fet
            enfet6 <= 1'b1; // enable fet
        end
        else
            begin
                enfet1 <= 1'b0; // disable fet
                enfet2 <= 1'b0; // disable fet
                enfet3 <= 1'b0; // disable fet
                enfet4 <= 1'b0; // disable fet
                enfet5 <= 1'b0; // disable fet
            end
    end

```

```
        enfet6 <= 1'b0;        // disable fet
    end
end
```

#### Back-to-Back Adjacent Read Commands

[0058] Due to their source synchronous nature, DDR SDRAM (e.g., DDR1, DDR2, DDR3) memory devices operate with a data transfer protocol which surrounds each burst of data strobes with a pre-ambler time interval and a post-ambler time interval. The pre-ambler time interval provides a timing window for the receiving memory device to enable its data capture circuitry when a known valid level is present on the strobe signal to avoid false triggers of the memory device's capture circuit. The post-ambler time interval provides extra time after the last strobe for this data capture to facilitate good signal integrity. In certain embodiments, when the computer system accesses two consecutive bursts of data from the same memory device, termed herein as a "back-to-back adjacent read," the post-ambler time interval of the first read command and the pre-ambler time interval of the second read command are skipped by design protocol to increase read efficiency. Figure 6A shows an exemplary timing diagram of this "gapless" read burst for a back-to-back adjacent read condition from one memory device.

[0059] In certain embodiments, when the second read command accesses data from a different memory device than does the first read command, there is at least one time interval (e.g., clock cycle) inserted between the data strobes of the two memory devices. This inserted time interval allows both read data bursts to occur without the post-ambler time interval of the first read data burst colliding or otherwise interfering with the pre-ambler time interval of the second read data burst. In certain embodiments, the memory controller of the computer system inserts an extra clock cycle between successive read commands issued to different memory devices, as shown in the exemplary timing diagram of Figure 6B for successive read accesses from different memory devices.

[0060] In typical computer systems, the memory controller is informed of the memory boundaries between the ranks of memory of the memory module prior to issuing read commands to the memory module. Such memory controllers can insert wait time intervals or clock cycles to avoid collisions or interference between back-to-back adjacent

read commands which cross memory device boundaries, which are referred to herein as “BBARX.”

[0061] In certain embodiments described herein in which the number of ranks 32 of the memory module 10 is doubled or quadrupled, the circuit 40 generates a set of output address and command signals so that the selection decoding is transparent to the computer system. However, in certain such embodiments, there are memory device boundaries of which the computer system is unaware, so there are occasions in which BBARX occurs without the cognizance of the memory controller 20 of the computer system. As shown in Figure 7, the last data strobe of memory device “a” collides with the pre-amble time interval of the data strobe of memory device “b,” resulting in a “collision window.”

[0062] Figures 8A-8D schematically illustrate circuit diagrams of example memory modules 10 comprising a circuit 40 which multiplexes the DQS data strobe signal lines 104a, 104b of two ranks 32a, 32b from one another in accordance with certain embodiments described herein. While the DQS data strobe signal lines 104a, 104b of Figures 8A-8D correspond to two ranks 32a, 32b of memory devices 30, in certain other embodiments, the circuit 40 multiplexes the DQS data strobe signal lines 104a, 104b corresponding to two individual memory devices 30a, 30b.

[0063] Figure 8A schematically illustrates a circuit diagram of an exemplary memory module 10 comprising a circuit 40 in accordance with certain embodiments described herein. In certain embodiments, BBARX collisions are avoided by a mechanism which electrically isolates the DQS data strobe signal lines 104a, 104b from one another during the transition from the first read data burst of one rank 32a of memory devices 30 to the second read data burst of another rank 32b of memory devices 30.

[0064] In certain embodiments, as schematically illustrated by Figure 8A, the circuit 40 comprises a first switch 130a electrically coupled to a first DQS data strobe signal line 104a of a first rank 32a of memory devices 30 and a second switch 130b electrically coupled to a second DQS data strobe signal line 104b of a second rank 32b of memory devices 30. In certain embodiments, the time for switching the first switch 130a and the second switch 130b is between the two read data bursts (e.g., after the last DQS data strobe of the read data burst of the first rank 32a and before the first DQS data strobe of the read data

burst of the second rank 32b). During the read data burst for the first rank 32a, the first switch 130a is enabled. After the last DQS data strobe of the first rank 32a and before the first DQS data strobe of the second rank 32b, the first switch 130a is disabled and the second switch 130b is enabled.

**[0065]** As shown in Figure 8A, each of the ranks 32a, 32b otherwise involved in a BBARX collision have their DQS data strobe signal lines 104a, 104b selectively electrically coupled to the common DQS line 114 through the circuit 40. The circuit 40 of certain embodiments multiplexes the DQS data strobe signal lines 104a, 104b of the two ranks 32a, 32b of memory devices 30 from one another to avoid a BBARX collision.

**[0066]** In certain embodiments, as schematically illustrated by Figure 8B, the circuit 40 comprises a switch 130 which multiplexes the DQS data strobe signal lines 104a, 104b from one another. For example, the circuit 40 receives a DQS data strobe signal from the common DQS data strobe signal line 114 and selectively transmits the DQS data strobe signal to the first DQS data strobe signal line 104a, to the second DQS data strobe signal line 104b, or to both DQS data strobe signal lines 104a, 104b. As another example, the circuit 40 receives a first DQS data strobe signal from the first rank 32a of memory devices 30 and a second DQS data strobe signal from a second rank 32b of memory devices 30 and selectively switches one of the first and second DQS data strobe signals to the common DQS data strobe signal line 114.

**[0067]** In certain embodiments, the circuit 40 also provides the load isolation described above in reference to Figures 1-5. For example, as schematically illustrated by Figure 8C, the circuit 40 comprises both the switch 120 for the DQ data signal lines 102a, 102b and the switch 130 for the DQS data strobe signal lines 104a, 104b. While in certain embodiments, the switches 130 are integral with a logic element of the circuit 40, in certain other embodiments, the switches 130 are separate components which are operatively coupled to a logic element 122 of the circuit 40, as schematically illustrated by Figure 8D. In certain such embodiments, the control and timing of the switch 130 is performed by the circuit 40 which is resident on the memory module 10. Example switches 130 compatible with embodiments described herein include, but are not limited to field-effect transistor (FET) switches, such as the SN74AUC1G66 single bilateral analog switch available from Texas

Instruments, Inc. of Dallas, Texas, and multiplexers, such as the SN74AUC2G53 2:1 analog multiplexer/demultiplexer available from Texas Instruments, Inc. of Dallas, Texas.

**[0068]** The circuit 40 of certain embodiments controls the isolation of the DQS data strobe signal lines 104a, 104b by monitoring commands received by the memory module 10 from the computer system and producing “windows” of operation whereby the appropriate switches 130 are activated or deactivated to enable and disable the DQS data strobe signal lines 104a, 104b to mitigate BBARX collisions. In certain other embodiments, the circuit 40 monitors the commands received by the memory module 10 from the computer system and selectively activates or deactivates the switches 120 to enable and disable the DQ data signal lines 102a, 102b to reduce the load of the memory module 10 on the computer system. In still other embodiments, the circuit 40 performs both of these functions together.

#### Command Signal Translation

**[0069]** Most high-density memory modules are currently built with 512-Megabit (“512-Mb”) memory devices wherein each memory device has a 64M x 8-bit configuration. For example, a 1-Gigabyte (“1-GB”) memory module with error checking capabilities can be fabricated using eighteen such 512-Mb memory devices. Alternatively, it can be economically advantageous to fabricate a 1-GB memory module using lower-density memory devices and doubling the number of memory devices used to produce the desired word width. For example, by fabricating a 1-GB memory module using thirty-six 256-Mb memory devices with 64M x 4-bit configuration, the cost of the resulting 1-GB memory module can be reduced since the unit cost of each 256-Mb memory device is typically lower than one-half the unit cost of each 512-Mb memory device. The cost savings can be significant, even though twice as many 256-Mb memory devices are used in place of the 512-Mb memory devices. For example, by using pairs of 512-Mb memory devices rather than single 1-Gb memory devices, certain embodiments described herein reduce the cost of the memory module by a factor of up to approximately five.

**[0070]** Market pricing factors for DRAM devices are such that higher-density DRAM devices (e.g., 1-Gb DRAM devices) are much more than twice the price of lower-density DRAM devices (e.g., 512-Mb DRAM devices). In other words, the price per bit ratio of the higher-density DRAM devices is greater than that of the lower-density DRAM devices.

This pricing difference often lasts for months or even years after the introduction of the higher-density DRAM devices, until volume production factors reduce the costs of the newer higher-density DRAM devices. Thus, when the cost of a higher-density DRAM device is more than the cost of two lower-density DRAM devices, there is an economic incentive for utilizing pairs of the lower-density DRAM devices to replace individual higher-density DRAM devices.

[0071] Figure 9A schematically illustrates an exemplary memory module 10 compatible with certain embodiments described herein. The memory module 10 is connectable to a memory controller 20 of a computer system (not shown). The memory module 10 comprises a printed circuit board 210 and a plurality of memory devices 30 coupled to the printed circuit board 210. The plurality of memory devices 30 has a first number of memory devices 30. The memory module 10 further comprises a circuit 40 coupled to the printed circuit board 210. The circuit 40 receives a set of input address and command signals from the computer system. The set of input address and command signals correspond to a second number of memory devices 30 smaller than the first number of memory devices 30. The circuit 40 generates a set of output address and command signals in response to the set of input address and command signals. The set of output address and command signals corresponds to the first number of memory devices 30.

[0072] In certain embodiments, as schematically illustrated in Figure 9A, the memory module 10 further comprises a phase-lock loop device 220 coupled to the printed circuit board 210 and a register 230 coupled to the printed circuit board 210. In certain embodiments, the phase-lock loop device 220 and the register 230 are each mounted on the printed circuit board 210. In response to signals received from the computer system, the phase-lock loop device 220 transmits clock signals to the plurality of memory devices 30, the circuit 40, and the register 230. The register 230 receives and buffers a plurality of command signals and address signals (e.g., bank address signals, row address signals, column address signals, gated column address strobe signals, chip-select signals), and transmits corresponding signals to the appropriate memory devices 30. In certain embodiments, the register 230 comprises a plurality of register devices. While the phase-lock loop device 220, the register 230, and the circuit 40 are described herein in certain embodiments as being



separate components, in certain other embodiments, two or more of the phase-lock loop device 220, the register 230, and the circuit 40 are portions of a single component. Persons skilled in the art are able to select a phase-lock loop device 220 and a register 230 compatible with embodiments described herein.

[0073] In certain embodiments, the memory module 10 further comprises electrical components which are electrically coupled to one another and are surface-mounted or embedded on the printed circuit board 210. These electrical components can include, but are not limited to, electrical conduits, resistors, capacitors, inductors, and transistors. In certain embodiments, at least some of these electrical components are discrete, while in other certain embodiments, at least some of these electrical components are constituents of one or more integrated circuits.

[0074] In certain embodiments, the printed circuit board 210 is mountable in a module slot of the computer system. The printed circuit board 210 of certain such embodiments has a plurality of edge connections electrically coupled to corresponding contacts of the module slot and to the various components of the memory module 10, thereby providing electrical connections between the computer system and the components of the memory module 10.

[0075] In certain embodiments, the plurality of memory devices 30 are arranged in a first number of ranks 32. For example, in certain embodiments, the memory devices 30 are arranged in four ranks 32a, 32b, 32c, 32d, as schematically illustrated by Figure 9A. In certain other embodiments, the memory devices 30 are arranged in two ranks 32a, 32b, as schematically illustrated by Figure 9B. Other numbers of ranks 32 of the memory devices 30 are also compatible with embodiments described herein.

[0076] As schematically illustrated by Figures 9A and 9B, in certain embodiments, the circuit 40 receives a set of input command signals (e.g., refresh, precharge) and address signals (e.g., bank address signals, row address signals, column address signals, gated column address strobe signals, chip-select signals) from the memory controller 20 of the computer system. In response to the set of input address and command signals, the circuit 40 generates a set of output address and command signals.

[0077] In certain embodiments, the set of output address and command signals corresponds to a first number of ranks in which the plurality of memory devices 30 of the memory module 10 are arranged, and the set of input address and command signals corresponds to a second number of ranks per memory module for which the computer system is configured. The second number of ranks in certain embodiments is smaller than the first number of ranks. For example, in the exemplary embodiment as schematically illustrated by Figure 9A, the first number of ranks is four while the second number of ranks is two. In the exemplary embodiment of Figure 9B, the first number of ranks is two while the second number of ranks is one. Thus, in certain embodiments, even though the memory module 10 actually has the first number of ranks of memory devices 30, the memory module 10 simulates a virtual memory module by operating as having the second number of ranks of memory devices 30. In certain embodiments, the memory module 10 simulates a virtual memory module when the number of memory devices 30 of the memory module 10 is larger than the number of memory devices 30 per memory module for which the computer system is configured to utilize. In certain embodiments, the circuit 40 comprises logic (e.g., address decoding logic, command decoding logic) which translates between a system memory domain of the computer system and a physical memory domain of the memory module 10.

[0078] In certain embodiments, the computer system is configured for a number of ranks per memory module which is smaller than the number of ranks in which the memory devices 30 of the memory module 10 are arranged. In certain such embodiments, the computer system is configured for two ranks of memory per memory module (providing two chip-select signals  $CS_0$ ,  $CS_1$ ) and the plurality of memory modules 30 of the memory module 10 are arranged in four ranks, as schematically illustrated by Figure 9A. In certain other such embodiments, the computer system is configured for one rank of memory per memory module (providing one chip-select signal  $CS_0$ ) and the plurality of memory modules 30 of the memory module 10 are arranged in two ranks, as schematically illustrated by Figure 9B.

[0079] In the exemplary embodiment schematically illustrated by Figure 9A, the memory module 10 has four ranks of memory devices 30 and the computer system is configured for two ranks of memory devices per memory module. The memory module 10 receives row/column address signals or signal bits ( $A_0$ - $A_{n+1}$ ), bank address signals ( $BA_0$ -

BA<sub>m</sub>), chip-select signals (CS<sub>0</sub> and CS<sub>1</sub>), and command signals (e.g., refresh, precharge, etc.) from the computer system. The A<sub>0</sub>-A<sub>n</sub> row/column address signals are received by the register 230, which buffers these address signals and sends these address signals to the appropriate ranks of memory devices 30. The circuit 40 receives the two chip-select signals (CS<sub>0</sub>, CS<sub>1</sub>) and one row/column address signal (A<sub>n+1</sub>) from the computer system. Both the circuit 40 and the register 230 receive the bank address signals (BA<sub>0</sub>-BA<sub>m</sub>) and at least one command signal (e.g., refresh, precharge, etc.) from the computer system.

#### Logic Tables

**[0080]** Table 1 provides a logic table compatible with certain embodiments described herein for the selection among ranks of memory devices 30 using chip-select signals.

Table 1:

| State | CS <sub>0</sub> | CS <sub>1</sub> | A <sub>n+1</sub> | Command | CS <sub>0A</sub> | CS <sub>0B</sub> | CS <sub>1A</sub> | CS <sub>1B</sub> |
|-------|-----------------|-----------------|------------------|---------|------------------|------------------|------------------|------------------|
| 1     | 0               | 1               | 0                | Active  | 0                | 1                | 1                | 1                |
| 2     | 0               | 1               | 1                | Active  | 1                | 0                | 1                | 1                |
| 3     | 0               | 1               | x                | Active  | 0                | 0                | 1                | 1                |
| 4     | 1               | 0               | 0                | Active  | 1                | 1                | 0                | 1                |
| 5     | 1               | 0               | 1                | Active  | 1                | 1                | 1                | 0                |
| 6     | 1               | 0               | x                | Active  | 1                | 1                | 0                | 0                |
| 7     | 1               | 1               | x                | x       | 1                | 1                | 1                | 1                |

Note:

1. CS<sub>0</sub>, CS<sub>1</sub>, CS<sub>0A</sub>, CS<sub>0B</sub>, CS<sub>1A</sub>, and CS<sub>1B</sub> are active low signals.
2. A<sub>n+1</sub> is an active high signal.
3. 'x' is a Don't Care condition.
4. Command involves a number of command signals that define operations such as refresh, precharge, and other operations.

**[0081]** In Logic State 1: CS<sub>0</sub> is active low, A<sub>n+1</sub> is non-active, and Command is active. CS<sub>0A</sub> is pulled low, thereby selecting Rank 0.

**[0082]** In Logic State 2: CS<sub>0</sub> is active low, A<sub>n+1</sub> is active, and Command is active. CS<sub>0B</sub> is pulled low, thereby selecting Rank 1.

**[0083]** In Logic State 3: CS<sub>0</sub> is active low, A<sub>n+1</sub> is Don't Care, and Command is active high. CS<sub>0A</sub> and CS<sub>0B</sub> are pulled low, thereby selecting Ranks 0 and 1.

**[0084]** In Logic State 4: CS<sub>1</sub> is active low, A<sub>n+1</sub> is non-active, and Command is active. CS<sub>1A</sub> is pulled low, thereby selecting Rank 2.

**[0085]** In Logic State 5: CS<sub>1</sub> is active low, A<sub>n+1</sub> is active, and Command is active. CS<sub>1B</sub> is pulled low, thereby selecting Rank 3.

**[0086]** In Logic State 6: CS<sub>1</sub> is active low, A<sub>n+1</sub> is Don't Care, and Command is active. CS<sub>1A</sub> and CS<sub>1B</sub> are pulled low, thereby selecting Ranks 2 and 3.

**[0087]** In Logic State 7: CS<sub>0</sub> and CS<sub>1</sub> are pulled non-active high, which deselects all ranks, i.e., CS<sub>0A</sub>, CS<sub>0B</sub>, CS<sub>1A</sub>, and CS<sub>1B</sub> are pulled high.

**[0088]** The "Command" column of Table 1 represents the various commands that a memory device (e.g., a DRAM device) can execute, examples of which include, but are not limited to, activation, read, write, precharge, and refresh. In certain embodiments, the command signal is passed through to the selected rank only (e.g., state 4 of Table 1). In such embodiments, the command signal (e.g., read) is sent to only one memory device or the other memory device so that data is supplied from one memory device at a time. In other embodiments, the command signal is passed through to both associated ranks (e.g., state 6 of Table 1). In such embodiments, the command signal (e.g., refresh) is sent to both memory devices to ensure that the memory content of the memory devices remains valid over time. Certain embodiments utilize a logic table such as that of Table 1 to simulate a single memory device from two memory devices by selecting two ranks concurrently.

**[0089]** Table 2 provides a logic table compatible with certain embodiments described herein for the selection among ranks of memory devices 30 using gated CAS signals.

Table 2:

| CS* | RAS* | CAS* | WE* | Density Bit | A <sub>10</sub> | Command  | CAS0* | CAS1* |
|-----|------|------|-----|-------------|-----------------|----------|-------|-------|
| 1   | x    | x    | x   | x           | x               | NOP      | x     | x     |
| 0   | 1    | 1    | 1   | x           | x               | NOP      | 1     | 1     |
| 0   | 0    | 1    | 1   | 0           | x               | ACTIVATE | 1     | 1     |
| 0   | 0    | 1    | 1   | 1           | x               | ACTIVATE | 1     | 1     |
| 0   | 1    | 0    | 1   | 0           | x               | READ     | 0     | 1     |
| 0   | 1    | 0    | 1   | 1           | x               | READ     | 1     | 0     |
| 0   | 1    | 0    | 0   | 0           | x               | WRITE    | 0     | 1     |

|   |   |   |   |   |   |              |   |   |
|---|---|---|---|---|---|--------------|---|---|
| 0 | 1 | 0 | 0 | 1 | x | WRITE        | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 0 | PRECHARGE    | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 0 | PRECHARGE    | 1 | 1 |
| 0 | 0 | 1 | 0 | x | 1 | PRECHARGE    | 1 | 1 |
| 0 | 0 | 0 | 0 | x | x | MODE REG SET | 0 | 0 |
| 0 | 0 | 0 | 1 | x | x | REFRESH      | 0 | 0 |

**[0090]** In certain embodiments in which the density bit is a row address bit, for read/write commands, the density bit is the value latched during the activate command for the selected bank.

#### Serial-Presence-Detect Device

**[0091]** Memory modules typically include a serial-presence detect (SPD) device 240 (e.g., an electrically-erasable-programmable read-only memory or EEPROM device) comprising data which characterize various attributes of the memory module, including but not limited to, the number of row addresses the number of column addresses, the data width of the memory devices, the number of ranks, the memory density per rank, the number of memory devices, and the memory density per memory device. The SPD device 240 communicates this data to the basic input/output system (BIOS) of the computer system so that the computer system is informed of the memory capacity and the memory configuration available for use and can configure the memory controller properly for maximum reliability and performance.

**[0092]** For example, for a commercially-available 512-MB (64M x 8-byte) memory module utilizing eight 512-Mb memory devices each with a 64M x 8-bit configuration, the SPD device contains the following SPD data (in appropriate bit fields of these bytes):

- Byte 3: Defines the number of row address bits in the DRAM device in the memory module [13 for the 512-Mb memory device].
- Byte 4: Defines the number of column address bits in the DRAM device in the memory module [11 for the 512-Mb memory device].
- Byte 13: Defines the bit width of the primary DRAM device used in the memory module [8 bits for the 512-Mb (64M x 8-bit) memory device].
- Byte 14: Defines the bit width of the error checking DRAM device used in the memory module [8 bits for the 512-Mb (64M x 8-bit) memory device].

Byte 17: Defines the number of banks internal to the DRAM device used in the memory module [4 for the 512-Mb memory device].

[0093] In a further example, for a commercially-available 1-GB (128M x 8-byte) memory module utilizing eight 1-Gb memory devices each with a 128M x 8-bit configuration, as described above, the SPD device contains the following SPD data (in appropriate bit fields of these bytes):

Byte 3: Defines the number of row address bits in the DRAM device in the memory module [14 for the 1-Gb memory device].

Byte 4: Defines the number of column address bits in the DRAM device in the memory module [11 for the 1-Gb memory device].

Byte 13: Defines the bit width of the primary DRAM device used in the memory module [8 bits for the 1-Gb (128M x 8-bit) memory device].

Byte 14: Defines the bit width of the error checking DRAM device used in the memory module [8 bits for the 1-Gb (128M x 8-bit) memory device].

Byte 17: Defines the number of banks internal to the DRAM device used in the memory module [4 for the 1-Gb memory device].

[0094] In certain embodiments, the SPD device 240 comprises data which characterize the memory module 10 as having fewer ranks of memory devices than the memory module 10 actually has, with each of these ranks having more memory density. For example, for a memory module 10 compatible with certain embodiments described herein having two ranks of memory devices 30, the SPD device 240 comprises data which characterizes the memory module 10 as having one rank of memory devices with twice the memory density per rank. Similarly, for a memory module 10 compatible with certain embodiments described herein having four ranks of memory devices 30, the SPD device 240 comprises data which characterizes the memory module 10 as having two ranks of memory devices with twice the memory density per rank. In addition, in certain embodiments, the SPD device 240 comprises data which characterize the memory module 10 as having fewer memory devices than the memory module 10 actually has, with each of these memory devices having more memory density per memory device. For example, for a memory module 10 compatible with certain embodiments described herein, the SPD device 240 comprises data which characterizes the memory module 10 as having one-half the number of memory devices that the memory module 10 actually has, with each of these memory devices

having twice the memory density per memory device. Thus, in certain embodiments, the SPD device 240 informs the computer system of the larger memory array by reporting a memory device density that is a multiple of the memory devices 30 resident on the memory module 10. Certain embodiments described herein advantageously do not require system level changes to hardware (e.g., the motherboard of the computer system) or to software (e.g., the BIOS of the computer system).

**[0095]** Figure 9C schematically illustrates an exemplary memory module 10 in accordance with certain embodiments described herein. The memory module 10 comprises a pair of substantially identical memory devices 31, 33. Each memory device 31, 33 has a first bit width, a first number of banks of memory locations, a first number of rows of memory locations, and a first number of columns of memory locations. The memory module 10 further comprises an SPD device 240 comprising data that characterizes the pair of memory devices 31, 33. The data characterize the pair of memory devices 31, 33 as a virtual memory device having a second bit width equal to twice the first bit width, a second number of banks of memory locations equal to the first number of banks, a second number of rows of memory locations equal to the first number of rows, and a second number of columns of memory locations equal to the first number of columns.

**[0096]** In certain such embodiments, the SPD device 240 of the memory module 10 is programmed to describe the combined pair of lower-density memory devices 31, 33 as one virtual or pseudo-higher-density memory device. In an exemplary embodiment, two 512-Mb memory devices, each with a 128M x 4-bit configuration, are used to simulate one 1-Gb memory device having a 128M x 8-bit configuration. The SPD device 240 of the memory module 10 is programmed to describe the pair of 512-Mb memory devices as one virtual or pseudo-1-Gb memory device.

**[0097]** For example, to fabricate a 1-GB (128M x 8-byte) memory module, sixteen 512-Mb (128M x 4-bit) memory devices can be used. The sixteen 512-Mb (128M x 4-bit) memory devices are combined in eight pairs, with each pair serving as a virtual or pseudo-1-Gb (128M x 8-bit) memory device. In certain such embodiments, the SPD device 240 contains the following SPD data (in appropriate bit fields of these bytes):

Byte 3: 13 row address bits.  
Byte 4: 12 column address bits.

Byte 13: 8 bits wide for the primary virtual 1-Gb (128M x 8-bit) memory device.  
Byte 14: 8 bits wide for the error checking virtual 1-Gb (128M x 8-bit) memory device.  
Byte 17: 4 banks.

[0098] In this exemplary embodiment, bytes 3, 4, and 17 are programmed to have the same values as they would have for a 512-MB (128M x 4-byte) memory module utilizing 512-Mb (128M x 4-bit) memory devices. However, bytes 13 and 14 of the SPD data are programmed to be equal to 8, corresponding to the bit width of the virtual or pseudo-higher-density 1-Gb (128M x 8-bit) memory device, for a total capacity of 1-GB. Thus, the SPD data does not describe the actual-lower-density memory devices, but instead describes the virtual or pseudo-higher-density memory devices. The BIOS accesses the SPD data and recognizes the memory module as having 4 banks of memory locations arranged in  $2^{13}$  rows and  $2^{12}$  columns, with each memory location having a width of 8 bits rather than 4 bits.

[0099] In certain embodiments, when such a memory module 10 is inserted in a computer system, the computer system's memory controller then provides to the memory module 10 a set of input address and command signals which correspond to the number of ranks or the number of memory devices reported by the SPD device 240. For example, placing a two-rank memory module 10 compatible with certain embodiments described herein in a computer system compatible with one-rank memory modules, the SPD device 240 reports to the computer system that the memory module 10 only has one rank. The circuit 40 then receives a set of input address and command signals corresponding to a single rank from the computer system's memory controller, and generates and transmits a set of output address and command signals corresponding to two ranks to the appropriate memory devices 30 of the memory module 10.

[0100] Similarly, when a two-rank memory module 10 compatible with certain embodiments described herein is placed in a computer system compatible with either one- or two-rank memory modules, the SPD device 240 reports to the computer system that the memory module 10 only has one rank. The circuit 40 then receives a set of input address and command signals corresponding to a single rank from the computer system's memory controller, and generates and transmits a set of output address and command signals corresponding to two ranks to the appropriate memory devices 30 of the memory module 10.



[0101] Furthermore, a four-rank memory module 10 compatible with certain embodiments described herein simulates a two-rank memory module whether the memory module 10 is inserted in a computer system compatible with two-rank memory modules or with two- or four-rank memory modules. Thus, by placing a four-rank memory module 10 compatible with certain embodiments described herein in a module slot that is four-rank-ready, the computer system provides four chip-select signals, but the memory module 10 only uses two of the chip-select signals.

[0102] In certain embodiments, the circuit 40 comprises the SPD device 240 which reports the CAS latency (CL) to the memory controller of the computer system. The SPD device 240 of certain embodiments reports a CL which has one more cycle than does the actual operational CL of the memory array. In certain embodiments, data transfers between the memory controller and the memory module are registered for one additional clock cycle by the circuit 40. The additional clock cycle of certain embodiments is added to the transfer time budget with an incremental overall CAS latency. This extra cycle of time in certain embodiments advantageously provides sufficient time budget to add a buffer which electrically isolates the ranks of memory devices 30 from the memory controller 20. The buffer of certain embodiments comprises combinatorial logic, registers, and logic pipelines. In certain embodiments, the buffer adds a one-clock cycle time delay, which is equivalent to a registered DIMM, to accomplish the address decoding. The one-cycle time delay of certain such embodiments provides sufficient time for read and write data transfers to provide the functions of the data path multiplexer/demultiplexer. Thus, for example, a DDR2 400-MHz memory system in accordance with embodiments described herein has an overall CAS latency of four, and uses memory devices with a CAS latency of three. In still other embodiments, the SPD device 240 does not utilize this extra cycle of time.

#### Memory Density Multiplication

[0103] In certain embodiments, two memory devices having a memory density are used to simulate a single memory device having twice the memory density, and an additional address signal bit is used to access the additional memory. Similarly, in certain embodiments, two ranks of memory devices having a memory density are used to simulate a single rank of memory devices having twice the memory density, and an additional address

signal bit is used to access the additional memory. As used herein, such simulations of memory devices or ranks of memory devices are termed as “memory density multiplication,” and the term “density transition bit” is used to refer to the additional address signal bit which is used to access the additional memory by selecting which rank of memory devices is enabled for a read or write transfer operation.

[0104] For example, for computer systems which are normally limited to using memory modules which have a single rank of 128M x 4-bit memory devices, certain embodiments described herein enable the computer system to utilize memory modules which have double the memory (e.g., two ranks of 128M x 4-bit memory devices). The circuit 40 of certain such embodiments provides the logic (e.g., command and address decoding logic) to double the number of chip selects, and the SPD device 240 reports a memory device density of 256M x 4-bit to the computer system.

[0105] In certain embodiments utilizing memory density multiplication embodiments, the memory module 10 can have various types of memory devices 30 (e.g., DDR1, DDR2, DDR3, and beyond). The circuit 40 of certain such embodiments utilizes implied translation logic equations having variations depending on whether the density transition bit is a row, column, or internal bank address bit. In addition, the translation logic equations of certain embodiments vary depending on the type of memory module 10 (e.g., UDIMM, RDIMM, FBDIMM, etc.). Furthermore, in certain embodiments, the translation logic equations vary depending on whether the implementation multiplies memory devices per rank or multiplies the number of ranks per memory module.

[0106] Table 3A provides the numbers of rows and columns for DDR-1 memory devices, as specified by JEDEC standard JESD79D, “Double Data Rate (DDR) SDRAM Specification,” published February 2004, and incorporated in its entirety by reference herein.

Table 3A:

|                                                       | 128-Mb | 256-Mb | 512-Mb | 1-Gb |
|-------------------------------------------------------|--------|--------|--------|------|
| Number of banks                                       | 4      | 4      | 4      | 4    |
| Number of row address bits                            | 12     | 13     | 13     | 14   |
| Number of column address bits for “x 4” configuration | 11     | 11     | 12     | 12   |
| Number of column address bits for “x 8” configuration | 10     | 10     | 11     | 11   |

|                                                        |   |   |    |    |
|--------------------------------------------------------|---|---|----|----|
| Number of column address bits for "x 16" configuration | 9 | 9 | 10 | 10 |
|--------------------------------------------------------|---|---|----|----|

[0107] As described by Table 3A, 512-Mb (128M x 4-bit) DRAM devices have  $2^{13}$  rows and  $2^{12}$  columns of memory locations, while 1-Gb (128M x 8-bit) DRAM devices have  $2^{14}$  rows and  $2^{11}$  columns of memory locations. Because of the differences in the number of rows and the number of columns for the two types of memory devices, complex address translation procedures and structures would typically be needed to fabricate a 1-GB (128M x 8-byte) memory module using sixteen 512-Mb (128M x 4-bit) DRAM devices.

[0108] Table 3B shows the device configurations as a function of memory density for DDR2 memory devices.

Table 3B:

|        | Number of Rows | Number of Columns | Number of Internal Banks | Page Size (x4s or x8s) |
|--------|----------------|-------------------|--------------------------|------------------------|
| 256 Mb | 13             | 11                | 4                        | 1 KB                   |
| 512 Mb | 14             | 11                | 4                        | 1 KB                   |
| 1 Gb   | 14             | 11                | 8                        | 1 KB                   |
| 2 Gb   | 15             | 11                | 8                        | 1 KB                   |
| 4 Gb   | 16             | 11                | 8                        | 1 KB                   |

Table 4 lists the corresponding density transition bit for the density transitions between the DDR2 memory densities of Table 3B.

Table 4:

| Density Transition | Density Transition Bit |
|--------------------|------------------------|
| 256 Mb to 512 Mb   | $A_{13}$               |
| 512 Mb to 1 Gb     | $BA_2$                 |
| 1 Gb to 2 Gb       | $A_{14}$               |
| 2 Gb to 4 Gb       | $A_{15}$               |

Other certain embodiments described herein utilize a transition bit to provide a transition from pairs of physical 4-Gb memory devices to simulated 8-Gb memory devices.

[0109] In an example embodiment, the memory module comprises one or more pairs of 256-Mb memory devices, with each pair simulating a single 512-Mb memory device. The simulated 512-Mb memory device has four internal banks while each of the two 256-Mb memory devices has four internal banks, for a total of eight internal banks for the pair of 256-Mb memory devices. In certain embodiments, the additional row address bit is translated by

the circuit 40 to the rank selection between each of the two 256-Mb memory devices of the pair. Although there are eight total internal banks in the rank-converted memory array, the computer system is only aware of four internal banks. When the memory controller activates a row for a selected bank, the circuit 40 activates the same row for the same bank, but it does so for the selected rank according to the logic state of the additional row address bit  $A_{13}$ .

[0110] In another example embodiment, the memory module comprises one or more pairs of 512-Mb memory devices, with each pair simulating a single 1-Gb memory device. The simulated 1-Gb memory device has eight internal banks while each of the two 512-Mb memory devices has four internal banks, for a total of eight internal banks for the pair of 512-Mb memory devices. In certain embodiments, the mapped  $BA_2$  (bank 2) bit is used to select between the two ranks of 512-Mb memory devices to preserve the internal bank geometry expected by the memory controller of the computer system. The state of the  $BA_2$  bit selects the upper or lower set of four banks, as well as the upper and lower 512-Mb rank.

[0111] In another example embodiment, the memory module comprises one or more pairs of 1-Gb memory devices, with each pair simulating a single 2-Gb memory device. Each of the two 1-Gb memory devices has eight internal banks for a total of sixteen internal banks, while the simulated 2-Gb memory device has eight internal banks. In certain embodiments, the additional row address bit translates to the rank selection between the two 1-Gb memory devices. Although there are sixteen total internal banks per pair of 1-Gb memory devices in the rank-converted memory array, the memory controller of the computer system is only aware of eight internal banks. When the memory controller activates a row of a selected bank, the circuit 40 activates the same row for the same bank, but it does so for the selected rank according to the logic state of the additional row address bit  $A_{14}$ .

[0112] The circuit 40 of certain embodiments provides substantially all of the translation logic used for the decoding (e.g., command and address decoding). In certain such embodiments, there is a fully transparent operational conversion from the "system memory" density domain of the computer system to the "physical memory" density domain of the memory module 10. In certain embodiments, the logic translation equations are programmed in the circuit 40 by hardware, while in certain other embodiments, the logic

translation equations are programmed in the circuit 40 by software. Examples 1 and 2 provide exemplary sections of Verilog code compatible with certain embodiments described herein. As described more fully below, the code of Examples 1 and 2 includes logic to reduce potential problems due to “back-to-back adjacent read commands which cross memory device boundaries or “BBARX.” Persons skilled in the art are able to provide additional logic translation equations compatible with embodiments described herein.

[0113] An exemplary section of Verilog code compatible with memory density multiplication from 512 Mb to 1 Gb using DDR2 memory devices with the BA<sub>2</sub> density transition bit is listed below in Example 2. The exemplary code of Example 2 corresponds to a circuit 40 which receives one chip-select signal from the computer system and which generates two chip-select signals.

[0114] Example 2:

```
always @(posedge clk_in)
begin
    rs0N_R <= rs0_in_N; // cs0
    rasN_R <= ras_in_N;
    casN_R <= cas_in_N;
    weN_R <= we_in_N;
end

// Gated Chip Selects
assign pcs0a_1 = (~rs0_in_N & ~ras_in_N & ~cas_in_N) // ref,md reg set
                | (~rs0_in_N & ras_in_N & cas_in_N) // ref exit, pwr dn
                | (~rs0_in_N & ~ras_in_N & cas_in_N & ~we_in_N & a10_in) // pchg all
                | (~rs0_in_N & ~ras_in_N & cas_in_N & ~we_in_N & ~a10_in & ~ba2_in) // pchg single bnk
                | (~rs0_in_N & ~ras_in_N & cas_in_N & we_in_N & ~ba2_in) // activate
                | (~rs0_in_N & ras_in_N & ~cas_in_N & ~ba2_in) // xfr
                ;
assign pcs0b_1 = (~rs0_in_N & ~ras_in_N & ~cas_in_N) // ref,md reg set
                | (~rs0_in_N & ras_in_N & cas_in_N) // ref exit, pwr dn
                | (~rs0_in_N & ~ras_in_N & cas_in_N & ~we_in_N & a10_in) // pchg all
                | (~rs0_in_N & ~ras_in_N & cas_in_N & ~we_in_N & ~a10_in & ba2_in) // pchg single bnk
                | (~rs0_in_N & ~ras_in_N & cas_in_N & we_in_N & ba2_in) // activate
                | (~rs0_in_N & ras_in_N & ~cas_in_N & ba2_in) // xfr
                ;

//-----
always @(posedge clk_in)
begin
    a4_r <= a4_in ;
    a5_r <= a5_in ;
    a6_r <= a6_in ;
    a10_r <= a10_in ;
    ba0_r <= ba0_in ;
    ba1_r <= ba1_in ;
    ba2_r <= ba2_in ;
    q_mrs_cmd_cycl <= q_mrs_cmd ;
end

//=====
// determine the cas latency
//=====
assign q_mrs_cmd_r = (!rasN_R & !casN_R & !weN_R)
                    & !rs0N_R
                    & (!ba0_r & !ba1_r)
```

```

; // md reg set cmd

always @(posedge clk_in)
if (~reset_N) // lmr
    cl3 <= 1'b1;
else if (q_mrs_cmd_cyc1) // load mode reg cmd
begin
    cl3 <= (~a6_r & a5_r & a4_r);
end

always @(posedge clk_in)
if (~reset_N) // reset
    cl2 <= 1'b0;
else if (q_mrs_cmd_cyc1) // load mode reg cmd
begin
    cl2 <= (~a6_r & a5_r & ~a4_r);
end

always @(posedge clk_in)
if (~reset_N) // reset
    cl4 <= 1'b0;
else if (q_mrs_cmd_cyc1) // load mode reg cmd
begin
    cl4 <= (a6_r & ~a5_r & ~a4_r);
end

always @(posedge clk_in)
if (~reset_N) cl5 <= 1'b0;
else if (q_mrs_cmd_cyc1) // load mode reg cmd
begin
    cl5 <= (a6_r & ~a5_r & a4_r);
end

assign pre_cyc2_enfet = (wr_cmd_cyc1 & acs_cyc1 & cl3) // wr brst cl3 preamble
;
assign pre_cyc3_enfet = (rd_cmd_cyc2 & cl3) // rd brst cl3 preamble
| (wr_cmd_cyc2 & cl3) // wr brst cl3 1st pair
| (wr_cmd_cyc2 & cl4) // wr brst cl4 preamble
;
assign pre_cyc4_enfet = (wr_cmd_cyc3 & cl3) // wr brst cl3 2nd pair
| (wr_cmd_cyc3 & cl4) // wr brst cl4 1st pair
| (rd_cmd_cyc3 & cl3) // rd brst cl3 1st pair
| (rd_cmd_cyc3 & cl4) // rd brst cl4 preamble
;
assign pre_cyc5_enfet = (rd_cmd_cyc4 & cl3) // rd brst cl3 2nd pair
| (wr_cmd_cyc4 & cl4) // wr brst cl4 2nd pair
| (rd_cmd_cyc4 & cl4) // rd brst cl4 1st pair
;

// dq
assign pre_dq_cyc = pre_cyc2_enfet
| pre_cyc3_enfet
| pre_cyc4_enfet
| pre_cyc5_enfet
;

assign pre_dq_ncyc = enfet_cyc2
| enfet_cyc3
| enfet_cyc4
| enfet_cyc5
;

// dqs

```

```

assign      pre_dqsa_cyc = (pre_cyc2_enfet & ~ba2_r)
              |(pre_cyc3_enfet & ~ba2_cyc2)
              |(pre_cyc4_enfet & ~ba2_cyc3)
              |(pre_cyc5_enfet & ~ba2_cyc4)
              ;
assign      pre_dqsb_cyc = (pre_cyc2_enfet & ba2_r)
              |(pre_cyc3_enfet & ba2_cyc2)
              |(pre_cyc4_enfet & ba2_cyc3)
              |(pre_cyc5_enfet & ba2_cyc4)
              ;
assign      pre_dqsa_ncyc = (enfet_cyc2 & ~ba2_cyc2)
              |(enfet_cyc3 & ~ba2_cyc3)
              |(enfet_cyc4 & ~ba2_cyc4)
              |(enfet_cyc5 & ~ba2_cyc5)
              ;
assign      pre_dqsb_ncyc = (enfet_cyc2 & ba2_cyc2)
              |(enfet_cyc3 & ba2_cyc3)
              |(enfet_cyc4 & ba2_cyc4)
              |(enfet_cyc5 & ba2_cyc5)
              ;

always @(posedge clk_in)
begin
    acs_cyc2 <= acs_cyc1 ;          // cs active
    ba2_cyc2 <= ba2_r ;
    ba2_cyc3 <= ba2_cyc2 ;
    ba2_cyc4 <= ba2_cyc3 ;
    ba2_cyc5 <= ba2_cyc4 ;

    rd_cmd_cyc2 <= rd_cmd_cyc1 & acs_cyc1 ;
    rd_cmd_cyc3 <= rd_cmd_cyc2 ;
    rd_cmd_cyc4 <= rd_cmd_cyc3 ;
    rd_cmd_cyc5 <= rd_cmd_cyc4 ;
    rd_cmd_cyc6 <= rd_cmd_cyc5 ;
    rd_cmd_cyc7 <= rd_cmd_cyc6 ;

    wr_cmd_cyc2 <= wr_cmd_cyc1 & acs_cyc1 ;
    wr_cmd_cyc3 <= wr_cmd_cyc2 ;
    wr_cmd_cyc4 <= wr_cmd_cyc3 ;
    wr_cmd_cyc5 <= wr_cmd_cyc4 ;

end

always @(negedge clk_in)
begin
    dq_ncyc <= dq_cyc ;
    dqs_ncyc_a <= dqs_cyc_a ;
    dqs_ncyc_b <= dqs_cyc_b ;

end

// DQ FET enables
assign      enq_fet1 = dq_cyc | dq_ncyc ;
assign      enq_fet2 = dq_cyc | dq_ncyc ;
assign      enq_fet3 = dq_cyc | dq_ncyc ;
assign      enq_fet4 = dq_cyc | dq_ncyc ;
assign      enq_fet5 = dq_cyc | dq_ncyc ;
// DQS FET enables
assign      ens_fet1a = dqs_cyc_a | dqs_ncyc_a ;
assign      ens_fet2a = dqs_cyc_a | dqs_ncyc_a ;
assign      ens_fet3a = dqs_cyc_a | dqs_ncyc_a ;
assign      ens_fet1b = dqs_cyc_b | dqs_ncyc_b ;
assign      ens_fet2b = dqs_cyc_b | dqs_ncyc_b ;
assign      ens_fet3b = dqs_cyc_b | dqs_ncyc_b ;

```

**[0115]** Another exemplary section of Verilog code compatible with memory density multiplication from 256 Mb to 512 Mb using DDR2 memory devices and gated CAS

signals with the row A<sub>13</sub> density transition bit is listed below in Example 3. The exemplary code of Example 3 corresponds to a circuit 40 which receives one gated CAS signal from the computer system and which generates two gated CAS signals.

**[0116] Example 3:**

```
// latched a13 flags cs0, banks 0-3
always @(posedge clk_in)
  if (actv_cmd_R & ~rs0N_R & ~bnk1_R & ~bnk0_R) // activate
    begin
      l_a13_00 <= a13_r;
    end
  always @(posedge clk_in)
    if (actv_cmd_R & ~rs0N_R & ~bnk1_R & bnk0_R) // activate
      begin
        l_a13_01 <= a13_r;
      end
  always @(posedge clk_in)
    if (actv_cmd_R & ~rs0N_R & bnk1_R & ~bnk0_R) // activate
      begin
        l_a13_10 <= a13_r;
      end
  always @(posedge clk_in)
    if (actv_cmd_R & ~rs0N_R & bnk1_R & bnk0_R) // activate
      begin
        l_a13_11 <= a13_r;
      end
  end
// gated cas
assign cas_i = ~(casN_R);
assign cas0_o = (~rasN_R & cas_i)
  | (rasN_R & ~l_a13_00 & ~bnk1_R & ~bnk0_R & cas_i)
  | (rasN_R & ~l_a13_01 & ~bnk1_R & bnk0_R & cas_i)
  | (rasN_R & ~l_a13_10 & bnk1_R & ~bnk0_R & cas_i)
  | (rasN_R & ~l_a13_11 & bnk1_R & bnk0_R & cas_i);
assign cas1_o = (~rasN_R & cas_i)
  | (rasN_R & l_a13_00 & ~bnk1_R & ~bnk0_R & cas_i)
  | (rasN_R & l_a13_01 & ~bnk1_R & bnk0_R & cas_i)
  | (rasN_R & l_a13_10 & bnk1_R & ~bnk0_R & cas_i)
  | (rasN_R & l_a13_11 & bnk1_R & bnk0_R & cas_i);
assign pcas_0_N = ~cas0_o;
assign pcas_1_N = ~cas1_o;
assign rd0_o_R1 = rasN_R & cas0_o & weN_R & ~rs0N_R; // mk0 rd cmd cyc
assign rd1_o_R1 = rasN_R & cas1_o & weN_R & ~rs0N_R; // mk1 rd cmd cyc
assign wr0_o_R1 = rasN_R & cas0_o & ~weN_R & ~rs0N_R; // mk0 wr cmd cyc
assign wr1_o_R1 = rasN_R & cas1_o & ~weN_R & ~rs0N_R; // mk1 wr cmd cyc
always @(posedge clk_in)
  begin
    rd0_o_R2 <= rd0_o_R1;
    rd0_o_R3 <= rd0_o_R2;
    rd0_o_R4 <= rd0_o_R3;
    rd0_o_R5 <= rd0_o_R4;
    rd1_o_R2 <= rd1_o_R1;
    rd1_o_R3 <= rd1_o_R2;
    rd1_o_R4 <= rd1_o_R3;
    rd1_o_R5 <= rd1_o_R4;
    wr0_o_R2 <= wr0_o_R1;
  end
```



```

        wr0_o_R3 <= wr0_o_R2;
        wr0_o_R4 <= wr0_o_R3;

        wr1_o_R2 <= wr1_o_R1;
        wr1_o_R3 <= wr1_o_R2;
        wr1_o_R4 <= wr1_o_R3;
    end

    always @(posedge clk_in)
    begin
        if (
            (rd0_o_R2 & ~rd1_o_R4)                // pre-am rd if no ped on mk 1
            | rd0_o_R3                               // 1st cyc of rd brst
            | rd0_o_R4                               // 2nd cyc of rd brst
            | (rd0_o_R5 & ~rd1_o_R2 & ~rd1_o_R3)    // post-rd cyc if no ped on mk 1
            | (wr0_o_R1)                             // pre-am wr
            | wr0_o_R2 | wr0_o_R3                   // wr brst 1st & 2nd cyc
            | (wr0_o_R4)                             // post-wr cyc (chgef9)
            | wr1_o_R1 | wr1_o_R2 | wr1_o_R3 | wr1_o_R4 // rank 1 (chgef9)
        )
            en_fet_a <= 1'b1;                        // enable fet
        else
            en_fet_a <= 1'b0;                        // disable fet
        end

    always @(posedge clk_in)
    begin
        if (
            (rd1_o_R2 & ~rd0_o_R4)
            | rd1_o_R3
            | rd1_o_R4
            | (rd1_o_R5 & ~rd0_o_R2 & ~rd0_o_R3)
            | (wr1_o_R1)                             // (chgef8)
            | wr1_o_R2 | wr1_o_R3
            | (wr1_o_R4)                             // post-wr cyc (chgef9)
            | wr0_o_R1 | wr0_o_R2 | wr0_o_R3 | wr0_o_R4 // rank 0 (chgef9)
        )
            en_fet_b <= 1'b1;                        //
        else
            en_fet_b <= 1'b0;
        end
    end

```

[0117] In certain embodiments, the chipset memory controller of the computer system uses the inherent behavioral characteristics of the memory devices (e.g., DDR2 memory devices) to optimize throughput of the memory system. For example, for each internal bank in the memory array, a row (e.g., 1KB page) is advantageously held activated for an extended period of time. The memory controller, by anticipating a high number of memory accesses or hits to a particular region of memory, can exercise this feature to advantageously eliminate time-consuming pre-charge cycles. In certain such embodiments in which two half-density memory devices are transparently substituted for a single full-density memory device (as reported by the SPD device 240 to the memory controller), the memory devices advantageously support the “open row” feature.

[0118] Figure 10A schematically illustrates an exemplary memory module 10 which doubles the rank density in accordance with certain embodiments described herein.

The memory module 10 has a first memory capacity. The memory module 10 comprises a plurality of substantially identical memory devices 30 configured as a first rank 32a and a second rank 32b. In certain embodiments, the memory devices 30 of the first rank 32a are configured in pairs, and the memory devices 30 of the second rank 32b are also configured in pairs. In certain embodiments, the memory devices 30 of the first rank 32a are configured with their respective DQS pins tied together and the memory devices 30 of the second rank 32b are configured with their respective DQS pins tied together, as described more fully below. The memory module 10 further comprises a circuit 40 which receives a first set of address and command signals from a memory controller (not shown) of the computer system. The first set of address and command signals is compatible with a second memory capacity substantially equal to one-half of the first memory capacity. The circuit 40 translates the first set of address and command signals into a second set of address and command signals which is compatible with the first memory capacity of the memory module 10 and which is transmitted to the first rank 32a and the second rank 32b.

[0119] The first rank 32a of Figure 10A has 18 memory devices 30 and the second rank 32b of Figure 10A has 18 memory devices 30. Other numbers of memory devices 30 in each of the ranks 32a, 32b are also compatible with embodiments described herein.

[0120] In the embodiment schematically illustrated by Figure 10A, the memory module 10 has a width of 8 bytes (or 64 bits) and each of the memory devices 30 of Figure 10A has a bit width of 4 bits. The 4-bit-wide ("x 4") memory devices 30 of Figure 10A have one-half the width, but twice the depth of 8-bit-wide ("x 8") memory devices. Thus, each pair of "x 4" memory devices 30 has the same density as a single "x 8" memory device, and pairs of "x 4" memory devices 30 can be used instead of individual "x 8" memory devices to provide the memory density of the memory module 10. For example, a pair of 512-Mb 128M x 4-bit memory devices has the same memory density as a 1-Gb 128M x 8-bit memory device.

[0121] For two "x 4" memory devices 30 to work in tandem to mimic a "x 8" memory device, the relative DQS pins of the two memory devices 30 in certain embodiments are advantageously tied together, as described more fully below. In addition, to access the

memory density of a high-density memory module 10 comprising pairs of “x 4” memory devices 30, an additional address line is used. While a high-density memory module comprising individual “x 8” memory devices with the next-higher density would also utilize an additional address line, the additional address lines are different in the two memory module configurations.

[0122] For example, a 1-Gb 128M x 8-bit DDR-1 DRAM memory device uses row addresses  $A_{13}-A_0$  and column addresses  $A_{11}$  and  $A_9-A_0$ . A pair of 512-Mb 128M x 4-bit DDR-1 DRAM memory devices uses row addresses  $A_{12}-A_0$  and column addresses  $A_{12}$ ,  $A_{11}$ , and  $A_9-A_0$ . In certain embodiments, a memory controller of a computer system utilizing a 1-GB 128M x 8 memory module 10 comprising pairs of the 512-Mb 128M x 4 memory devices 30 supplies the address and command signals including the extra row address ( $A_{13}$ ) to the memory module 10. The circuit 40 receives the address and command signals from the memory controller and converts the extra row address ( $A_{13}$ ) into an extra column address ( $A_{12}$ ).

[0123] Figure 10B schematically illustrates an exemplary circuit 40 compatible with embodiments described herein. The circuit 40 is used for a memory module 10 comprising pairs of “x 4” memory devices 30 which mimic individual “x 8” memory devices. In certain embodiments, each pair has the respective DQS pins of the memory devices 30 tied together. In certain embodiments, as schematically illustrated by Figure 10B, the circuit 40 comprises a programmable-logic device (PLD) 42, a first multiplexer 44 electrically coupled to the first rank 32a of memory devices 30, and a second multiplexer 46 electrically coupled to the second rank 32b of memory devices 30. In certain embodiments, the PLD 42 and the first and second multiplexers 44, 46 are discrete elements, while in other certain embodiments, they are integrated within a single integrated circuit. Persons skilled in the art can select an appropriate PLD 42, first multiplexer 44, and second multiplexer 46 in accordance with embodiments described herein.

[0124] In the exemplary circuit 40 of Figure 10B, during a row access procedure (CAS is high), the first multiplexer 44 passes the  $A_{12}$  address through to the first rank 32, the second multiplexer 46 passes the  $A_{12}$  address through to the second rank 34, and the PLD 42 saves or latches the  $A_{13}$  address from the memory controller. In certain embodiments, a copy

of the  $A_{13}$  address is saved by the PLD 42 for each of the internal banks (e.g., 4 internal banks) per memory device 30. During a subsequent column access procedure (CAS is low), the first multiplexer 44 passes the previously-saved  $A_{13}$  address through to the first rank 32a as the  $A_{12}$  address and the second multiplexer 46 passes the previously-saved  $A_{13}$  address through to the second rank 32b as the  $A_{12}$  address. The first rank 32a and the second rank 32b thus interpret the previously-saved  $A_{13}$  row address as the current  $A_{12}$  column address. In this way, in certain embodiments, the circuit 40 translates the extra row address into an extra column address in accordance with certain embodiments described herein.

[0125] Thus, by allowing two lower-density memory devices to be used rather than one higher-density memory device, certain embodiments described herein provide the advantage of using lower-cost, lower-density memory devices to build “next-generation” higher-density memory modules. Certain embodiments advantageously allow the use of lower-cost readily-available 512-Mb DDR-2 SDRAM devices to replace more expensive 1-Gb DDR-2 SDRAM devices. Certain embodiments advantageously reduce the total cost of the resultant memory module.

[0126] Figure 11A schematically illustrates an exemplary memory module 10 which doubles number of ranks in accordance with certain embodiments described herein. The memory module 10 has a first plurality of memory locations with a first memory density. The memory module 10 comprises a plurality of substantially identical memory devices 30 configured as a first rank 32a, a second rank 32b, a third rank 32c, and a fourth rank 32d. The memory module 10 further comprises a circuit 40 which receives a first set of address and command signals from a memory controller (not shown). The first set of address and command signals is compatible with a second plurality of memory locations having a second memory density. The second memory density is substantially equal to one-half of the first memory density. The circuit 40 translates the first set of address and command signals into a second set of address and command signals which is compatible with the first plurality of memory locations of the memory module 10 and which is transmitted to the first rank 32a, the second rank 32b, the third rank 32c, and the fourth rank 32d.

[0127] Each rank 32a, 32b, 32c, 32d of Figure 11A has 9 memory devices 30. Other numbers of memory devices 30 in each of the ranks 32a, 32b, 32c, 32d are also compatible with embodiments described herein.

[0128] In the embodiment schematically illustrated by Figure 11A, the memory module 10 has a width of 8 bytes (or 64 bits) and each of the memory devices 30 of Figure 11A has a bit width of 8 bits. Because the memory module 10 has twice the number of 8-bit-wide (“x 8”) memory devices 30 as does a standard 8-byte-wide memory module, the memory module 10 has twice the density as does a standard 8-byte-wide memory module. For example, a 1-GB 128M x 8-byte memory module with 36 512-Mb 128M x 8-bit memory devices (arranged in four ranks) has twice the memory density as a 512-Mb 128M x 8-byte memory module with 18 512-Mb 128M x 8-bit memory devices (arranged in two ranks).

[0129] To access the additional memory density of the high-density memory module 10, the two chip-select signals (CS<sub>0</sub>, CS<sub>1</sub>) are used with other address and command signals to gate a set of four gated CAS signals. For example, to access the additional ranks of four-rank 1-GB 128M x 8-byte DDR-1 DRAM memory module, the CS<sub>0</sub> and CS<sub>1</sub> signals along with the other address and command signals are used to gate the CAS signal appropriately, as schematically illustrated by Figure 11A. Figure 11B schematically illustrates an exemplary circuit 40 compatible with embodiments described herein. In certain embodiments, the circuit 40 comprises a programmable-logic device (PLD) 42 and four “OR” logic elements 52, 54, 56, 58 electrically coupled to corresponding ranks 32a, 32b, 32c, 32d of memory devices 30.

[0130] In certain embodiments, the PLD 42 comprises an ASIC, an FPGA, a custom-designed semiconductor device, or a CPLD. In certain embodiments, the PLD 42 and the four “OR” logic elements 52, 54, 56, 58 are discrete elements, while in other certain embodiments, they are integrated within a single integrated circuit. Persons skilled in the art can select an appropriate PLD 42 and appropriate “OR” logic elements 52, 54, 56, 58 in accordance with embodiments described herein.

[0131] In the embodiment schematically illustrated by Figure 11B, the PLD 42 transmits each of the four “enabled CAS” (ENCAS<sub>0a</sub>, ENCAS<sub>0b</sub>, ENCAS<sub>1a</sub>, ENCAS<sub>1b</sub>) signals to a corresponding one of the “OR” logic elements 52, 54, 56, 58. The CAS signal is

also transmitted to each of the four “OR” logic elements 52, 54, 56, 58. The CAS signal and the “enabled CAS” signals are “low” true signals. By selectively activating each of the four “enabled CAS” signals which are inputted into the four “OR” logic elements 52, 54, 56, 58, the PLD 42 is able to select which of the four ranks 32a, 32b, 32c, 32d is active.

[0132] In certain embodiments, the PLD 42 uses sequential and combinatorial logic procedures to produce the gated CAS signals which are each transmitted to a corresponding one of the four ranks 32a, 32b, 32c, 32d. In certain other embodiments, the PLD 42 instead uses sequential and combinatorial logic procedures to produce four gated chip-select signals (e.g., CS<sub>0a</sub>, CS<sub>0b</sub>, CS<sub>1a</sub>, and CS<sub>1b</sub>) which are each transmitted to a corresponding one of the four ranks 32a, 32b, 32c, 32d.

#### Tied Data Strobe Signal Pins

[0133] For proper operation, the computer system advantageously recognizes a 1-GB memory module comprising 256-Mb memory devices with 64M x 4-bit configuration as a 1-GB memory module having 512-Mb memory devices with 64M x 8-bit configuration (e.g., as a 1-GB memory module with 128M x 8-byte configuration). This advantageous result is desirably achieved in certain embodiments by electrically connecting together two output signal pins (e.g., DQS or data strobe pins) of the two 256-Mb memory devices such that both output signal pins are concurrently active when the two memory devices are concurrently enabled. The DQS or data strobe is a bi-directional signal that is used during both read cycles and write cycles to validate or latch data. As used herein, the terms “tying together” or “tied together” refer to a configuration in which corresponding pins (e.g., DQS pins) of two memory devices are electrically connected together and are concurrently active when the two memory devices are concurrently enabled (e.g., by a common chip-select or CS signal). Such a configuration is different from standard memory module configurations in which the output signal pins (e.g., DQS pins) of two memory devices are electrically coupled to the same source, but these pins are not concurrently active since the memory devices are not concurrently enabled. However, a general guideline of memory module design warns against tying together two output signal pins in this way.

[0134] Figures 12 and 13 schematically illustrate a problem which may arise from tying together two output signal pins. Figure 12 schematically illustrates an exemplary

memory module 305 in which a first DQS pin 312 of a first memory device 310 is electrically connected to a second DQS pin 322 of a second memory device 320. The two DQS pins 312, 322 are both electrically connected to a memory controller 330.

[0135] Figure 13 is an exemplary timing diagram of the voltages applied to the two DQS pins 312, 322 due to non-simultaneous switching. As illustrated by Figure 13, at time  $t_1$ , both the first DQS pin 312 and the second DQS pin 322 are high, so no current flows between them. Similarly, at time  $t_4$ , both the first DQS pin 312 and the second DQS pin 322 are low, so no current flows between them. However, for times between approximately  $t_2$  and approximately  $t_3$ , the first DQS pin 312 is low while the second DQS pin 322 is high. Under such conditions, a current will flow between the two DQS pins 312, 322. This condition in which one DQS pin is low while the other DQS pin is high can occur for fractions of a second (e.g., 0.8 nanoseconds) during the dynamic random-access memory (DRAM) read cycle. During such conditions, the current flowing between the two DQS pins 312, 322 can be substantial, resulting in heating of the memory devices 310, 320, and contributing to the degradation of reliability and eventual failure of these memory devices.

[0136] A second problem may also arise from tying together two output signal pins. Figure 14 schematically illustrates another exemplary memory module 305 in which a first DQS pin 312 of a first memory device 310 is electrically connected to a second DQS pin 322 of a second memory device 320. The two DQS pins 312, 322 of Figure 14 are both electrically connected to a memory controller (not shown). The DQ (data input/output) pin 314 of the first memory device 310 and the corresponding DQ pin 324 of the second memory device 320 are each electrically connected to the memory controller by the DQ bus (not shown). Typically, each memory device 310, 320 will have a plurality of DQ pins (e.g., eight DQ pins per memory device), but for simplicity, Figure 14 only shows one DQ pin for each memory device 310, 320.

[0137] Each of the memory devices 310, 320 of Figure 14 utilizes a respective on-die termination or “ODT” circuit 332, 334 which has termination resistors (e.g., 75 ohms) internal to the memory devices 310, 320 to provide signal termination. Each memory device 310, 320 has a corresponding ODT signal pin 362, 364 which is electrically connected to the memory controller via an ODT bus 340. The ODT signal pin 362 of the first memory device

310 receives a signal from the ODT bus 340 and provides the signal to the ODT circuit 332 of the first memory device 310. The ODT circuit 332 responds to the signal by selectively enabling or disabling the internal termination resistors 352, 356 of the first memory device 310. This behavior is shown schematically in Figure 14 by the switches 342, 344 which are either closed (dash-dot line) or opened (solid line). The ODT signal pin 364 of the second memory device 320 receives a signal from the ODT bus 340 and provides the signal to the ODT circuit 334 of the second memory device 320. The ODT circuit 334 responds to the signal by selectively enabling or disabling the internal termination resistors 354, 358 of the second memory device 320. This behavior is shown schematically in Figure 14 by the switches 346, 348 which are either closed (dash-dot line) or opened (solid line). The switches 342, 344, 346, 348 of Figure 14 are schematic representations of the operation of the ODT circuits 332, 334, and do not signify that the ODT circuits 332, 334 necessarily include mechanical switches.

[0138] Examples of memory devices 310, 320 which include such ODT circuits 332, 334 include, but are not limited to, DDR2 memory devices. Such memory devices are configured to selectively enable or disable the termination of the memory device in this way in response to signals applied to the ODT signal pin of the memory device. For example, when the ODT signal pin 362 of the first memory device 310 is pulled high, the termination resistors 352, 356 of the first memory device 310 are enabled. When the ODT signal pin 362 of the first memory device 310 is pulled low (e.g., grounded), the termination resistors 352, 356 of the first memory device 310 are disabled. By selectively disabling the termination resistors of an active memory device, while leaving the termination resistors of inactive memory devices enabled, such configurations advantageously preserve signal strength on the active memory device while continuing to eliminate signal reflections at the bus-die interface of the inactive memory devices.

[0139] In certain configurations, as schematically illustrated by Figure 14, the DQS pins 312, 322 of each memory device 310, 320 are selectively connected to a voltage VTT through a corresponding termination resistor 352, 354 internal to the corresponding memory device 310, 320. Similarly, in certain configurations, as schematically illustrated by Figure 14, the DQ pins 314, 324 are selectively connected to a voltage VTT through a



corresponding termination resistor 356, 358 internal to the corresponding memory device 310, 320. In certain configurations, rather than being connected to a voltage VTT, the DQ pins 314, 324 and/or the DQS pins 312, 322 are selectively connected to ground through the corresponding termination resistors 352, 354, 356, 358. The resistances of the internal termination resistors 352, 354, 356, 358 are selected to clamp the voltages so as to reduce the signal reflections from the corresponding pins. In the configuration schematically illustrated by Figure 14, each internal termination resistor 352, 354, 356, 358 has a resistance of approximately 75 ohms.

[0140] When connecting the first memory device 310 and the second memory device 320 together to form a double word width, both the first memory device 310 and the second memory device 320 are enabled at the same time (e.g., by a common CS signal). Connecting the first memory device 310 and the second memory device 320 by tying the DQS pins 312, 322 together, as shown in Figure 14, results in a reduced effective termination resistance for the DQS pins 312, 322. For example, for the exemplary configuration of Figure 14, the effective termination resistance for the DQS pins 312, 322 is approximately 37.5 ohms, which is one-half the desired ODT resistance (for 75-ohm internal termination resistors) to reduce signal reflections since the internal termination resistors 352, 354 of the two memory devices 310, 320 are connected in parallel. This reduction in the termination resistance can result in signal reflections causing the memory device to malfunction.

[0141] Figure 15 schematically illustrates an exemplary memory module 400 in accordance with certain embodiments described herein. The memory module 400 comprises a first memory device 410 having a first data strobe (DQS) pin 412 and a second memory device 420 having a second data strobe (DQS) pin 422. The memory module 400 further comprises a first resistor 430 electrically coupled to the first DQS pin 412. The memory module 400 further comprises a second resistor 440 electrically coupled to the second DQS pin 422 and to the first resistor 430. The first DQS pin 412 is electrically coupled to the second DQS pin 422 through the first resistor 430 and through the second resistor 440.

[0142] In certain embodiments, the memory module 400 is a 1-GB unbuffered Double Data Rate (DDR) Synchronous Dynamic RAM (SDRAM) high-density dual in-line memory module (DIMM). Figures 16A and 16B schematically illustrate a first side 462 and

a second side 464, respectively, of such a memory module 400 with eighteen 64M x 4-bit, DDR-1 SDRAM FBGA memory devices on each side of a 184-pin glass-epoxy printed circuit board (PCB) 460. In certain embodiments, the memory module 400 further comprises a phase-lock-loop (PLL) clock driver 470, an EEPROM for serial-presence detect (SPD) data 480, and decoupling capacitors (not shown) mounted on the PCB in parallel to suppress switching noise on VDD and VDDQ power supply for DDR-1 SDRAM. By using synchronous design, such memory modules 400 allow precise control of data transfer between the memory module 400 and the system controller. Data transfer can take place on both edges of the DQS signal at various operating frequencies and programming latencies. Therefore, certain such memory modules 400 are suitable for a variety of high-performance system applications.

[0143] In certain embodiments, the memory module 400 comprises a plurality of memory devices configured in pairs, each pair having a first memory device 410 and a second memory device 420. For example, in certain embodiments, a 128M x 72-bit DDR SDRAM high-density memory module 400 comprises thirty-six 64M x 4-bit DDR-1 SDRAM integrated circuits in FBGA packages configured in eighteen pairs. The first memory device 410 of each pair has the first DQS pin 412 electrically coupled to the second DQS pin 422 of the second memory device 420 of the pair. In addition, the first DQS pin 412 and the second DQS pin 422 are concurrently active when the first memory device 410 and the second memory device 420 are concurrently enabled.

[0144] In certain embodiments, the first resistor 430 and the second resistor 440 each has a resistance advantageously selected to reduce the current flow between the first DQS pin 412 and the second DQS pin 422 while allowing signals to propagate between the memory controller and the DQS pins 412, 422. In certain embodiments, each of the first resistor 430 and the second resistor 440 has a resistance in a range between approximately 5 ohms and approximately 50 ohms. For example, in certain embodiments, each of the first resistor 430 and the second resistor 440 has a resistance of approximately 22 ohms. Other resistance values for the first resistor 430 and the second resistor 440 are also compatible with embodiments described herein. In certain embodiments, the first resistor 430 comprises a single resistor, while in other embodiments, the first resistor 430 comprises a plurality of

resistors electrically coupled together in series and/or in parallel. Similarly, in certain embodiments, the second resistor 440 comprises a single resistor, while in other embodiments, the second resistor 440 comprises a plurality of resistors electrically coupled together in series and/or in parallel.

[0145] Figures 17A and 17B schematically illustrate an exemplary embodiment of a memory module 400 in which the first resistor 430 and the second resistor 440 are used to reduce the current flow between the first DQS pin 412 and the second DQS pin 422. As schematically illustrated by Figure 17A, the memory module 400 is part of a computer system 500 having a memory controller 510. The first resistor 430 has a resistance of approximately 22 ohms and the second resistor 440 has a resistance of approximately 22 ohms. The first resistor 430 and the second resistor 440 are electrically coupled in parallel to the memory controller 510 through a signal line 520 having a resistance of approximately 25 ohms. The first resistor 430 and the second resistor 440 are also electrically coupled in parallel to a source of a fixed termination voltage (identified by VTT in Figures 17A and 17B) by a signal line 540 having a resistance of approximately 47 ohms. Such an embodiment can advantageously be used to allow two memory devices having lower bit widths (e.g., 4-bit) to behave as a single virtual memory device having a higher bit width (e.g., 8-bit).

[0146] Figure 17B schematically illustrates exemplary current-limiting resistors 430, 440 in conjunction with the impedances of the memory devices 410, 420. During an exemplary portion of a data read operation, the memory controller 510 is in a high-impedance condition, the first memory device 410 drives the first DQS pin 412 high (e.g., 2.7 volts), and the second memory device 420 drives the second DQS pin 422 low (e.g., 0 volts). The amount of time for which this condition occurs is approximated by the time between  $t_2$  and  $t_3$  of Figure 13, which in certain embodiments is approximately twice the tDQSQ (data strobe edge to output data edge skew time, e.g., approximately 0.8 nanoseconds). At least a portion of this time in certain embodiments is caused by simultaneous switching output (SSO) effects.

[0147] In certain embodiments, as schematically illustrated by Figure 17B, the DQS driver of the first memory device 410 has a driver impedance  $R_1$  of approximately

17 ohms, and the DQS driver of the second memory device 420 has a driver impedance  $R_4$  of approximately 17 ohms. Because the upper network of the first memory device 410 and the first resistor 430 (with a resistance  $R_2$  of approximately 22 ohms) is approximately equal to the lower network of the second memory device 420 and the second resistor 440 (with a resistance  $R_3$  of approximately 22 ohms), the voltage at the midpoint is approximately  $0.5 * (2.7 - 0) = 1.35$  volts, which equals VTT, such that the current flow across the 47-ohm resistor of Figure 17B is approximately zero.

[0148] The voltage at the second DQS pin 422 in Figure 17B is given by  $V_{DQS2} = 2.7 * R_4 / (R_1 + R_2 + R_3 + R_4) = 0.59$  volts and the current flowing through the second DQS pin 422 is given by  $I_{DQS2} = 0.59 / R_4 = 34$  milliamps. The power dissipation in the DQS driver of the second memory device 420 is thus  $P_{DQS2} = 34 \text{ mA} * 0.59 \text{ V} = 20$  milliwatts. In contrast, without the first resistor 430 and the second resistor 440, only the 17-ohm impedances of the two memory devices 410, 420 would limit the current flow between the two DQS pins 412, 422, and the power dissipation in the DQS driver of the second memory device 420 would be approximately 107 milliwatts. Therefore, the first resistor 430 and the second resistor 440 of Figures 17A and 17B advantageously limit the current flowing between the two memory devices during the time that the DQS pin of one memory device is driven high and the DQS pin of the other memory device is driven low.

[0149] In certain embodiments in which there is overshoot or undershoot of the voltages, the amount of current flow can be higher than those expected for nominal voltage values. Therefore, in certain embodiments, the resistances of the first resistor 430 and the second resistor 440 are advantageously selected to account for such overshoot/undershoot of voltages.

[0150] For certain such embodiments in which the voltage at the second DQS pin 422 is  $V_{DQS2} = 0.59$  volts and the duration of the overdrive condition is approximately 0.8 nanoseconds at maximum, the total surge is approximately  $0.59 \text{ V} * 1.2 \text{ ns} = 0.3 \text{ V-ns}$ . For comparison, the JEDEC standard for overshoot/undershoot is 2.4 V-ns, so certain embodiments described herein advantageously keep the total surge within predetermined standards (e.g., JEDEC standards).

[0151] Figure 18 schematically illustrates another exemplary memory module 600 compatible with certain embodiments described herein. The memory module 600 comprises a termination bus 605. The memory module 600 further comprises a first memory device 610 having a first data strobe pin 612, a first termination signal pin 614 electrically coupled to the termination bus 605, a first termination circuit 616, and at least one data pin 618. The first termination circuit 616 selectively electrically terminating the first data strobe pin 612 and the first data pin 618 in response to a first signal received by the first termination signal pin 614 from the termination bus 605. The memory module 600 further comprises a second memory device 620 having a second data strobe pin 622 electrically coupled to the first data strobe pin 612, a second termination signal pin 624, a second termination circuit 626, and at least one data pin 628. The second termination signal pin 624 is electrically coupled to a voltage, wherein the second termination circuit 626 is responsive to the voltage by not terminating the second data strobe pin 622 or the second data pin 628. The memory module 600 further comprises at least one termination assembly 630 having a third termination signal pin 634, a third termination circuit 636, and at least one termination pin 638 electrically coupled to the data pin 628 of the second memory device 620. The third termination signal pin 634 is electrically coupled to the termination bus 605. The third termination circuit 636 selectively electrically terminates the data pin 628 of the second memory device 620 through the termination pin 638 in response to a second signal received by the third termination signal pin 634 from the termination bus 605.

[0152] Figure 19 schematically illustrates a particular embodiment of the memory module 600 schematically illustrated by Figure 18. The memory module 600 comprises an on-die termination (ODT) bus 605. The memory module 600 comprises a first memory device 610 having a first data strobe (DQS) pin 612, a first ODT signal pin 614 electrically coupled to the ODT bus 605, a first ODT circuit 616, and at least one data (DQ) pin 618. The first ODT circuit 616 selectively electrically terminates the first DQS pin 612 and the DQ pin 618 of the first memory device 610 in response to an ODT signal received by the first ODT signal pin 614 from the ODT bus 605. This behavior of the first ODT circuit 616 is schematically illustrated in Figure 14 by the switches 672, 676 which are selectively closed (dash-dot line) or opened (solid line).

**[0153]** The memory module 600 further comprises a second memory device 620 having a second DQS pin 622 electrically coupled to the first DQS pin 612, a second ODT signal pin 624, a second ODT circuit 626, and at least one DQ pin 628. The first DQS pin 612 and the second DQS pin 622 are concurrently active when the first memory device 610 and the second memory device 620 are concurrently enabled. The second ODT signal pin 624 is electrically coupled to a voltage (e.g., ground), wherein the second ODT circuit 626 is responsive to the voltage by not terminating the second DQS pin 622 or the second DQ pin 624. This behavior of the second ODT circuit 626 is schematically illustrated in Figure 14 by the switches 674, 678 which are opened.

**[0154]** The memory module 600 further comprises at least one termination assembly 630 having a third ODT signal pin 634 electrically coupled to the ODT bus 605, a third ODT circuit 636, and at least one termination pin 638 electrically coupled to the DQ pin 628 of the second memory device 620. The third ODT circuit 636 selectively electrically terminates the DQ pin 628 of the second memory device 620 through the termination pin 638 in response to an ODT signal received by the third ODT signal pin 634 from the ODT bus 605. This behavior of the third ODT circuit 636 is schematically illustrated in Figure 19 by the switch 680 which is either closed (dash-dot line) or opened (solid line).

**[0155]** In certain embodiments, the termination assembly 630 comprises discrete electrical components which are surface-mounted or embedded on the printed-circuit board of the memory module 600. In certain other embodiments, the termination assembly 630 comprises an integrated circuit mounted on the printed-circuit board of the memory module 600. Persons skilled in the art can provide a termination assembly 630 in accordance with embodiments described herein.

**[0156]** Certain embodiments of the memory module 600 schematically illustrated by Figure 19 advantageously avoid the problem schematically illustrated by Figure 12 of electrically connecting the internal termination resistances of the DQS pins of the two memory devices in parallel. As described above in relation to Figure 14, Figures 18 and 19 only show one DQ pin for each memory device for simplicity. Other embodiments have a plurality of DQ pins for each memory device. In certain embodiments, each of the first ODT circuit 616, the second ODT circuit 626, and the third ODT circuit 636 are responsive to a

high voltage or signal level by enabling the corresponding termination resistors and are responsive to a low voltage or signal level (e.g., ground) by disabling the corresponding termination resistors. In other embodiments, each of the first ODT circuit 616, the second ODT circuit 626, and the third ODT circuit 636 are responsive to a high voltage or signal level by disabling the corresponding termination resistors and are responsive to a low voltage or signal level (e.g., ground) by enabling the corresponding termination resistors. Furthermore, the switches 672, 674, 676, 678, 680 of Figure 18 are schematic representations of the enabling and disabling operation of the ODT circuits 616, 626, 636 and do not signify that the ODT circuits 616, 626, 636 necessarily include mechanical switches.

[0157] The first ODT signal pin 614 of the first memory device 610 receives an ODT signal from the ODT bus 605. In response to this ODT signal, the first ODT circuit 616 selectively enables or disables the termination resistance for both the first DQS pin 612 and the DQ pin 618 of the first memory device 610. The second ODT signal pin 624 of the second memory device 620 is tied (e.g., directly hard-wired) to the voltage (e.g., ground), thereby disabling the internal termination resistors 654, 658 on the second DQS pin 622 and the second DQ pin 628, respectively, of the second memory device 620 (schematically shown by open switches 674, 678 in Figure 19). The second DQS pin 622 is electrically coupled to the first DQS pin 612, so the termination resistance for both the first DQS pin 612 and the second DQS pin 622 is provided by the termination resistor 652 internal to the first memory device 610.

[0158] The termination resistor 656 of the DQ pin 618 of the first memory device 610 is enabled or disabled by the ODT signal received by the first ODT signal pin 614 of the first memory device 610 from the ODT bus 605. The termination resistance of the DQ pin 628 of the second memory device 620 is enabled or disabled by the ODT signal received by the third ODT signal pin 634 of the termination assembly 630 which is external to the second memory device 620. Thus, in certain embodiments, the first ODT signal pin 614 and the third ODT signal pin 634 receive the same ODT signal from the ODT bus 605, and the termination resistances for both the first memory device 610 and the second memory device 620 are selectively enabled or disabled in response thereto when these memory devices are concurrently enabled. In this way, certain embodiments of the memory module 600

schematically illustrated by Figure 19 provides external or off-chip termination of the second memory device 620.

[0159] Certain embodiments of the memory module 600 schematically illustrated by Figure 19 advantageously allow the use of two lower-cost readily-available 512-Mb DDR-2 SDRAM devices to provide the capabilities of a more expensive 1-GB DDR-2 SDRAM device. Certain such embodiments advantageously reduce the total cost of the resultant memory module 600.

[0160] Certain embodiments described herein advantageously increase the memory capacity or memory density per memory slot or socket on the system board of the computer system. Certain embodiments advantageously allow for higher memory capacity in systems with limited memory slots. Certain embodiments advantageously allow for flexibility in system board design by allowing the memory module 10 to be used with computer systems designed for different numbers of ranks (e.g., either with computer systems designed for two-rank memory modules or with computer systems designed for four-rank memory modules). Certain embodiments advantageously provide lower costs of board designs.

[0161] In certain embodiments, the memory density of a memory module is advantageously doubled by providing twice as many memory devices as would otherwise be provided. For example, pairs of lower-density memory devices can be substituted for individual higher-density memory devices to reduce costs or to increase performance. As another example, twice the number of memory devices can be used to produce a higher-density memory configuration of the memory module. Each of these examples can be limited by the number of chip select signals which are available from the memory controller or by the size of the memory devices. Certain embodiments described herein advantageously provide a logic mechanism to overcome such limitations.

[0162] Various embodiments of the present invention have been described above. Although this invention has been described with reference to these specific embodiments, the descriptions are intended to be illustrative of the invention and are not intended to be limiting. Various modifications and applications may occur to those skilled in the art without departing from the true spirit and scope of the invention.



WE CLAIM:

1. A circuit for use on a memory module, the memory module including a plurality of memory devices and operable in a computer system to perform memory operations in response to memory commands from a memory controller, the circuit comprising:

a register device to receive a set of input control/address signals associated with a respective memory command from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals, the set of output control/address signals being provided to the plurality of memory devices; and

logic to monitor the memory commands from the memory controller and to selectively isolate one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

2. The circuit of claim 1, wherein the circuit further comprises multiple groups of DQ-DQS paths, and wherein the logic selectively isolate one or more first memory devices by disabling at least one first group of DQ-DQS paths corresponding to the one or more first memory devices.

3. The circuit of Claim 2, wherein the logic is further configured to enable at least one second group of DQ-DQS paths in response to the respective memory command so as to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals.

4. The circuit of claim 1, wherein the logic is further configured to translate between a system memory domain and a physical memory device domain such that a number of signals in the set of output control/address signals is greater than a number of signals in the set of input control/address signals.

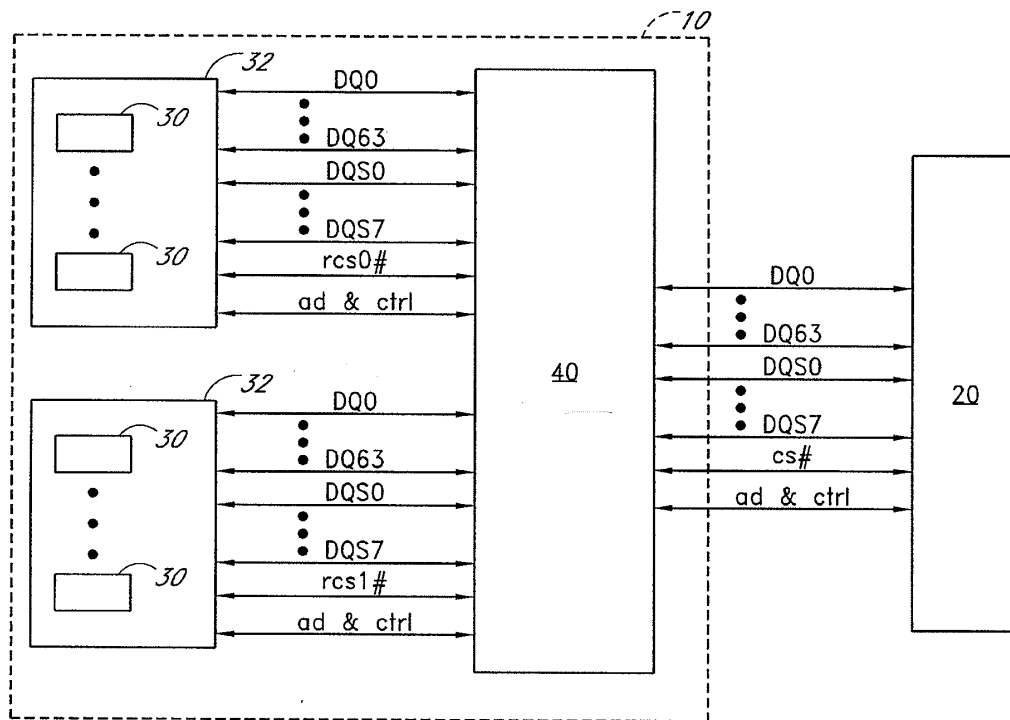
5. The circuit of Claim 4, wherein the set of input control/address signals include at least one chip-select signal and the set of output control/address signals include a greater number of chip-select signals.

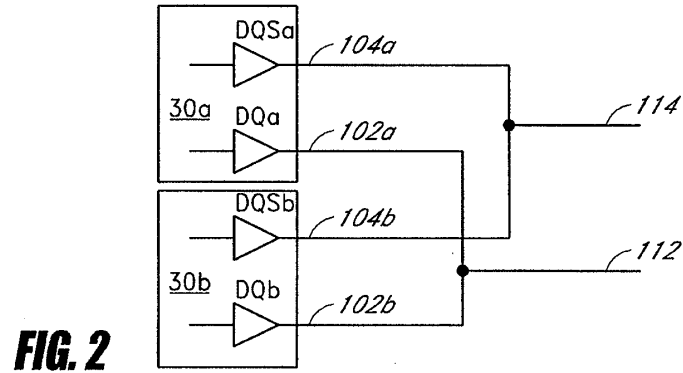
6. The circuit of Claim 1, wherein the logic element includes a buffer circuit to electrically and selectively isolate the one or more first memory devices from the memory controller and to selectively allow one or more second memory devices to communicate data with the memory controller, the buffer circuit adding a time delay to a data signal from the one or more second memory devices to the memory controller.
7. The circuit of Claim 6, wherein the logic provides functions of a data path multiplexer /demultiplexer using the time delay.
8. The circuit of Claim 6, wherein the time delay is about one clock cycle.
9. The circuit of Claim 1, wherein the respective memory command is a read command or a write command.
10. A method of operating a circuit in a memory module, the memory module including a plurality of memory devices and operable to perform memory operations in response to memory commands from a memory controller, the method comprising:
  - receiving a set of input control/address signals associated with a respective memory command from the memory controller;
  - generating a set of output control/address signals in response to the set of input control/address signals;
  - providing the set of output control/address signals to the plurality of memory devices;
  - monitoring the memory commands from the memory controller; and
  - selectively isolating one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the memory controller while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

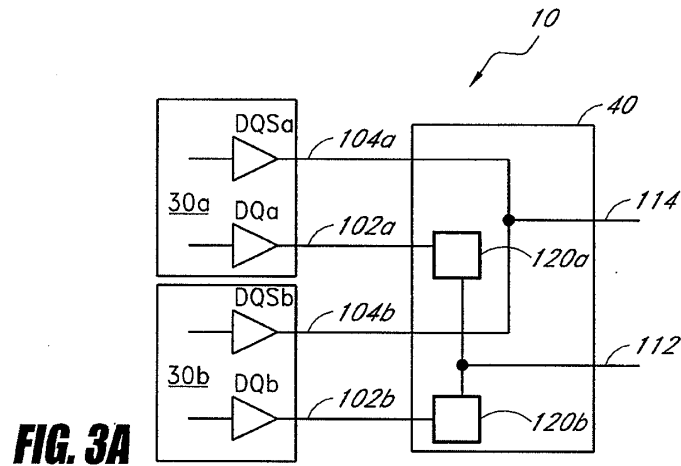
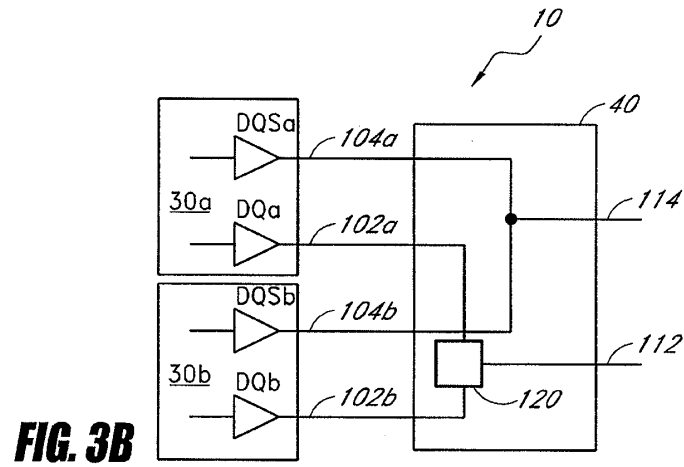
## **LOAD-REDUCING CIRCUIT FOR MEMORY MODULE**

### **ABSTRACT OF THE DISCLOSURE**

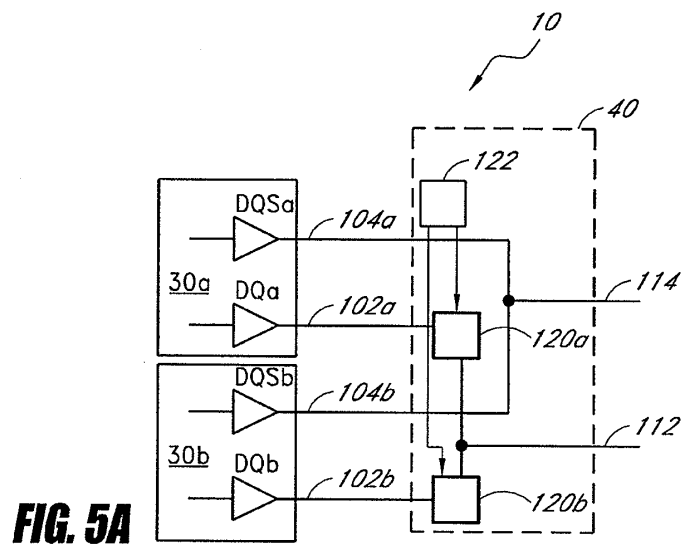
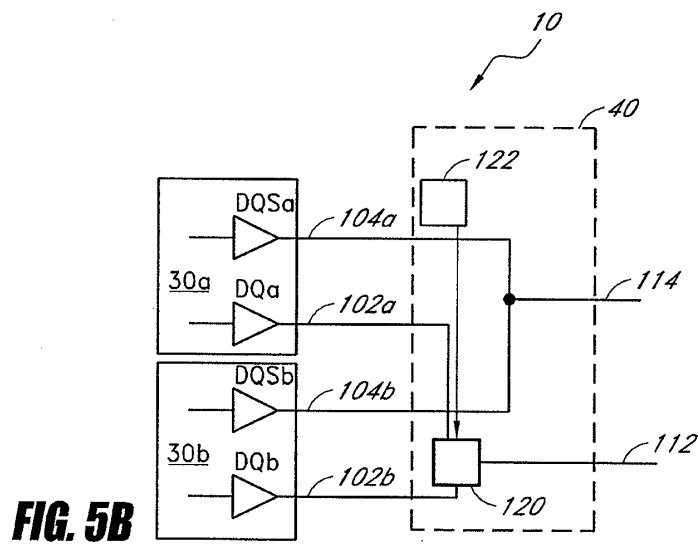
A circuit is mountable on a memory module that includes a plurality of memory devices and that is operable in a computer system to perform memory operations in response to memory commands from a memory controller. The circuit comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of output control/address signals are provided to the plurality of memory devices. The circuit further comprises logic to monitor the memory commands from the memory controller and to selectively isolate one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

**FIG. 1**

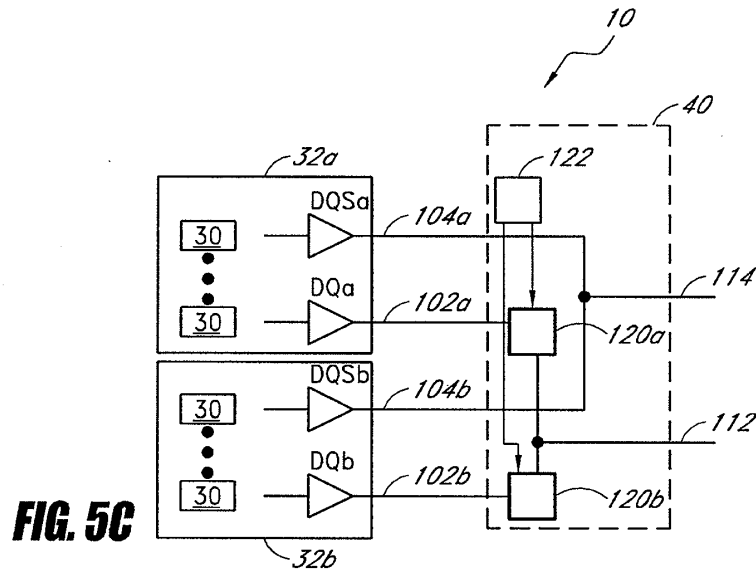
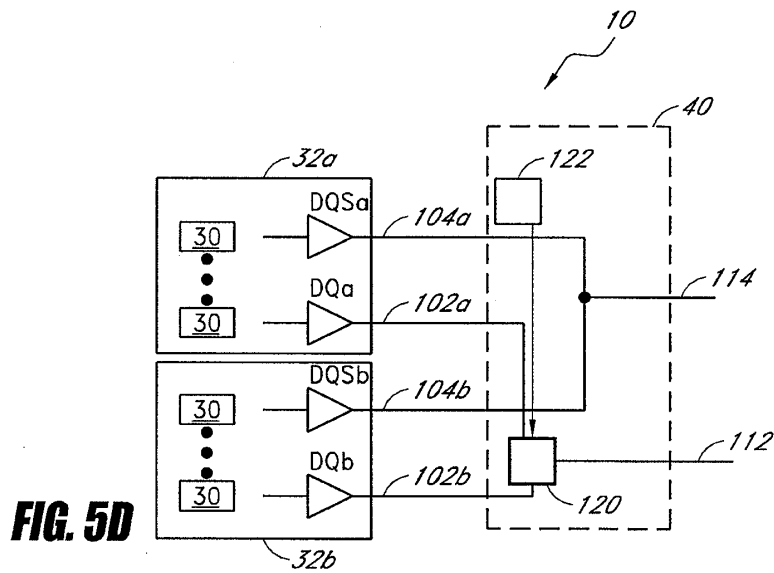












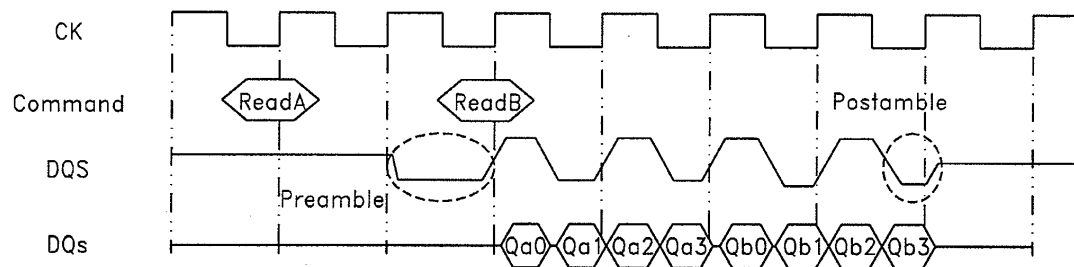


**FIG. 6A**

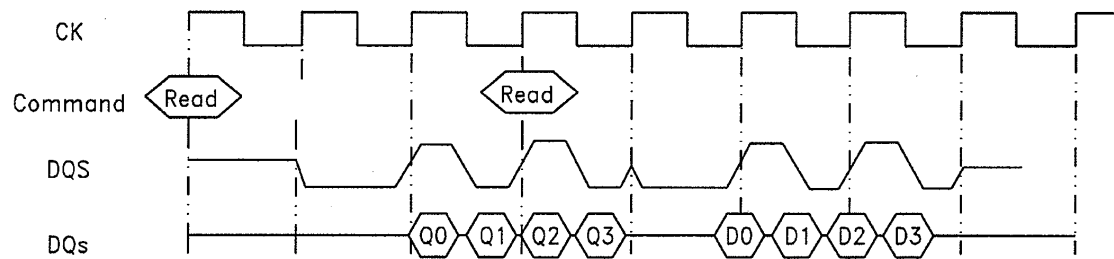


**FIG. 6B**

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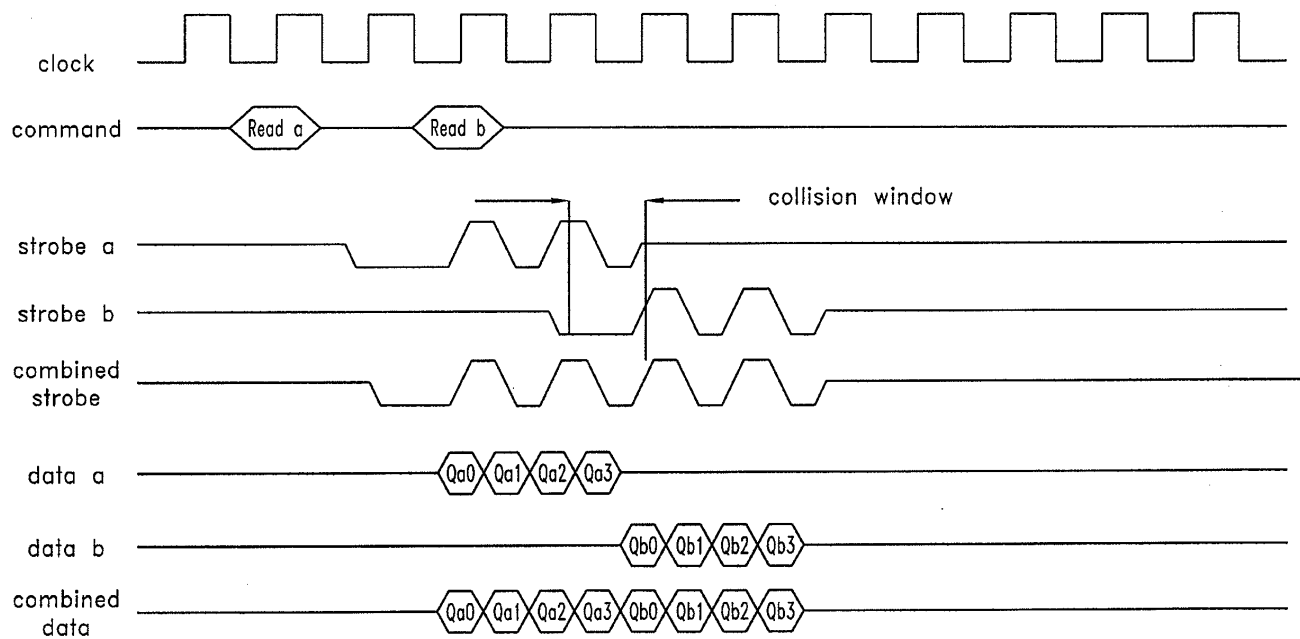


**FIG. 7**

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**FIG. 8A**

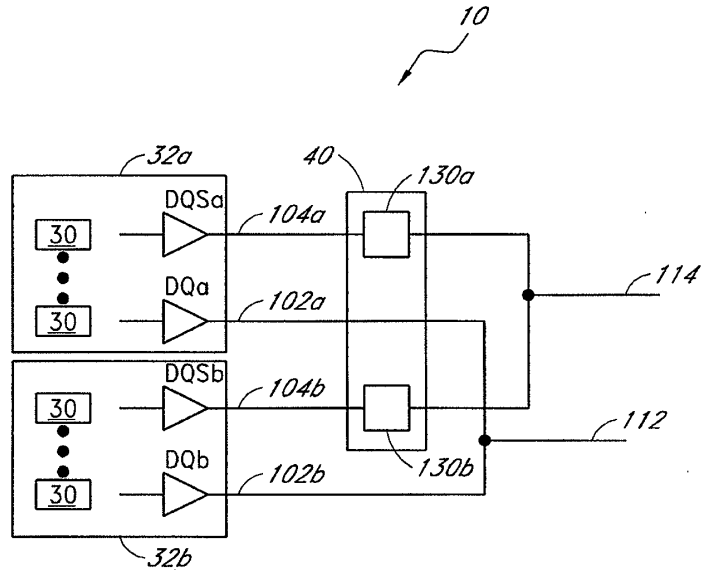
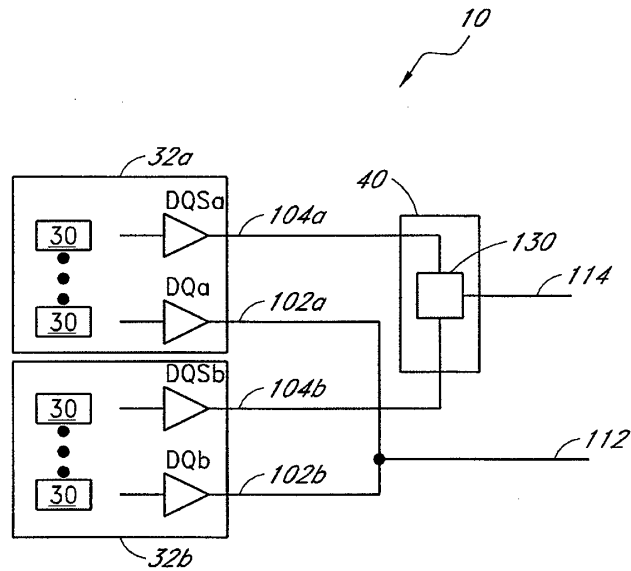
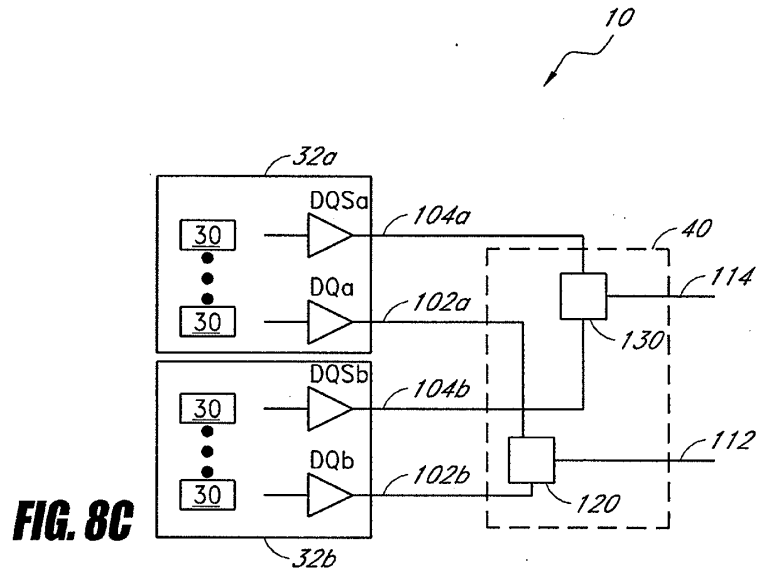
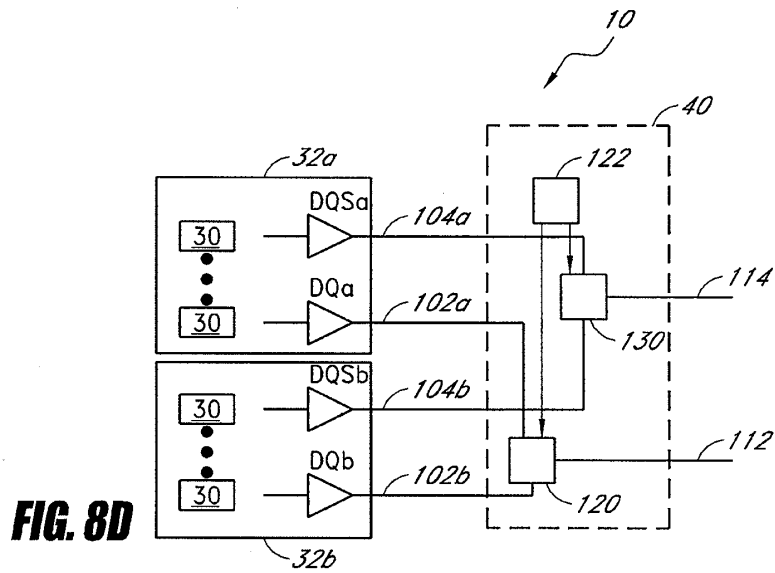


**FIG. 8B**





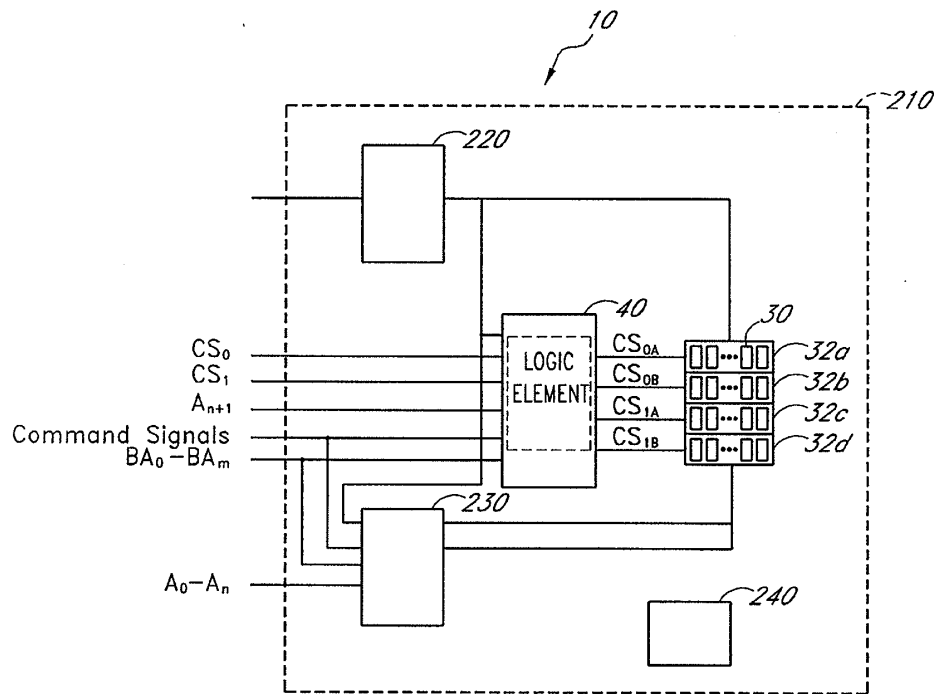


**FIG. 9A**

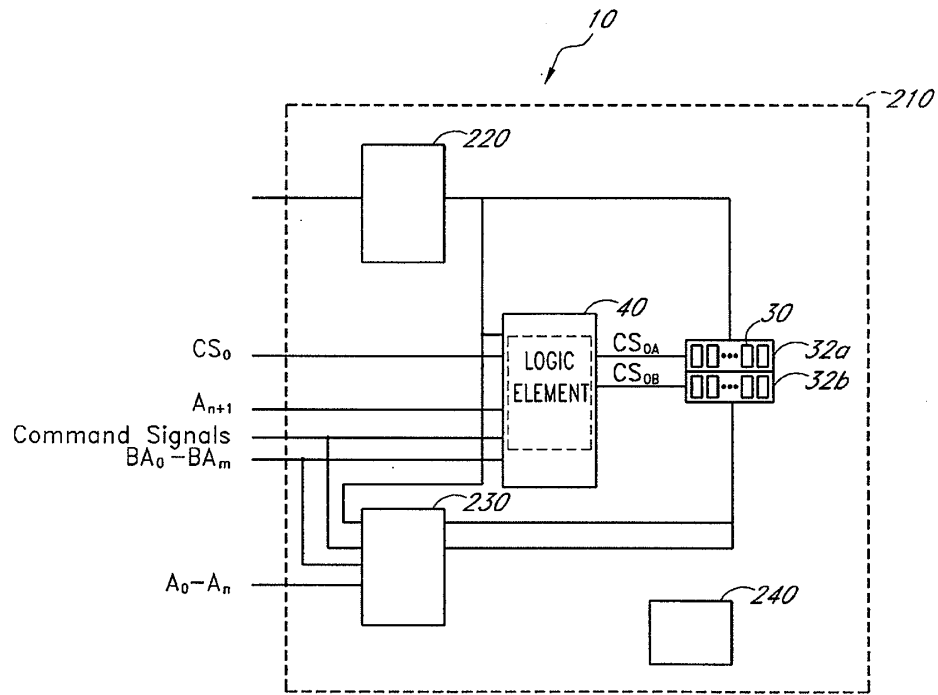


**FIG. 9B**

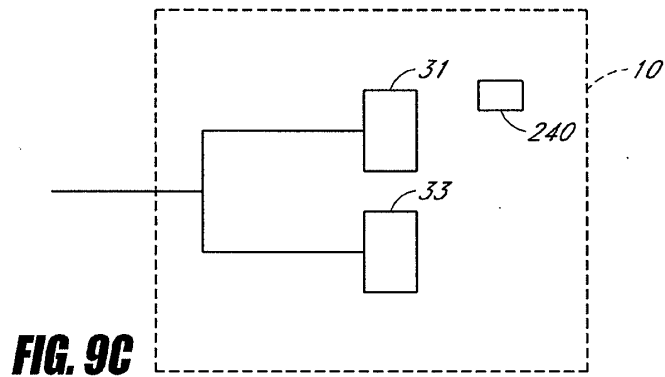


**FIG. 9C**



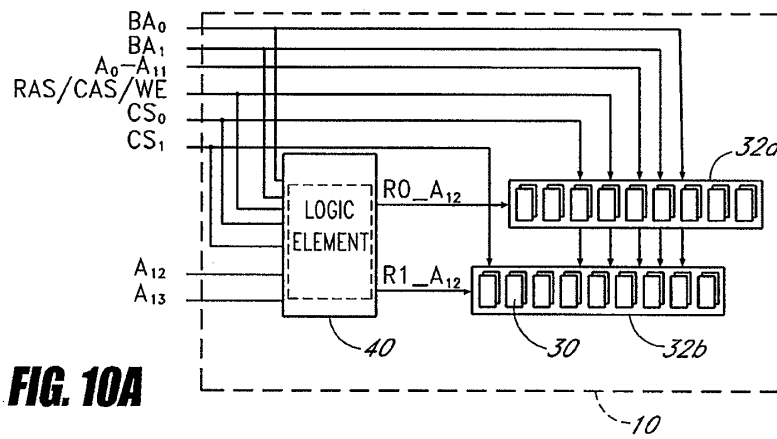


**FIG. 10A**

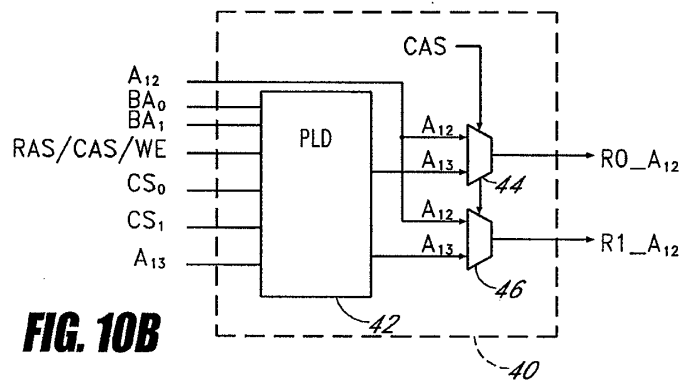


**FIG. 10B**

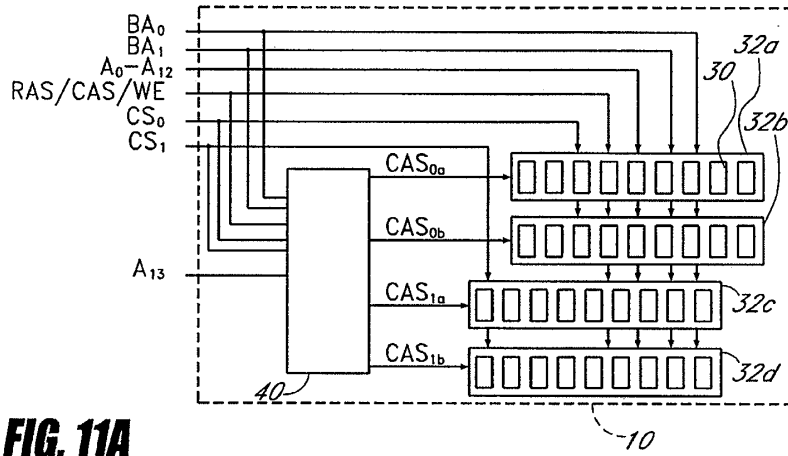


**FIG. 11A**

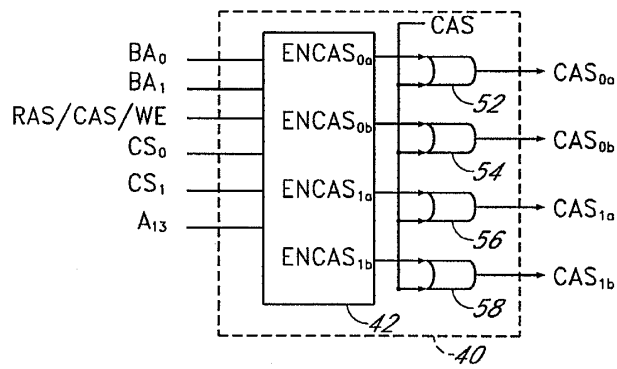


**FIG. 11B**

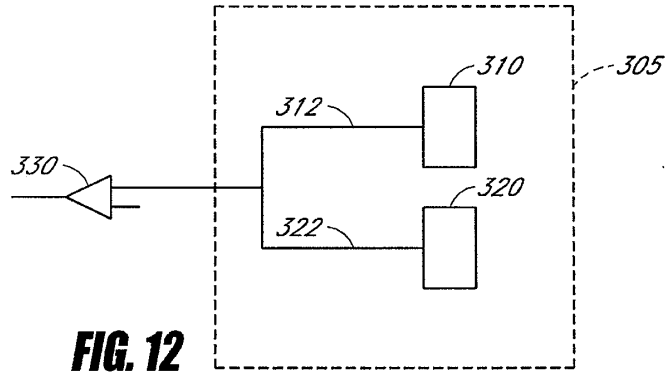


**FIG. 12**

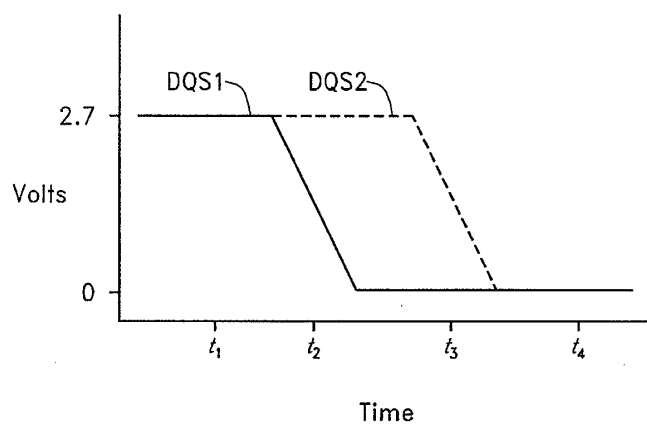
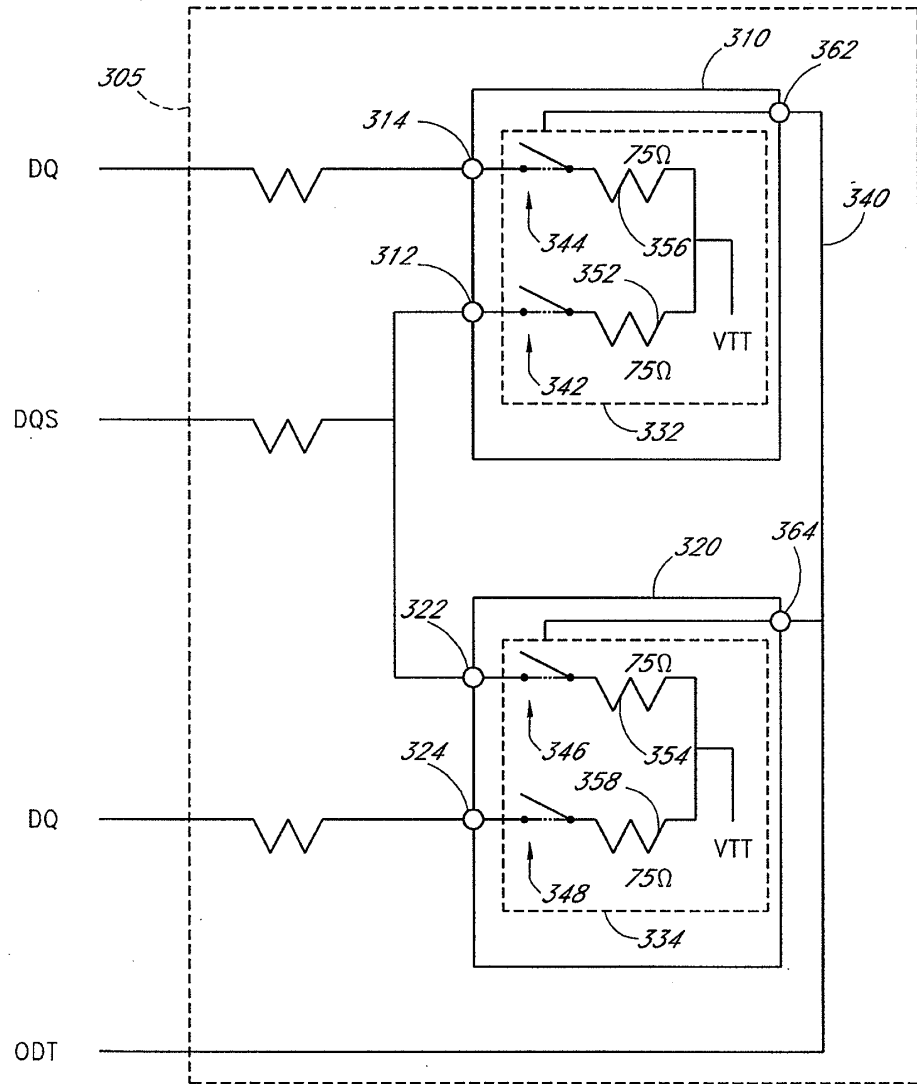


**FIG. 13**

**FIG. 14**

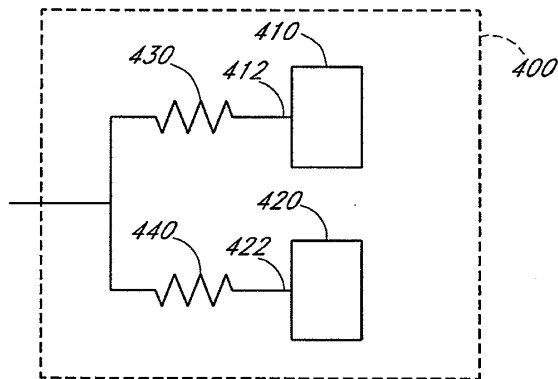


**FIG. 15**

20/23

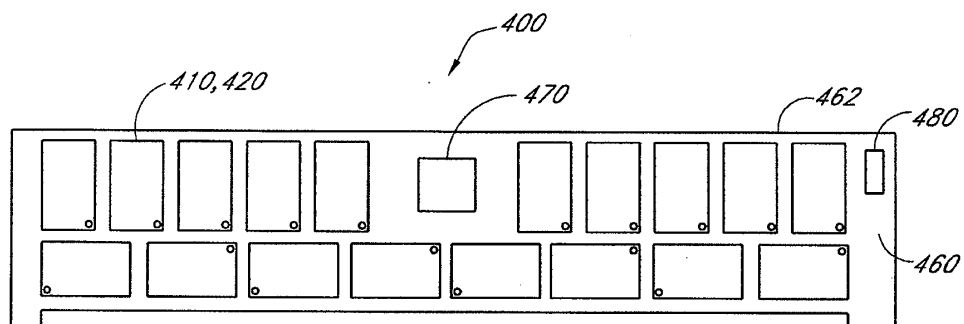


**FIG. 16A**

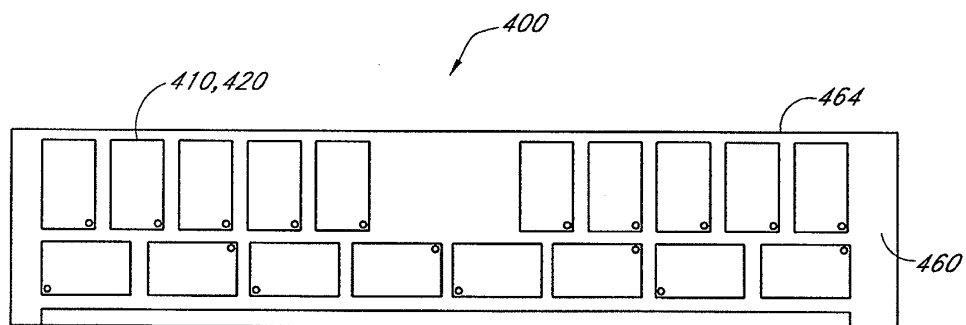


**FIG. 16B**

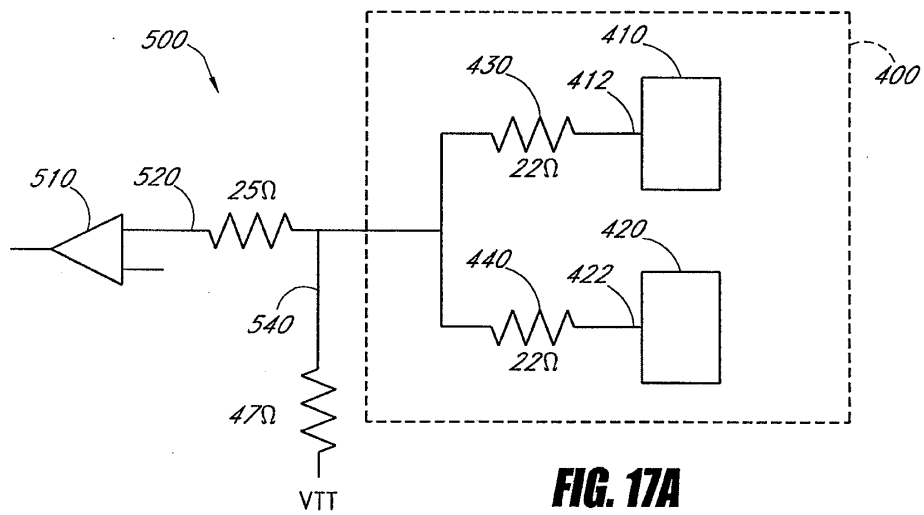


**FIG. 17A**

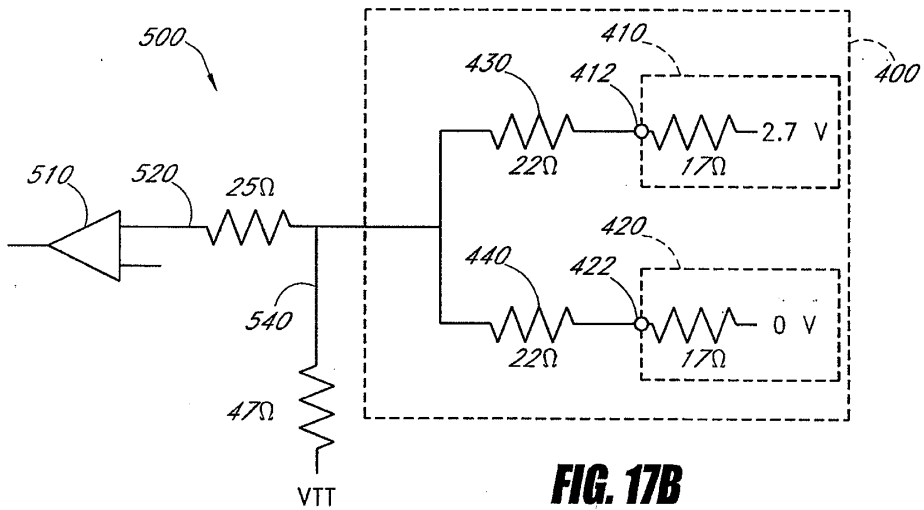


**FIG. 17B**



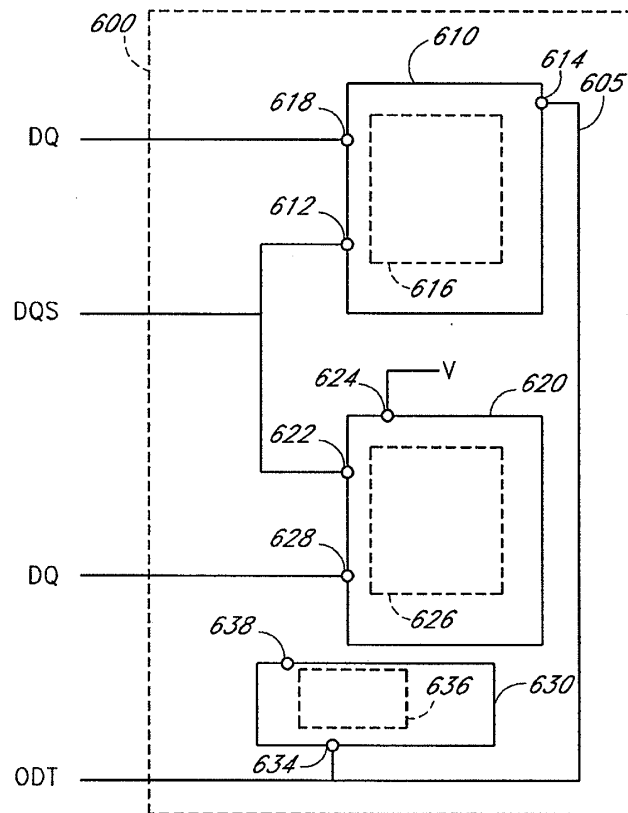
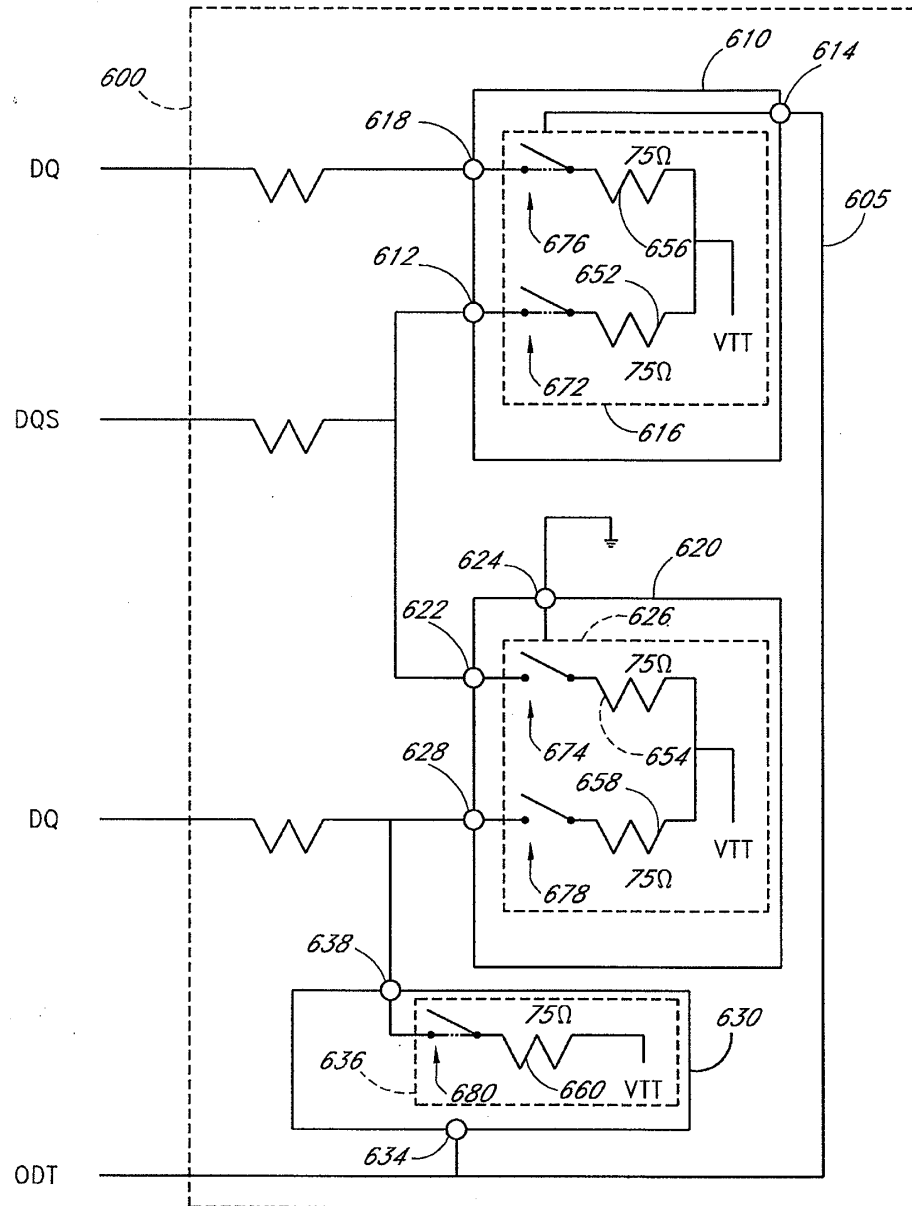


**FIG. 18**

**FIG. 19**

| Electronic Patent Application Fee Transmittal |          |                                         |        |                      |
|-----------------------------------------------|----------|-----------------------------------------|--------|----------------------|
| Application Number:                           |          |                                         |        |                      |
| Filing Date:                                  |          |                                         |        |                      |
| Title of Invention:                           |          | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |        |                      |
| First Named Inventor/Applicant Name:          |          | Jefferey C. Solomon                     |        |                      |
| Filer:                                        |          | Jamie Jie Zheng                         |        |                      |
| Attorney Docket Number:                       |          | NETL.018P2C7                            |        |                      |
| Filed as Large Entity                         |          |                                         |        |                      |
| Utility under 35 USC 111(a) Filing Fees       |          |                                         |        |                      |
| Description                                   | Fee Code | Quantity                                | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                         |        |                      |
| Utility application filing                    | 1011     | 1                                       | 280    | 280                  |
| Utility Search Fee                            | 1111     | 1                                       | 600    | 600                  |
| Utility Examination Fee                       | 1311     | 1                                       | 720    | 720                  |
| Pages:                                        |          |                                         |        |                      |
| Claims:                                       |          |                                         |        |                      |
| Miscellaneous-Filing:                         |          |                                         |        |                      |
| Petition:                                     |          |                                         |        |                      |
| Patent-Appeals-and-Interference:              |          |                                         |        |                      |

| Description                              | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|------------------------------------------|----------|----------|--------|----------------------|
| <b>Post-Allowance-and-Post-Issuance:</b> |          |          |        |                      |
| <b>Extension-of-Time:</b>                |          |          |        |                      |
| <b>Miscellaneous:</b>                    |          |          |        |                      |
| <b>Total in USD (\$)</b>                 |          |          |        | <b>1600</b>          |

| Electronic Acknowledgement Receipt   |                                         |
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| EFS ID:                              | 16636180                                |
| Application Number:                  | 13971231                                |
| International Application Number:    |                                         |
| Confirmation Number:                 | 2072                                    |
| Title of Invention:                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                     |
| Customer Number:                     | 79141                                   |
| Filer:                               | Jamie Jie Zheng                         |
| Filer Authorized By:                 |                                         |
| Attorney Docket Number:              | NETL.018P2C7                            |
| Receipt Date:                        | 20-AUG-2013                             |
| Filing Date:                         |                                         |
| Time Stamp:                          | 15:36:51                                |
| Application Type:                    | Utility under 35 USC 111(a)             |

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### File Listing:

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|                              |                                                     |                                                 |                                                      |     |    |
|------------------------------|-----------------------------------------------------|-------------------------------------------------|------------------------------------------------------|-----|----|
| 1                            | Application Data Sheet                              | 2013-08-20_ApplicationDataSheet_NETL018P2C7.pdf | 1438247<br>a814c44d030e00ced7f70f50810e0511c188fe2   | no  | 7  |
| Warnings:                    |                                                     |                                                 |                                                      |     |    |
| Information:                 |                                                     |                                                 |                                                      |     |    |
| 2                            |                                                     | 2013-08-20_Specification_NETL018P2C7.pdf        | 11691549<br>ce9130252c1812e83d84daeb1d2dfb811b02d436 | yes | 56 |
|                              | Multipart Description/PDF files in .zip description |                                                 |                                                      |     |    |
|                              | Document Description                                |                                                 | Start                                                | End |    |
|                              | Specification                                       |                                                 | 1                                                    | 53  |    |
|                              | Claims                                              |                                                 | 54                                                   | 55  |    |
|                              | Abstract                                            |                                                 | 56                                                   | 56  |    |
| Warnings:                    |                                                     |                                                 |                                                      |     |    |
| Information:                 |                                                     |                                                 |                                                      |     |    |
| 3                            | Drawings-only black and white line drawings         | 2013-08-20_Drawings_NETL018P2C7.pdf             | 542321<br>af402d9aa0eef9391b004b980ff65e011911960    | no  | 23 |
| Warnings:                    |                                                     |                                                 |                                                      |     |    |
| Information:                 |                                                     |                                                 |                                                      |     |    |
| 4                            | Fee Worksheet (SB06)                                | fee-info.pdf                                    | 32767<br>6796c9372b580f3c94de71b2b138838804657bbbb   | no  | 2  |
| Warnings:                    |                                                     |                                                 |                                                      |     |    |
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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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|          | 03 FC : 1311  | -720.00                    | OP       |



**ASSERTION OF ENTITLEMENT TO SMALL ENTITY STATUS UNDER 37 CFR 1.27  
AND  
REQUEST FOR REFUND OF EXCESS FEES PAID UNDER 37 CFR 1.26 AND 1.28(a)**

|            |                                              |
|------------|----------------------------------------------|
| Applicant  | : Netlist                                    |
| App. No.   | : 13/971,231                                 |
| Filed      | : August 20, 2013                            |
| For        | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner   | : Unknown                                    |
| Art Unit   | : Unknown                                    |
| Conf. No.  | : 2072                                       |
| Docket No. | : NETL.018P2C7                               |

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

The Assignee of all rights and title in the above-identified patent, Netlist, Inc., is a small entity concern as defined in 37 C.F.R. 1.27(a). Assertion of entitlement to small entity status under 37 C.F.R. 1.27(c) is hereby made in this application.

Applicants hereby request a refund of a portion of the basic filing fee, utility search fee and utility examination fee paid on August 20, 2013 pursuant to 37 C.F.R. § 1.26 and 1.28(a) based on establishment of small entity status.

Applicants acknowledge the duty to file notification of a loss of entitlement to small entity status in the patent prior to paying, or at the time of paying, any maintenance fee due after the date on which status as a small entity is no longer appropriate.

Respectfully submitted,

Date: August 29, 2013

/Jamie J. Zheng/

Jamie J. Zheng  
Customer No. 79141

51167

(Reg. No.)

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|--------------------------------------|-----------------------------------------|
| EFS ID:                              | 16727603                                |
| Application Number:                  | 13971231                                |
| International Application Number:    |                                         |
| Confirmation Number:                 | 2072                                    |
| Title of Invention:                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                     |
| Customer Number:                     | 79141                                   |
| Filer:                               | Jamie Jie Zheng                         |
| Filer Authorized By:                 |                                         |
| Attorney Docket Number:              | NETL.018P2C7                            |
| Receipt Date:                        | 29-AUG-2013                             |
| Filing Date:                         |                                         |
| Time Stamp:                          | 19:43:44                                |
| Application Type:                    | Utility under 35 USC 111(a)             |

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| Submitted with Payment | no |
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| Document Number | Document Description                            | File Name                                                 | File Size(Bytes)/<br>Message Digest                  | Multi Part /.zip | Pages (if appl.) |
|-----------------|-------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------|------------------|------------------|
| 1               | Assertion of entitlement to small entity status | 2013-08-29_Small_Entity_Statu<br>s_Refund_NETL018P2C7.pdf | 74842<br>35c74878a9cf3be92de4978ee46bd473ca2<br>ea1d | no               | 1                |

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**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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|          |      | 02        | FC : 2111    | 300.00     | OP       |
|          |      | 03        | FC : 2311    | 360.00     | OP       |

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|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 13/971,231            | 08/20/2013               | 2189            | 730           | NETL.018P2C7     | 10         | 2          |

CONFIRMATION NO. 2072

FILING RECEIPT



OC00000063798629

79141

The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

Date Mailed: 09/17/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Jefferey C. Solomon, Irvine, CA;  
Jayesh R. Bhakta, Residence Not Provided;

**Applicant(s)**

Netlist, Inc., Irvine, CA

**Assignment For Published Patent Application**

Netlist, Inc., Irvine, CA

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This application is a CON of 13/287,081 11/01/2011 PAT 8516188  
which is a CON of 13/032,470 02/22/2011 PAT 8081536  
which is a CON of 12/955,711 11/29/2010 PAT 7916574  
which is a CON of 12/629,827 12/02/2009 PAT 7881150  
which is a CON of 12/408,652 03/20/2009 PAT 7636274  
which is a CON of 11/335,875 01/19/2006 PAT 7532537  
which claims benefit of 60/645,087 01/19/2005  
and is a CIP of 11/173,175 07/01/2005 PAT 7289386  
which claims benefit of 60/588,244 07/15/2004  
and is a CIP of 11/075,395 03/07/2005 PAT 7286436  
which claims benefit of 60/550,668 03/05/2004  
and claims benefit of 60/575,595 05/28/2004  
and claims benefit of 60/590,038 07/21/2004

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**If Required, Foreign Filing License Granted:** 09/11/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/971,231**

**Projected Publication Date:** To Be Determined - pending completion of Missing Parts

**Non-Publication Request:** No

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

**Preliminary Class**

711

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

## **PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

**LICENSE FOR FOREIGN FILING UNDER**  
**Title 35, United States Code, Section 184**  
**Title 37, Code of Federal Regulations, 5.11 & 5.15**

**GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

**NOT GRANTED**

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop



technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                  |          |                                    |               | Application or Docket Number<br><b>13/971,231</b> |                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|------------------------------------|---------------|---------------------------------------------------|--------------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                                   |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                       |          | SMALL ENTITY                       |               | OTHER THAN SMALL ENTITY                           |                    |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                     | RATE(\$) | FEE(\$)                            |               | RATE(\$)                                          | FEE(\$)            |
| BASIC FEE<br><small>(37 CFR 1.16(a), (b), or (c))</small>                                                                                                                                                                                                                                                                                                                                                  | N/A                                                                                                                                                                                                                           | N/A                              | N/A      | 70                                 |               | N/A                                               |                    |
| SEARCH FEE<br><small>(37 CFR 1.16(k), (l), or (m))</small>                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                              | N/A      | 300                                |               | N/A                                               |                    |
| EXAMINATION FEE<br><small>(37 CFR 1.16(o), (p), or (q))</small>                                                                                                                                                                                                                                                                                                                                            | N/A                                                                                                                                                                                                                           | N/A                              | N/A      | 360                                |               | N/A                                               |                    |
| TOTAL CLAIMS<br><small>(37 CFR 1.16(i))</small>                                                                                                                                                                                                                                                                                                                                                            | 10                                                                                                                                                                                                                            | minus 20 = *                     | x 40     | = 0.00                             | OR            |                                                   |                    |
| INDEPENDENT CLAIMS<br><small>(37 CFR 1.16(h))</small>                                                                                                                                                                                                                                                                                                                                                      | 2                                                                                                                                                                                                                             | minus 3 = *                      | x 210    | = 0.00                             |               |                                                   |                    |
| APPLICATION SIZE FEE<br><small>(37 CFR 1.16(s))</small>                                                                                                                                                                                                                                                                                                                                                    | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                  |          | 0.00                               |               |                                                   |                    |
| MULTIPLE DEPENDENT CLAIM PRESENT <small>(37 CFR 1.16(j))</small>                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                               |                                  |          | 0.00                               |               |                                                   |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  | TOTAL    | 730                                |               | TOTAL                                             |                    |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                                   |                    |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                                   |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                       |          | (Column 3)                         |               | SMALL ENTITY                                      |                    |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                          | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br><small>(37 CFR 1.16(i))</small>                                                                                                                                                                                      | *                                | Minus    | **                                 | =             | x                                                 | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br><small>(37 CFR 1.16(h))</small>                                                                                                                                                                                | *                                | Minus    | ***                                | =             | x                                                 | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee <small>(37 CFR 1.16(s))</small>                                                                                                                                                                          |                                  |          |                                    |               |                                                   |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>                                                                                                                                                |                                  |          |                                    |               |                                                   |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  |          |                                    |               | TOTAL ADD'L FEE                                   |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                       |          | (Column 3)                         |               | OTHER THAN SMALL ENTITY                           |                    |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                          | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br><small>(37 CFR 1.16(i))</small>                                                                                                                                                                                      | *                                | Minus    | **                                 | =             | x                                                 | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br><small>(37 CFR 1.16(h))</small>                                                                                                                                                                                | *                                | Minus    | ***                                | =             | x                                                 | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee <small>(37 CFR 1.16(s))</small>                                                                                                                                                                          |                                  |          |                                    |               |                                                   |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>                                                                                                                                                |                                  |          |                                    |               |                                                   |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  |          |                                    |               | TOTAL ADD'L FEE                                   |                    |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                                   |                    |



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 13/971,231         | 08/20/2013            | Jefferey C. Solomon   | NETL.018P2C7           |

CONFIRMATION NO. 2072

FORMALITIES LETTER



\*OC000000063798630\*

Date Mailed: 09/17/2013

79141

The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

*Filing Date Granted*

**Items Required To Avoid Abandonment:**

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- A mailing address for each inventor has not been submitted. A new application data sheet (ADS) in compliance with 37 CFR 1.76 or inventor's oath or declaration in compliance with 37 CFR 1.63 identifying the mailing address and residence (if the inventor lives at a location which is different from where the inventor customarily receives mail) is required.

Jayesh R. Bhakta

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of \$ **70** for a small entity in compliance with 37 CFR 1.27, must be submitted.

**SUMMARY OF FEES DUE:**

Total fee(s) required within **TWO MONTHS** from the date of this Notice is \$ **70** for a small entity

- \$ **70** Surcharge.

**Items Required To Avoid Processing Delays:**

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):  
Jefferey C. Solomon

Jayesh R. Bhakta

Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.

<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/fasrat/

---

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

**RESPONSE TO NOTICE TO FILE MISSING PARTS**

Applicant : Netlist  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : LOAD-REDUCING CIRCUIT FOR  
MEMORY MODULE  
Examiner : Unknown  
Art Unit : 2189  
Conf. No. : 2072  
Docket No. : NETL018P2C7

## CERTIFICATE OF EFS WEB

## TRANSMISSION

I hereby certify that this correspondence and any other attachment noted on the Automated Acknowledgement Receipt, is being transmitted from within the Pacific Time zone to the Commissioner for Patents via the EFS Web Server on:

October 18, 2013

(Date)

/Jamie J. Zheng/

Jamie J. Zheng, Reg. No. 51167

Mail Stop Missing Parts  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

In response to the Notice to File Missing Parts mailed on September 10, 2013, Applicant herewith submits the following:

(X) A revised application data sheet showing change made to correct an error in the original application data sheet where the state of residence for inventor Jayesh Bhakta was not entered.

(X) Signed declaration

(X) Surcharge paid via EFS Web.

The Commissioner is hereby authorized to charge any additional fees to Deposit Account No. 50-5963 for Inscape IP, APC.

|                               |                         |              |
|-------------------------------|-------------------------|--------------|
| Date: <u>October 18, 2013</u> | <u>/Jamie J. Zheng/</u> | <u>51167</u> |
|                               | Jamie J. Zheng          | (Reg. No.)   |
|                               | Customer No. 79141      |              |
|                               | (650) 273-6008          |              |

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                         |                        |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                         | Application Number     |              |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |                                         |                        |              |

**Secrecy Order 37 CFR 5.2**

|                                                                                                                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Inventor Information:**

|                                                                                                                                                                                 |                   |                       |                    |                             |                        |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------|--------------------|-----------------------------|------------------------|--|
| <b>Inventor 1</b>                                                                                                                                                               |                   |                       |                    |                             | <a href="#">Remove</a> |  |
| <b>Legal Name</b>                                                                                                                                                               |                   |                       |                    |                             |                        |  |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>    | <b>Family Name</b> | <b>Suffix</b>               |                        |  |
| ▼                                                                                                                                                                               | Jefferey          | C.                    | Solomon            | ▼                           |                        |  |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                       |                    |                             |                        |  |
| <b>City</b>                                                                                                                                                                     | Irvine            | <b>State/Province</b> | CA                 | <b>Country of Residence</b> | US                     |  |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                   |                       |                    |                             |                        |  |
| <b>Address 1</b>                                                                                                                                                                |                   | 16 Silver Fir         |                    |                             |                        |  |
| <b>Address 2</b>                                                                                                                                                                |                   |                       |                    |                             |                        |  |
| <b>City</b>                                                                                                                                                                     | Irvine            | <b>State/Province</b> | CA                 |                             |                        |  |
| <b>Postal Code</b>                                                                                                                                                              | 92604             | <b>Country</b>        | US                 |                             |                        |  |
| <b>Inventor 2</b>                                                                                                                                                               |                   |                       |                    |                             | <a href="#">Remove</a> |  |
| <b>Legal Name</b>                                                                                                                                                               |                   |                       |                    |                             |                        |  |
| <b>Prefix</b>                                                                                                                                                                   | <b>Given Name</b> | <b>Middle Name</b>    | <b>Family Name</b> | <b>Suffix</b>               |                        |  |
| ▼                                                                                                                                                                               | Jayesh            | R.                    | Bhakta             | ▼                           |                        |  |
| <b>Residence Information (Select One)</b> <input checked="" type="radio"/> US Residency <input type="radio"/> Non US Residency <input type="radio"/> Active US Military Service |                   |                       |                    |                             |                        |  |
| <b>City</b>                                                                                                                                                                     | Cerritos          | <b>State/Province</b> | CA                 | <b>Country of Residence</b> | US                     |  |
| <b>Mailing Address of Inventor:</b>                                                                                                                                             |                   |                       |                    |                             |                        |  |
| <b>Address 1</b>                                                                                                                                                                |                   | 12220 Rose Street     |                    |                             |                        |  |
| <b>Address 2</b>                                                                                                                                                                |                   |                       |                    |                             |                        |  |
| <b>City</b>                                                                                                                                                                     | Cerritos          | <b>State/Province</b> | CA                 |                             |                        |  |
| <b>Postal Code</b>                                                                                                                                                              | 90703             | <b>Country</b>        | US                 |                             |                        |  |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button.                                     |                   |                       |                    |                             | <a href="#">Add</a>    |  |

**Correspondence Information:**

|                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Enter either Customer Number or complete the Correspondence Information section below.</p> <p>For further information see 37 CFR 1.33(a).</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------|

|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

☐ An Address is being provided for the correspondence information of this application.

|                 |                 |                           |                              |
|-----------------|-----------------|---------------------------|------------------------------|
| Customer Number | 79141           |                           |                              |
| Email Address   | jz@jzpatent.com | <a href="#">Add Email</a> | <a href="#">Remove Email</a> |

### Application Information:

|                                         |                                         |                                           |                                     |
|-----------------------------------------|-----------------------------------------|-------------------------------------------|-------------------------------------|
| Title of the Invention                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                                           |                                     |
| Attorney Docket Number                  | NETL.018P2C7                            | Small Entity Status Claimed               | <input checked="" type="checkbox"/> |
| Application Type                        | Nonprovisional ▼                        |                                           |                                     |
| Subject Matter                          | Utility ▼                               |                                           |                                     |
| Suggested Class (if any)                |                                         | Sub Class (if any)                        |                                     |
| Suggested Technology Center (if any)    |                                         |                                           |                                     |
| Total Number of Drawing Sheets (if any) | 23                                      | Suggested Figure for Publication (if any) | 8D                                  |

### Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

### Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

|                    |                                                  |                                              |                                                         |
|--------------------|--------------------------------------------------|----------------------------------------------|---------------------------------------------------------|
| Please Select One: | <input checked="" type="radio"/> Customer Number | <input type="radio"/> US Patent Practitioner | <input type="radio"/> Limited Recognition (37 CFR 11.9) |
| Customer Number    | 79141                                            |                                              |                                                         |

### Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

|                          |                   |                          |                          |
|--------------------------|-------------------|--------------------------|--------------------------|
| Prior Application Status | Pending ▼         | <a href="#">Remove</a>   |                          |
| Application Number       | Continuity Type   | Prior Application Number | Filing Date (YYYY-MM-DD) |
|                          | Continuation of ▼ | 13287081                 | 2011-11-01               |

|                                           |  |                                         |  |              |  |
|-------------------------------------------|--|-----------------------------------------|--|--------------|--|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number                  |  | NETL.018P2C7 |  |
|                                           |  | Application Number                      |  |              |  |
| Title of Invention                        |  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |  |              |  |

|                          |                           |                          |                          |                        |                         |
|--------------------------|---------------------------|--------------------------|--------------------------|------------------------|-------------------------|
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 13287081                 | Continuation of ▼         | 13032470                 | 2011-02-22               | 8081536                | 2011-12-20              |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 13032470                 | Continuation of ▼         | 12955711                 | 2010-11-29               | 7916574                | 2011-03-29              |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12955711                 | Continuation of ▼         | 12629827                 | 2009-12-02               | 7881150                | 2011-02-01              |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12629827                 | Continuation of ▼         | 12408652                 | 2009-03-20               | 7636274                | 2009-12-22              |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 12408652                 | Continuation of ▼         | 11335875                 | 2006-01-19               | 7532537                | 2009-05-12              |
| Prior Application Status |                           | Expired ▼                |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11335875                 | non provisional of ▼      | 60645087                 | 2005-01-19               |                        |                         |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 11335875                 | Continuation in part of ▼ | 11173175                 | 2005-07-01               | 7289386                | 2007-10-30              |
| Prior Application Status |                           | Expired ▼                |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11173175                 | non provisional of ▼      | 60588244                 | 2004-07-15               |                        |                         |
| Prior Application Status |                           | Patented ▼               |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) | Patent Number          | Issue Date (YYYY-MM-DD) |
| 11173175                 | Continuation in part of ▼ | 11075395                 | 2005-03-07               | 7286436                | 2007-10-23              |
| Prior Application Status |                           | Expired ▼                |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11075395                 | non provisional of ▼      | 60550668                 | 2004-03-05               |                        |                         |
| Prior Application Status |                           | Expired ▼                |                          | <a href="#">Remove</a> |                         |
| Application Number       | Continuity Type           | Prior Application Number | Filing Date (YYYY-MM-DD) |                        |                         |
| 11075395                 | non provisional of ▼      | 60575595                 | 2004-05-28               |                        |                         |



|                                                                                                                       |                                         |                          |                          |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------|--------------------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                             |                                         | Attorney Docket Number   | NETL.018P2C7             |
|                                                                                                                       |                                         | Application Number       |                          |
| Title of Invention                                                                                                    | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                          |                          |
| Prior Application Status                                                                                              | Expired ▼                               | <a href="#">Remove</a>   |                          |
| Application Number                                                                                                    | Continuity Type                         | Prior Application Number | Filing Date (YYYY-MM-DD) |
| 11075395                                                                                                              | non provisional of ▼                    | 60590038                 | 2004-07-21               |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. |                                         |                          | <a href="#">Add</a>      |

### Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

|                                                                                                        |                      |                          |                                                               |
|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------|---------------------------------------------------------------|
|                                                                                                        |                      |                          | <a href="#">Remove</a>                                        |
| Application Number                                                                                     | Country <sup>1</sup> | Filing Date (YYYY-MM-DD) | Priority Claimed                                              |
|                                                                                                        |                      |                          | <input checked="" type="radio"/> Yes <input type="radio"/> No |
| Additional Foreign Priority Data may be generated within this form by selecting the <b>Add</b> button. |                      |                          | <a href="#">Add</a>                                           |

### Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

### Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL 018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                                                                |                                                                        |                                      |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------------------------------------------------------------|------------------------------------------------------------------------|--------------------------------------|----|
| <b>Applicant 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |                                                                |                                                                        | <a href="#">Remove</a>               |    |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> |    |                                                                |                                                                        |                                      |    |
| <a href="#">Clear</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |                                                                |                                                                        |                                      |    |
| <input checked="" type="radio"/> Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    | <input type="radio"/> Legal Representative under 35 U.S.C. 117 |                                                                        | <input type="radio"/> Joint Inventor |    |
| <input type="radio"/> Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |                                                                | <input type="radio"/> Person who shows sufficient proprietary interest |                                      |    |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |                                                                |                                                                        |                                      |    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |                                                                |                                                                        |                                      |    |
| Name of the Deceased or Legally Incapacitated Inventor : <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |                                                                |                                                                        |                                      |    |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                                                                |                                                                        |                                      |    |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    | Netlist, Inc.                                                  |                                                                        |                                      |    |
| <b>Mailing Address Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |                                                                |                                                                        |                                      |    |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    | 51 Discovery, #150                                             |                                                                        |                                      |    |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |                                                                |                                                                        |                                      |    |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    | Irvine                                                         | State/Province                                                         |                                      | CA |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US | Postal Code                                                    |                                                                        | 92618                                |    |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    | 949-435-0025                                                   | Fax Number                                                             |                                      |    |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    | gsasaki@netlist.com                                            |                                                                        |                                      |    |
| Additional Applicant Data may be generated within this form by selecting the Add button. <a href="#">Add</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |                                                                |                                                                        |                                      |    |

## Non-Applicant Assignee Information:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.                                                                                                                                                                                                                                                                       |  |  |  |  |  |
| <b>Assignee 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
| <p>Complete this section only if non-applicant assignee information is desired to be included on the patent application publication in accordance with 37 CFR 1.215(b). Do not include in this section an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest), as the patent application publication will include the name of the applicant(s).</p> |  |  |  |  |  |
| <a href="#">Remove</a>                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |
| If the Assignee is an Organization check here. <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                   |  |  |  |  |  |

|                                           |                                         |                        |              |
|-------------------------------------------|-----------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                         | Attorney Docket Number | NETL.018P2C7 |
|                                           |                                         | Application Number     |              |
| Title of Invention                        | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |                        |              |

|        |            |             |             |        |
|--------|------------|-------------|-------------|--------|
| Prefix | Given Name | Middle Name | Family Name | Suffix |
| ▼      |            |             |             | ▼      |

**Mailing Address Information:**

|                      |  |                |  |
|----------------------|--|----------------|--|
| Address 1            |  |                |  |
| Address 2            |  |                |  |
| City                 |  | State/Province |  |
| Country <sup>i</sup> |  | Postal Code    |  |
| Phone Number         |  | Fax Number     |  |
| Email Address        |  |                |  |

Additional Assignee Data may be generated within this form by selecting the Add button.

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**Signature:**

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NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications

|                  |                  |           |                   |                     |
|------------------|------------------|-----------|-------------------|---------------------|
| <b>Signature</b> | /Jamie J. Zheng/ |           | Date (YYYY-MM-DD) | 2013-10-18          |
| First Name       | Jamie            | Last Name | Zheng             | Registration Number |
|                  |                  |           | 51167             |                     |

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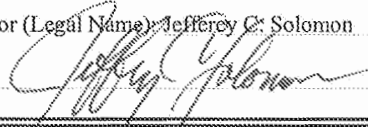
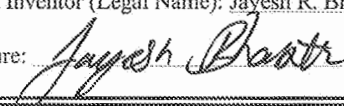
This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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| DECLARATION FOR UTILITY OR DESIGN APPLICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| <b>Title of<br/>Invention</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| <p>As a below named inventor, I hereby declare that:</p> <p>This declaration<br/>is directed to: <input type="checkbox"/> The attached application, or</p> <p><input checked="" type="checkbox"/> United States application or PCT international application<br/>number 13/971,231 filed on August 20, 2013</p> <p>The above-identified application was made or authorized to be made by me.</p> <p>I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.</p> <p>I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001<br/>by fine or imprisonment of not more than five (5) years, or both.</p> <p>Note to Inventor: 37 C.F.R. § 1.63(c) states: "A person may not execute an oath or declaration for an application<br/>unless that person has reviewed and understands the contents of the application, including the claims, and is aware<br/>of the duty to disclose to the Office all information known to the person to be material to patentability as defined in<br/>§ 1.56."</p> |                                         |
| <p>First Inventor (Legal Name): Jeffrey C. Solomon</p> <p>Signature:  Date (Optional): 10-14-2013</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         |
| <p>Second Inventor (Legal Name): Jayesh R. Bhakta</p> <p>Signature:  Date (Optional): 10-14-2013</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                         |

| Electronic Patent Application Fee Transmittal  |                 |                                         |               |                             |
|------------------------------------------------|-----------------|-----------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                     |                 | 13971231                                |               |                             |
| <b>Filing Date:</b>                            |                 | 20-Aug-2013                             |               |                             |
| <b>Title of Invention:</b>                     |                 | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |               |                             |
| <b>First Named Inventor/Applicant Name:</b>    |                 | Jefferey C. Solomon                     |               |                             |
| <b>Filer:</b>                                  |                 | Jamie Jie Zheng                         |               |                             |
| <b>Attorney Docket Number:</b>                 |                 | NETL.018P2C7                            |               |                             |
| Filed as Small Entity                          |                 |                                         |               |                             |
| <b>Utility under 35 USC 111(a) Filing Fees</b> |                 |                                         |               |                             |
| <b>Description</b>                             | <b>Fee Code</b> | <b>Quantity</b>                         | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                           |                 |                                         |               |                             |
| <b>Pages:</b>                                  |                 |                                         |               |                             |
| <b>Claims:</b>                                 |                 |                                         |               |                             |
| <b>Miscellaneous-Filing:</b>                   |                 |                                         |               |                             |
| Late Filing Fee for Oath or Declaration        | 2051            | 1                                       | 70            | 70                          |
| <b>Petition:</b>                               |                 |                                         |               |                             |
| <b>Patent-Appeals-and-Interference:</b>        |                 |                                         |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>       |                 |                                         |               |                             |
| <b>Extension-of-Time:</b>                      |                 |                                         |               |                             |

| Description              | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>    |          |          |        |                      |
| <b>Total in USD (\$)</b> |          |          |        | <b>70</b>            |

| Electronic Acknowledgement Receipt          |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>EFS ID:</b>                              | 17174430                                |
| <b>Application Number:</b>                  | 13971231                                |
| <b>International Application Number:</b>    |                                         |
| <b>Confirmation Number:</b>                 | 2072                                    |
| <b>Title of Invention:</b>                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                     |
| <b>Customer Number:</b>                     | 79141                                   |
| <b>Filer:</b>                               | Jamie Jie Zheng                         |
| <b>Filer Authorized By:</b>                 |                                         |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                            |
| <b>Receipt Date:</b>                        | 19-OCT-2013                             |
| <b>Filing Date:</b>                         | 20-AUG-2013                             |
| <b>Time Stamp:</b>                          | 03:06:15                                |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)             |

**Payment information:**

|                                          |             |
|------------------------------------------|-------------|
| Submitted with Payment                   | yes         |
| Payment Type                             | Credit Card |
| Payment was successfully received in RAM | \$ 70       |
| RAM confirmation Number                  | 8605        |
| Deposit Account                          |             |
| Authorized User                          |             |

**File Listing:**

| Document Number | Document Description | File Name | File Size(Bytes)/<br>Message Digest | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------|-------------------------------------|------------------|------------------|
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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|----|---|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Applicant Response to Pre-Exam Formalities Notice | 2013-10-18_Rsps_NTFMP_NETL018P2C7.pdf               | 75766<br>7322aced2c896a3dab2391476076362817511930   | no | 1 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                     |                                                     |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                     |                                                     |    |   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Application Data Sheet                            | 2013-10-18_ApplicationDataSheet_Rev_NETL018P2C7.pdf | 2792327<br>a82a001993275b7139f8e2df66a5a6434048f9fc | no | 7 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                     |                                                     |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                     |                                                     |    |   |
| This is not an USPTO supplied ADS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                   |                                                     |                                                     |    |   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Oath or Declaration filed                         | 2013-10-15_Declaration_Signed_NETL018P2C7.pdf       | 393053<br>6d21a4c728c4e7fe0fa43f25a82f93f87bdf6da3  | no | 1 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                     |                                                     |    |   |
| The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                   |                                                     |                                                     |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                     |                                                     |    |   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Fee Worksheet (SB06)                              | fee-info.pdf                                        | 29957<br>726d7f9fda165057ec0da15d7f08359ee61ad100   | no | 2 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                   |                                                     |                                                     |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                     |                                                     |    |   |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                   |                                                     | 3291103                                             |    |   |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                   |                                                     |                                                     |    |   |

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                 |              |                    | Application or Docket Number<br><b>13/971,231</b> |                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------|--------------|--------------------|---------------------------------------------------|-------------------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                    |                 |              |                    |                                                   |                         |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                 | SMALL ENTITY |                    | OTHER THAN SMALL ENTITY                           |                         |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE(\$)        | FEE(\$)      |                    | RATE(\$)                                          | FEE(\$)                 |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                                | N/A             | 70           |                    | N/A                                               |                         |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                                                                           | N/A                                | N/A             | 300          |                    | N/A                                               |                         |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                                                                                                                                                                                           | N/A                                | N/A             | 360          |                    | N/A                                               |                         |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                                                                                                                                                                                                                                                                                           | 10                                                                                                                                                                                                                            | minus 20 = *                       | x 40            | = 0.00       | OR                 |                                                   |                         |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 2                                                                                                                                                                                                                             | minus 3 = *                        | x 210           | = 0.00       |                    |                                                   |                         |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))                                                                                                                                                                                                                                                                                                                                                                   | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                 | 0.00         |                    |                                                   |                         |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                    |                 | 0.00         |                    |                                                   |                         |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL           | 730          |                    | TOTAL                                             |                         |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                    |                 |              |                    |                                                   |                         |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                    |                 |              |                    |                                                   |                         |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                 | (Column 3)   |                    | SMALL ENTITY                                      |                         |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA   | RATE(\$)     | ADDITIONAL FEE(\$) |                                                   | OTHER THAN SMALL ENTITY |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **        | =            | x                  | =                                                 | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***       | =            | x                  | =                                                 | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |                 |              |                    |                                                   | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |                 |              |                    |                                                   | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL ADD'L FEE |              |                    | OR                                                | TOTAL ADD'L FEE         |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                         |                 | (Column 3)   |                    | SMALL ENTITY                                      |                         |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA   | RATE(\$)     | ADDITIONAL FEE(\$) |                                                   | OTHER THAN SMALL ENTITY |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                  | Minus **        | =            | x                  | =                                                 | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                  | Minus ***       | =            | x                  | =                                                 | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                    |                 |              |                    |                                                   | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                    |                 |              |                    |                                                   | OR                      |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                    | TOTAL ADD'L FEE |              |                    | OR                                                | TOTAL ADD'L FEE         |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                    |                 |              |                    |                                                   |                         |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO. | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 13/971,231            | 08/20/2013               | 2189            | 800           | NETL.018P2C7     | 10         | 2          |

CONFIRMATION NO. 2072

UPDATED FILING RECEIPT



OC00000064541118

79141

The Law Office of Jamie Zheng, Ph.D Esq.

P.O. Box 60573

Palo Alto, CA 94306

Date Mailed: 10/28/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Jefferey C. Solomon, Irvine, CA;

Jayesh R. Bhakta, Cerritos, CA;

**Applicant(s)**

Netlist, Inc., Irvine, CA

**Assignment For Published Patent Application**

Netlist, Inc., Irvine, CA

**Power of Attorney:** None

**Domestic Priority data as claimed by applicant**

This application is a CON of 13/287,081 11/01/2011 PAT 8516188

which is a CON of 13/032,470 02/22/2011 PAT 8081536

which is a CON of 12/955,711 11/29/2010 PAT 7916574

which is a CON of 12/629,827 12/02/2009 PAT 7881150

which is a CON of 12/408,652 03/20/2009 PAT 7636274

which is a CON of 11/335,875 01/19/2006 PAT 7532537

which claims benefit of 60/645,087 01/19/2005

and is a CIP of 11/173,175 07/01/2005 PAT 7289386

which claims benefit of 60/588,244 07/15/2004

and is a CIP of 11/075,395 03/07/2005 PAT 7286436

which claims benefit of 60/550,668 03/05/2004

and claims benefit of 60/575,595 05/28/2004

and claims benefit of 60/590,038 07/21/2004

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**If Required, Foreign Filing License Granted:** 09/11/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/971,231**

**Projected Publication Date:** 02/06/2014

**Non-Publication Request:** No

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

**Preliminary Class**

711

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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page 2 of 4

countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 13/971,231         | 08/20/2013            | Jefferey C. Solomon   | NETL.018P2C7           |

CONFIRMATION NO. 2072

PUBLICATION NOTICE



\*OC000000066486320\*

79141

The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

**Title:**LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

**Publication No.**US-2014-0040569-A1

**Publication Date:**02/06/2014

**NOTICE OF PUBLICATION OF APPLICATION**

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at [www.uspto.gov](http://www.uspto.gov). The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

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Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

|                                                                                                                                          |         |    |                          |                        |              |
|------------------------------------------------------------------------------------------------------------------------------------------|---------|----|--------------------------|------------------------|--------------|
| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |         |    | <b>Complete if Known</b> |                        |              |
|                                                                                                                                          |         |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |         |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |         |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |         |    | Art Unit                 | 2189                   |              |
| Examiner Name                                                                                                                            | Unknown |    |                          |                        |              |
| Sheet                                                                                                                                    | 1       | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 5345412                                  | 09-06-1994                       | Shiratsuchi                                        |                                                                                 |
|                        | 2                        | 5537584                                  | 07-16-1996                       | Miyai et al.                                       |                                                                                 |
|                        | 3                        | 5617559                                  | 04-01-1997                       | Le et al.                                          |                                                                                 |
|                        | 4                        | 5649159                                  | 07-15-1997                       | Le et al.                                          |                                                                                 |
|                        | 5                        | 5717851                                  | 02-10-1998                       | Yishay et al.                                      |                                                                                 |
|                        | 6                        | 5724604                                  | 03-03-1998                       | Moyer                                              |                                                                                 |
|                        | 7                        | 5729716                                  | 05-17-1998                       | Lee et al.                                         |                                                                                 |
|                        | 8                        | 5784705                                  | 07-21-1998                       | Leung, Wingyu                                      |                                                                                 |
|                        | 9                        | 5802541                                  | 09-01-1998                       | Reed                                               |                                                                                 |
|                        | 10                       | 5973392                                  | 10-26-1999                       | Senba et al.                                       |                                                                                 |
|                        | 11                       | 6173357                                  | 01-09-2011                       | Ju                                                 |                                                                                 |
|                        | 12                       | 6260127                                  | 07-10-2001                       | Olari et al.                                       |                                                                                 |
|                        | 13                       | 6446158                                  | 09-03-2002                       | Karabatsos                                         |                                                                                 |
|                        | 14                       | 6553449                                  | 04-22-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 15                       | 6618791                                  | 09-09-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 16                       | 6717855                                  | 04-06-2004                       | Underwood                                          |                                                                                 |
|                        | 17                       | 6788592                                  | 09-07-2004                       | Nakata et al.                                      |                                                                                 |
|                        | 18                       | 6948084                                  | 09-20-2005                       | Manapat et al                                      |                                                                                 |
|                        | 19                       | 7130308                                  | 10-31-2006                       | Haddock et al.                                     |                                                                                 |
|                        | 20                       | 7133960                                  | 11-07-2006                       | Thompson et al.                                    |                                                                                 |
|                        | 21                       | 7379361                                  | 05-27-2008                       | Co et al.                                          |                                                                                 |
|                        | 22                       | 20050010737                              | 01-01-2005                       | Ware et al.                                        |                                                                                 |
|                        | 23                       | 20070293094                              | 12-01-2007                       | Aekins, Robert A.                                  |                                                                                 |

| US PATENT APPLICATIONS |                          |                                          |                             |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                             |                                                    |                                                                                 |
|                        | 24                       | 95/001,758                               | 09-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 25                       | 13/154,172                               | 06-06-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 26                       | 13/287,042                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 27                       | 13/473,413                               | 05-16-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 28                       | 13/032,470                               | 02-22-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 29                       | 13/287,081                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 30                       | 13/971,231                               | 08-20-2013                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 31                       | 13/412,243                               | 03-05-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 32                       | 13/183,253                               | 07-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 33                       | 13/745,790                               | 01-19-2013                  | Owned by Netlist, Inc.                             |                                                                                 |

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| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | <b>Complete if Known</b> |                        |              |
|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 2 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT APPLICATIONS |                       |                                          |                          |                                                 |                                                                           |
|------------------------|-----------------------|------------------------------------------|--------------------------|-------------------------------------------------|---------------------------------------------------------------------------|
| Examiner Initials *    | Cite No. <sup>1</sup> | Document Number                          | Filing Date (MM-DD-YYYY) | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                        |                       | Number-Kind Code <sup>2</sup> (if known) |                          |                                                 |                                                                           |
|                        | 34                    | 14/229,844                               | 3/29/2014                | Owned by Netlist, Inc.                          |                                                                           |
|                        | 35                    | 12/504,131                               | 7/16/2009                | Owned by Netlist, Inc.                          |                                                                           |
|                        | 36                    | 12/761,179                               | 4/15/2010                | Owned by Netlist, Inc.                          |                                                                           |
|                        | 37                    | 13/970,606                               | 8/20/2013                | Owned by Netlist, Inc.                          |                                                                           |
|                        | 38                    | 13/288,850                               | 11/3/2011                | Owned by Netlist, Inc.                          |                                                                           |
|                        | 39                    | 13/411,344                               | 3/2/2012                 | Owned by Netlist, Inc.                          |                                                                           |

| FOREIGN PATENT DOCUMENTS |                       |                                                                                   |                               |                                                 |                                                                           |                |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------|---------------------------------------------------------------------------|----------------|
| Examiner Initials *      | Cite No. <sup>1</sup> | Foreign Patent Document                                                           | Publication Date (MM-DD-YYYY) | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear | T <sup>6</sup> |
|                          |                       | Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup> (if known) |                               |                                                 |                                                                           |                |
|                          | 40                    | JP2009237492                                                                      | 9/9/97                        | Toshiba Corp.                                   |                                                                           |                |
|                          | 41                    | JP2000285674                                                                      | 10/13/00                      | Fujitsu Ltd.                                    |                                                                           |                |
|                          | 42                    | JP2002184176                                                                      | 6/28/02                       | NEC Tohoku Ltd.                                 |                                                                           |                |
|                          | 43                    | JP2003007963                                                                      | 1/10/03                       | Hitachi, Ltd.                                   |                                                                           |                |
|                          | 44                    | JP2008046989                                                                      | 2/28/08                       | Fujitsu Ltd.                                    |                                                                           |                |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |  |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |  |
|                                 | 45                    | Anonymous. (December 1996). "Applications Note: Understanding DRAM Operation," IBM, 10 pages.                                                                                                                                                                   |                |  |
|                                 | 46                    | Behrens, S. "HP Printer Memory Explained", The ZonkPage, Last Updated 01-21-2004. Accessed 02-10-2013, Retrieved from the Internet: URL < <a href="http://warshaft.com/hpmem.htm">http://warshaft.com/hpmem.htm</a> >. 7pp.                                     |                |  |
|                                 | 47                    | Non-Final Office Action, U.S. Pat. App. 13/412,243, January 2, 2014, 20 pages                                                                                                                                                                                   |                |  |
|                                 | 48                    | Non-Final Office Action, U.S. Pat. App. 12/761,179, September 13, 2012, 20 pages                                                                                                                                                                                |                |  |
|                                 | 49                    | Non-final office action, U.S. Patent Application No. 13/288,850, October 14, 2013, 24 pages                                                                                                                                                                     |                |  |
|                                 | 50                    | Non-final office action, U.S. Patent Application No. 13/411,344, December 31, 2013, 28 pages                                                                                                                                                                    |                |  |
|                                 | 51                    | Non-final office action, U.S. Patent Application No. 13/473,413, November 17, 2011, 46 pages                                                                                                                                                                    |                |  |
|                                 | 52                    | Response to non-final office action dated September 13, 2012 for U.S. Patent Application No. 12/761,179, filed March 13, 2013, 16 pages                                                                                                                         |                |  |

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| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | <b>Complete if Known</b> |                        |              |
|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 3 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 53                    | Response to non-final office action dated October 14, 2013 for U.S. Patent Application No. 13/288,850, filed January 14, 2014, 15 pages                                                                                                                         |                |
|                                 | 54                    | Response to non-final office action dated 12/31/2013 for U.S. Patent Application No. 13/411,344, filed March 31, 2014, 12 pages                                                                                                                                 |                |
|                                 | 55                    | Patent Owner's Response to Office Action mailed November 13, 2012 for Reexamination Control Nos.95/000,578; 95/000,579, and 95/001,339, filed January 14, 2013, 96 pages.                                                                                       |                |
|                                 | 56                    | Patent Owner's Response to Office Action mailed December 19, 2012 for Reexamination Control No. 95/001,758, filed March 19, 2013, 61 pages                                                                                                                      |                |
|                                 | 57                    | Patent Owner's Response to Office Action mailed September 26, 2013 for Reexamination Control No. 95/001,758, filed November 26, 2013, 85 pages                                                                                                                  |                |
|                                 | 58                    | Third Party Requester's Comments after Non-Final Action mailed September 26, 2013 for Reexamination Control No. 95/001,758, filed December 26, 2013,                                                                                                            |                |
|                                 | 59                    | Reexamination Control No. 95/002,399, filed April 25, 2013, and its entire file history                                                                                                                                                                         |                |
|                                 | 60                    | Patent Owner's Appeal Brief for Reexamination Control Nos. 95/000,546 and 95/000,577, filed October 2, 2013, 46 pages                                                                                                                                           |                |
|                                 | 61                    | Patent Trial and Appeal Board Decision on Appeal for Reexamination Control No.95/001/337, mailed January 16, 2014, 30 pages                                                                                                                                     |                |
|                                 | 62                    | Patent Trial and Appeal Board Decision on Appeal for Reexamination Control No.95/001/381, mailed January 16, 2014, 24 pages                                                                                                                                     |                |
|                                 | 63                    | Action Closing Prosecution mailed March 27, 2014 for Reexamination Control No. 95/001,758, filed September 14, 2011, 40 pages                                                                                                                                   |                |
|                                 | 64                    | Action Closing Prosecution mailed March 27, 2014 for Reexamination Control No. 95/001,339, filed June 8, 2010, 106 pages                                                                                                                                        |                |
|                                 | 65                    | Notice of Allowance, U.S. Pat. App. 12/761,179, July 11, 2013, 37 pages                                                                                                                                                                                         |                |
|                                 | 66                    | Notice of Allowance, U.S. Pat. App. 12/504,131, February 12, 2013, 52 pages                                                                                                                                                                                     |                |

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 20080025137                              | 01-31-2008                       | Natarajan et al.                                   |                                                                                 |
|                        | 2                        | 2006233012                               | 10-19-2006                       | Tomonori et al.                                    |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          | 3                        | EP 1 816 570 A2         | 08-08-2007                          | Rambus, Inc.                                          |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
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| Examiner<br>Initials*           | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 4                        | International Search Report and Written Opinion, PCT/US2011/059209, January 31, 2013                                                                                                                                                                            |                |

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| Electronic Acknowledgement Receipt          |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>EFS ID:</b>                              | 18697660                                |
| <b>Application Number:</b>                  | 13971231                                |
| <b>International Application Number:</b>    |                                         |
| <b>Confirmation Number:</b>                 | 2072                                    |
| <b>Title of Invention:</b>                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                     |
| <b>Customer Number:</b>                     | 79141                                   |
| <b>Filer:</b>                               | Jamie Jie Zheng                         |
| <b>Filer Authorized By:</b>                 |                                         |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                            |
| <b>Receipt Date:</b>                        | 07-APR-2014                             |
| <b>Filing Date:</b>                         | 20-AUG-2013                             |
| <b>Time Stamp:</b>                          | 19:52:13                                |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)             |

**Payment information:**

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**File Listing:**

| Document Number | Document Description | File Name                            | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|--------------------------------------|---------------------------------------------------|------------------|------------------|
| 1               | Transmittal Letter   | 2014-04-07_IDS_Cover_NETL018P2C7.pdf | 55713<br>fb51323fedbfda34cc6d07c2f3e070b8c4d0f950 | no               | 2                |

**Warnings:**

**Information:**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |                                 |                                                    |    |   |
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| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Information Disclosure Statement (IDS) Form (SB08) | 2014-04-07_IDS1_NETL018P2C7.pdf | 153758<br>144ceca778da744e69c982014275ca8f12ba3314 | no | 3 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                    |                                 |                                                    |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                 |                                                    |    |   |
| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |                                 |                                                    |    |   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Information Disclosure Statement (IDS) Form (SB08) | 2014-04-07_IDS2_NETL018P2C7.pdf | 97875<br>77219edb3677df5ded3135bd081bb7fc49125710  | no | 1 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                    |                                 |                                                    |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                 |                                                    |    |   |
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| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Information Disclosure Statement (IDS) Form (SB08) | 2014-04-07_IDS3_NETL018P2C7.pdf | 93080<br>eb90c0d7ebd20b85fa88cf9b2a38d5840fb5b5ce  | no | 1 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                    |                                 |                                                    |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                 |                                                    |    |   |
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| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                    |                                 | 400426                                             |    |   |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> <b>If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</b></p> |                                                    |                                 |                                                    |    |   |

INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : BHAKTA et al.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : BANSAL, GURTEJ                             |
| Art Unit  | : 2189                                       |
| Conf No.  | : 2072                                       |

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application are three Forms PTO/SB/08a/b Equivalent listing 77 references. Copies of foreign documents and/or their translation and non-patent literature have been submitted together with corresponding Information Disclosure Statements in the commonly-owned co-pending U.S. Pat. App. No. 13/287,042, which are available on PAIR.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

Application No.: 13/971,231  
Filing Date: August 20, 2013

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This Information Disclosure Statement is believed to be submitted before the mailing of the first Office Action. The Commissioner is authorized to charge the fee set forth in 37 C.F.R. § 1.17(p) to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: April 7, 2014

/Jamie J. Zheng/

Jamie J. Zheng  
Customer No. 79141  
(650) 273-6008

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|                                                                                                                                          |         |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |         |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |         |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |         |    | Art Unit                 | 2189                   |              |
| Examiner Name                                                                                                                            | Unknown |    |                          |                        |              |
| Sheet                                                                                                                                    | 1       | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 6717855                                  | 04-06-2004                       | Underwood                                          |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          |                          |                         |                                     |                                                       |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |  |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|--|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |  |
|                                 | 2                     | Action Closing Prosecution mailed October 1, 2012, for Control Nos. 95/000,546 and 95/000,577, filed May 11, '2010 and October 20, 2010 respectively, 39 pages.                                                                                                 |                |  |
|                                 | 3                     | Non-Final Office Action mailed November 13, 2012, for Control Nos. 95/001,339, 95/000,578 and 95/000,579, filed April 20, 2010, October 20, 2010 and October 21, 2010 respectively, 81 pages                                                                    |                |  |
|                                 | 4                     | Order Granting Request for Inter Partes Reexamination and Non-Final Office Action mailed December 7,2012, for Control No. 95/002,399, filed September 15, 2012, 89 pages.                                                                                       |                |  |
|                                 | 5                     | Non-Final Office Action mailed December 19, 2012, for Control No. 95/001,758, filed September 14, 2011, 36 Pages.                                                                                                                                               |                |  |
|                                 | 6                     | Request for Inter Partes Reexamination; Reexam U.S. Patent Application No. 95/001,758, for U.S. Patent No. 7,864,627, filed September 15, 2011, 814 pages (submitted in four parts.)                                                                            |                |  |
|                                 | 7                     | Request for Inter Partes Reexamination; Reexam U.S. Patent Application No. 95/001,381, for U.S. Patent No. 7,532,537, filed June 9, 2010, 247 pages                                                                                                             |                |  |

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\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.



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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                               |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|-------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                               |                                                    |                                                                                 |
|                        | 1                        | 2003/0070052                             | 04-2003                       | Lai, Jiin                                          |                                                                                 |
|                        | 2                        | 2004/0098528                             | 05-2004                       | Janzen, Jefferey W.                                |                                                                                 |
|                        | 3                        | 2002/0048195                             | 04-2002                       | Klein, Dean A.                                     |                                                                                 |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *          | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 4                        | Non-Final Office Action, dated January 2, 2014, for U.S. Pat. App. No. 13/287,042 filed November 1, 2011, 42 pages                                                                                                                                              |                |
|                                 | 5                        | Response to Non-Final Office Action dated January 2, 2014 for U.S. Pat. App. No. 13/287,042, filed April 2, 2014, 12 pages                                                                                                                                      |                |

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| Electronic Acknowledgement Receipt   |                                         |
|--------------------------------------|-----------------------------------------|
| EFS ID:                              | 18704500                                |
| Application Number:                  | 13971231                                |
| International Application Number:    |                                         |
| Confirmation Number:                 | 2072                                    |
| Title of Invention:                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                     |
| Customer Number:                     | 79141                                   |
| Filer:                               | Jamie Jie Zheng                         |
| Filer Authorized By:                 |                                         |
| Attorney Docket Number:              | NETL.018P2C7                            |
| Receipt Date:                        | 08-APR-2014                             |
| Filing Date:                         | 20-AUG-2013                             |
| Time Stamp:                          | 14:53:47                                |
| Application Type:                    | Utility under 35 USC 111(a)             |

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**File Listing:**

| Document Number | Document Description | File Name                            | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|--------------------------------------|---------------------------------------------------|------------------|------------------|
| 1               | Transmittal Letter   | 2014-04-08_IDS_Cover_NETL018P2C7.pdf | 54999<br>6f5529ec3a84ddd9a34c4a9a6975d730708a1dba | no               | 2                |

**Warnings:**

**Information:**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |                                          |                                                         |    |    |
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| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Information Disclosure Statement (IDS)<br>Form (SB08) | 2014-04-08_IDS_NETL018P2C7.<br>pdf       | 92232<br>af2ed60caa03fa353024f616c0e181c05eb9<br>12d5   | no | 1  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                                          |                                                         |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                          |                                                         |    |    |
| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |                                          |                                                         |    |    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Non Patent Literature                                 | 2014-01-02_NFOA_NETL018P1<br>C6.pdf      | 2348292<br>127ee6aa81f352113c242f877f736f1ff7ac94<br>8b | no | 42 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                                          |                                                         |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                          |                                                         |    |    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Non Patent Literature                                 | 2014-04-02_Rsps_NFOA_NETLO<br>18P1C6.pdf | 146023<br>fc425b898e830757f902cd1d25ae548fddb1b<br>da50 | no | 12 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                                          |                                                         |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                          |                                                         |    |    |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                                          | 2641546                                                 |    |    |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                       |                                          |                                                         |    |    |

INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : BHAKTA et al.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : BANSAL, GURTEJ                             |
| Art Unit  | : 2189                                       |
| Conf No.  | : 2072                                       |

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application is a Form PTO/SB/08a/b Equivalent listing 5 references. Copies of foreign documents and/or their translation and non-patent literature are submitted herewith.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

Application No.: 13/971,231  
Filing Date: August 20, 2013

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This Information Disclosure Statement is believed to be submitted before the mailing of the first Office Action. The Commissioner is authorized to charge the fee set forth in 37 C.F.R. § 1.17(p) to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: April 8, 2014

/Jamie J. Zheng/

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|                                                                                                                                          |         |    | Application Number       | 13/971,231             |              |
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|                                                                                                                                          |         |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |         |    | Art Unit                 | 2189                   |              |
| Examiner Name                                                                                                                            | Unknown |    |                          |                        |              |
| Sheet                                                                                                                                    | 1       | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 20060262586                              | 11-23-2006                       | Solomon, et al                                     |                                                                                 |
|                        | 2.                       | 20080162790                              | 07-03-2008                       | Im, Jeon-Taek                                      |                                                                                 |
|                        | 3.                       | 20090103387                              | 04-23-2009                       | Shau, Jeng-Jye                                     |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          | 4.                       | JPH10092169 A           | 9/9/97                              | Toshiba Corp.                                         |                                                                                    |                |
|                          | 5.                       | JP2000311485 A          | 10/13/00                            | Fujitsu Ltd.                                          |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*           | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 6.                       | Office Action mailed April 2, 2014, for Japanese Patent Application No. 2012-520662 and English translation thereof, 7 pages                                                                                                                                    |                |

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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-092169

(43)Date of publication of application : 10.04.1998

(51)Int.Cl.

G11C 5/00

(21)Application number : 09-181302

(71)Applicant : INTERNATL BUSINESS MACH CORP  
<IBM>

(22)Date of filing : 07.07.1997

(72)Inventor : BRIAN J CONNOLLY  
MARK W KELLOGG  
BRUCE G HEEZERUZETSUTO

(30)Priority

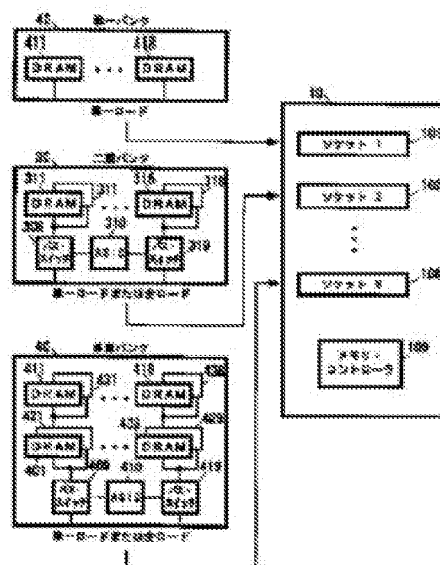
Priority number : 96 676609 Priority date : 08.07.1996 Priority country : US

## (54) MEMORY MODULE

### (57)Abstract:

PROBLEM TO BE SOLVED: To minimize a data line load by providing a bus switch between a system and a RAM and then comprising a logic circuit to produce a signal for enabling this switch into an ASIC.

SOLUTION: DRAM chips 301 to 304 and DRAM chips 311 to 314 are connected to a bus switch 309, while DRAM chips 305 to 308 and DRAM chips 315 to 318 are connected to a bus switch 319. A couple of bus switches are connected to ASIC 310 which is connected to a RAS pin and a CAS pin. A data bus load can be minimized by forming a bank DIMM 30 or DIMM 40 by utilizing bus switches 309, 319 or bus switches 409, 419.



(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-92169

(43) 公開日 平成10年(1998) 4月10日

(51) Int.Cl.<sup>6</sup>  
G 1 1 C 5/00

識別記号  
3 0 3

F I  
G 1 1 C 5/00

3 0 3 A

審査請求 未請求 請求項の数4 O L (全 7 頁)

(21) 出願番号 特願平9-181302

(22) 出願日 平成9年(1997) 7月7日

(31) 優先権主張番号 08/676609

(32) 優先日 1996年7月8日

(33) 優先権主張国 米国 (US)

(71) 出願人 390009531

インターナショナル・ビジネス・マシー  
ズ・コーポレーション

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(74) 代理人 弁理士 坂口 博 (外1名)

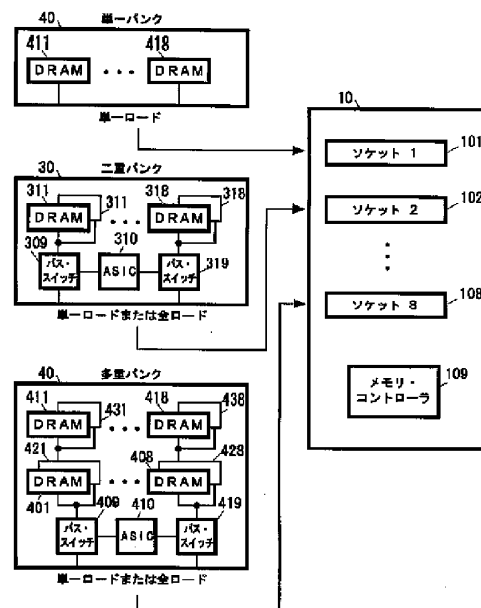
最終頁に続く

(54) 【発明の名称】 メモリ・モジュール

(57) 【要約】

【課題】 複数のDRAMを有する高密度モジュール上のデータ線負荷を最小にし、データ線容量性負荷に起因する性能低下なしに、システムの最大のメモリ密度を可能にすること。

【解決手段】 システム・ボード10上のコネクタ101~108と相互接続されるタブを有するプリント回路カード20~40と、プリント回路カードに取り付けられた複数のバンクのランダム・アクセス・メモリ・デバイス301~318、401~438と、選択されたランダム・アクセス・メモリ・デバイスと接続された、イネーブル信号に応答する1つまたは複数のバス・スイッチ309、319、409、419と、システムの実アドレス・ストロブ信号および列アドレス・ストロブ信号に応答して、1つまたは複数のバス・スイッチのイネーブル信号を生成する、論理手段とを含む。





## 【特許請求の範囲】

【請求項1】システム・ボード上のコネクタと相互接続される接点タブを有し、カード・データ・バスを有するプリント回路カードと、

前記プリント回路カードに取り付けられ、前記カード・データ・バスに接続された、複数バンクのランダム・アクセス・メモリ・デバイスと、

前記複数バンクのランダム・アクセス・メモリ・デバイスのうちの選択されたものが前記カード・データ・バスを介して接続された、イネーブル信号に応答する、1つまたは複数のバス・スイッチと、

システムの行アドレス・ストロブ信号および列アドレス・ストロブ信号に応答して、前記1つまたは複数のスイッチの前記イネーブル信号を生成する、論理手段とを含む、メモリ・モジュール。

【請求項2】前記1つまたは複数のバス・スイッチおよび前記論理手段が、前記プリント回路カードに取り付けられることを特徴とする、請求項1に記載の高密度メモリ・モジュール。

【請求項3】第2のプリント回路カードを含み、前記第1および第2のプリント回路カードが異なる数のメモリ・バンクを有することを特徴とする、請求項1に記載の高密度メモリ・モジュール。

【請求項4】前記1つまたは複数のバス・スイッチのそれぞれが、前記カード・データ・バスの信号線1本につき1つの複数の電界効果トランジスタ(FET)と、前記イネーブル信号に応答して前記FETをバイアスするための手段とを含むことを特徴とする、請求項1に記載の高密度メモリ・モジュール。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、全般的にはコンピュータ用の高密度メモリ・モジュールに関し、具体的には、最小限のメモリ・バス負荷を有する多重バンク・メモリ・モジュールに関する。

## 【0002】

【従来の技術】S I M M (シングル・インライン・メモリ・モジュール)やD I M M (デュアル・インライン・メモリ・モジュール)などの高密度メモリ・モジュールは、多くの応用分野で追加のシステム性能を達成できるので、ハイ・エンド・パーソナル・コンピュータ(PC)、ネットワーク・サーバおよびワークステーションで需要がある。しかし、最大システム密度は、下記の1つまたは複数によって不自然に制限されることがしばしばである。

・システムが有するメモリ・モジュール「スロット」の数が限られている。

・システムが有するメモリ「バンク」の数が(メモリ・コントローラからの選択信号線の不足が原因で)限られている。

・高密度メモリ・チップ(たとえば64メガビット(Mb)、256Mbおよびそれ以上)は、非常に高価であるか、簡単に入手できないか、その両方である。

・高密度メモリ・チップは、システムのメモリ・インターフェース電圧より低い動作電圧を有する場合がある。

・標準ランダム・アクセス・メモリ・デバイス(RAM)(ダイナミックRAM(DRAM)、シンクロナスDRAM(SDRAM)およびスタティックRAM(SRAM)を含む)の積層化/立体化または大型モジュールの使用は、システム限界をはるかに超えるデータ線容量をもたらす。以前の解決は、最後の問題以外の上記の問題のすべてについて提供されてきたが、これらの解決は、データ線負荷の問題が原因で応用性が制限されている。メモリ拡張を制限されているシステムで安価なRAMチップをよりよく利用するために必要なものは、データ線の容量性負荷を最小にし、その結果、RAMチップのバンクを有する大型メモリ・モジュールをシステムに追加できるようにする方法である。

## 【0003】

【発明が解決しようとする課題】したがって、本発明の目的は、データ線ごとに複数のランダム・アクセス・メモリ・デバイスを有する高密度モジュールでのデータ線負荷を最小にするための解決を提供することである。

【0004】本発明のもう1つの目的は、データ線の容量性負荷に起因する性能低下なしに、密度を制限されているシステムのメモリ密度を最大にすることである。

## 【0005】

【課題を解決するための手段】本発明によれば、データ線容量を許容可能なシステム限界まで減らす解決法には、2つの部分がある。第1の部分には、インライン・バス・スイッチを有するメモリ・モジュールの設計が含まれる。バス・スイッチは、モジュール・タブ(システム)とランダム・アクセス・メモリ・デバイス(RAM)の間に置かれ、高インピーダンス(オフ)またはアクティブ(活動)状態のいずれかになる。高インピーダンス状態の時には、メモリ・モジュールの実効負荷は、ビット・スイッチ・デバイスの負荷になる。アクティブ(たとえば、リード/ライト・サイクル)の時には、RAM負荷の他に、最小限のキャパシタンス/抵抗がメモリ・バスに追加される。一時に1つのメモリ・モジュールだけがアクティブになる。

【0006】本発明による解決の第2の部分は、バス・スイッチをイネーブルする信号を生成する論理回路を特定用途向け集積回路(ASIC)に組み込むことである。バス・スイッチは、メモリ・モジュールへの行アドレス・ストロブ(RAS)選択線の立ち上がりエッジでアクティブになり、RAS選択線または列アドレス・ストロブ(CAS)選択線のうちの最後の線がインアクティブ(非活動)状態になるまで活動状態にとどまり、これによって、高速ページ・モード(FPM)動作

とEDO(拡張データ出力)動作の両方がサポートされる。ASICの回路は、システムのRAS選択線とCAS選択線をデコードし、信号を駆動してバス・スイッチをイネーブルすることによって、この作業を実行する。論理回路は、リード/ライト・サイクル、ROR(RAS only refresh)サイクル、CBR(CAS before RAS refresh)サイクルおよびヒドン・リフレッシュ(hidden refresh)サイクルを区別し、それ相応にバス・スイッチをアクティブにしなければならない。CBRサイクルが発生する時には、バス・スイッチはインアクティブのままになる。ヒドン・リフレッシュ・サイクルでは、バス・スイッチはアクティブにされ、リフレッシュ・サイクルが完了するまでアクティブのままになる。これは、リード動作またはライト動作が存在する可能性があるのである。

#### 【0007】

【発明の実施の形態】本発明を、DIMMを使用する特定の実施例に関して説明するが、当業者であれば、SIMMなどの他のメモリ・モジュールを本発明の実施に使用できることを諒解するであろう。このようなモジュールは、通常は、コンピュータ・システム基板上のコネクタに挿入するための接点タブを有するプリント回路カードとして実施される。

【0008】ここで図面、具体的には図1を参照すると、8つのメモリ・モジュール・ソケット101～108とメモリ・コントローラ109を有する通常のシステム・ボード10が示されている。たとえば8つの4MbのDRAMチップ201～208を有する通常の単一バンクDIMM 20は、通常はメモリ・コントローラ109に最も近いメモリ・モジュール・ソケット101から始めて、メモリ・モジュール・ソケット101～108のすべてに単一バンクDIMM 20が挿入されるまで順番に、メモリ・モジュール・ソケット101～108のうちの1つに挿入することができる。したがって、この例では、システム・ボードは、4メガバイト(MB)の最小構成と32MBの最大構成を有する。

【0009】本発明によれば、二重バンクDIMM 30または多重バンクDIMM 40によって、単一バン

クDIMM 20を置換することができる。二重バンクDIMM 30の場合、バス・スイッチ309および319に接続された、8つのDRAMチップ301～308の第1のグループと、8つのDRAMチップ311～318の第2のグループがある。DRAMチップ301～304およびDRAMチップ311～314はバス・スイッチ309に接続され、DRAMチップ305～308およびDRAMチップ315～318はバス・スイッチ319に接続される。2つのバス・スイッチは、ASIC 310に接続され、ASIC 310は、このモジュールのRASピンおよびCASピンに接続される。この概念は、多重バンクDIMM 40の場合に拡張され、この例では、DRAMチップの4つのグループすなわち、DRAMチップ401～408、DRAMチップ411～418、DRAMチップ421～428およびDRAMチップ431～438がある。DRAMチップ401～404、DRAMチップ411～414、DRAMチップ421～424およびDRAMチップ431～434は、バス・スイッチ409に接続され、DRAMチップ405～408、DRAMチップ415～418、DRAMチップ425～428およびDRAMチップ435～438は、バス・スイッチ419に接続される。二重バンクDIMM 30の場合と同様に、バス・スイッチ409および419は、ASIC 410に接続され、ASIC 410は、このモジュールのRASピンおよびCASピンに接続される。

【0010】二重バンクDIMM 30を使用する場合、システムの最小構成は8MBに増加し、最大構成は64MBに増加する。多重バンクDIMM 40を使用すると、図示の4バンクのDRAMチップの例では、最小構成は16MB、最大構成は128MBに増加する。より高密度のデバイス(たとえば16Mb、64Mbなど)を使用すると、最大メモリ密度のかかなりの増加がもたらされるはずである。これは、下の表からわかるように、最小限のデータ・バス負荷で達成される。

#### 【0011】

【表1】

| データ・バス負荷の比較* (最大値) |      |      |      |
|--------------------|------|------|------|
|                    | 1バンク | 2バンク | 4バンク |
| 従来技術               | 8    | 16   | 32   |
| 本発明                | 8    | 9    | 11   |

\* DIMM当たりのDRAM等価負荷の数として表す (通常は7 pF/DRAM)

【0012】これは、二重バンクDIMM 30の場合にはバス・スイッチ309および319、多重バンクD

IMM 40の場合にはバス・スイッチ409および419を使用することによって達成される。ASIC 3

10および410は、バス・スイッチとシステム・ボードの間のインターフェースを提供する。

【0013】ここで図2に移ると、バス・スイッチの一般化された論理図が示されている。バス・スイッチには、信号線ごとに1つずつ、複数のFETが含まれる。1つまたは複数のインバータ50が、FETをオンにバイアスするのに使用される。インバータ50への入力BEN（NはBEの反転を表す）は、バス・スイッチのイネーブル入力である。イネーブル入力が行うになると、インバータの出力はハイになり、その結果、正バイアスがFETのゲートに印加され、FETが導通する。このバス・スイッチを介する遅延は、1ナノ秒（ns）未満であり、これによって、正しいメモリ動作が保証される。

【0014】図3のブロック図からわかるように、ASIC 60（図1のASIC 310および410に対応する）は、システムのRAS信号（SYS\_RAS）とCAS信号（SYS\_CAS）を受け取り、バス・スイッチ61および62のイネーブル入力へのRC\_SELECT信号を生成する。バス・スイッチ61および62は、カード・データ・バス63とプリント回路カードの接点タブ64の間のインターフェースを提供する。接点タブ64はシステム・ボードのソケット1～8に挿入されるモジュール20、30、40のプリント回路カードのエッジに設けられている。

【0015】RC\_SELECT信号は、アクティブ・ロウの信号であり、独自の機能を有する。通常のメモリ・リード・サイクルおよびメモリ・ライト・サイクルの間、RC\_SELECT信号は、図4に示されるように、システムのRAS選択線のアクティブ（立ち下がり）エッジでアクティブにされ、システムのRAS選択線とCAS選択線の両方がインアクティブになるまでアクティブのままになる。

【0016】ヒドン・リフレッシュ・サイクル中は、図5からわかるように、ヒドン・リフレッシュ・サイクルの性質が原因で、RC\_SELECT信号はアクティブになる。ヒドン・リフレッシュ・サイクルの第1の部分は、RASが立ち上がってから立ち下がる（CBRリフレッシュ・サイクルの開始）までシステムのCAS選択線がアクティブのままになるメモリ・サイクルである。RC\_SELECT論理回路は、CAS外乱をフィルタリングし、インアクティブのままになる。

【0017】CBRリフレッシュ中は、図6からわかるように、システムのCAS選択線が、システムのRAS選択線がアクティブになるより前にアクティブになる。RC\_SELECT信号は、CBRサイクル中はインアクティブのままになる。

【0018】RORサイクル中は、図7からわかるように、システムのRAS選択線がアクティブになり、RC\_SELECT信号上に駆動される。バス・スイッチが

アクティブになっても、データがその時点で駆動されていないので、システム動作には影響しない。

【0019】所与の応用分野で必要であれば、追加回路を追加して、RORサイクル中にバス・スイッチがアクティブにならないようにすることができる。

【0020】図8のASICの内部ロジックには、システムのCAS選択線CAS\_N（Nは反転を表す）のアクティブ（すなわち立ち下がり）エッジでシステムRAS選択線（ANY\_RAS）の状態をラッチするD型のフリップフロップ70が含まれる。ANY\_RAS信号は、ANDゲート71によって生成され、バッファ72を介してフリップフロップ70のD入力に供給されるが、ANY\_CAS信号は、ANDゲート73によって生成され、インバータ74を介してフリップフロップ70のクロック入力に供給される。フリップフロップ70の出力は、インバータ76を介して2入力NANDゲート75に接続され、マルチプレクサ77の入力「0」にも接続される。インバータ76の出力は、信号CBR\_BIT\_Nである。信号ANY\_RASは、インバータ78によって反転され、インバータ78の出力は、2入力NANDゲート75のもう一方の入力に接続される。2入力NANDゲート75の出力は、信号RC\_ACTIVEであり、マルチプレクサ77の入力「1」に接続される。フリップフロップ70は、システムのRAS選択線とCAS選択線がインアクティブであり、フリップフロップ70の「Q」出力が論理「1」である時に、NANDゲート79の出力によってリセットされる。マルチプレクサ77の選択線は、4つのゲート（インバータ80と3つのバッファ81～83）によって遅延されたシステムのCAS選択線DELAY\_CASによって選択される。これは、フリップフロップ70が信号ANY\_RASの状態をラッチする時間を与えるために行われる。

【0021】各サイクルの初期の開始時に、マルチプレクサ77は、「1」入力位置にセットされる。これによって、システムのRAS選択線をすばやく流すことができるようになる。システムのCAS選択線がアクティブになった時には、マルチプレクサ77は、「0」入力位置に切り替わり、これによって、フリップフロップ70の出力が選択される。

【0022】図1に戻って、本発明の実装は、DRAMチップのバンク群を1つのプリント回路カードに取り付け、ASICとバス・スイッチを別のキャリアに取り付けることによって、変更することができる。たとえば、ASICとバス・スイッチは、システム・ボード10に直接に取り付けることができるが、これにはシステム・ボードの変更が必要である。代替案は、DRAMカードを受けるコネクタを備えた別のプリント回路カードにASICとバス・スイッチを取り付けることである。どちらの代替案でも、DRAMチップだけでDRAMカード

を製造することができる。

【図面の簡単な説明】

【図１】システム・メモリ・ボードと、従来の単一バンクＤＩＭＭと本発明による多重バンクＤＩＭＭの両方を示すブロック図である。

【図２】図１に示された本発明の実施例に使用されるバス・スイッチを一般化した論理ブロック図である。

【図3】図1の実施例でのASCIIとバス・スイッチの  
関係を示すブロック図である。

【図4】通常のリード／ライト・サイクルの場合の、R  
C\_SELECT出力信号を生成するASIC論理回路  
の動作を示すタイミング図である。

【図5】ヒドン・リフレッシュの場合の、RC\_SELECT出力信号を生成するASIC論理回路の動作を示すタイミング図である。

【図6】CBRの場合の、RC\_SELECT出力信号を生成するASIC論理回路の動作を示すタイミング図である。

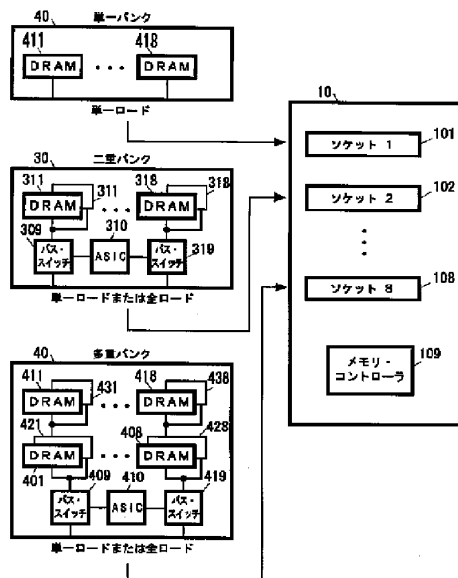
【図7】RORの場合の、RC\_SELECT出力信号を生成するASIC論理回路の動作を示すタイミング図である。

【図8】本発明の好ましい実施例によるASCIIの論理回路を示す論理ブロック図である。

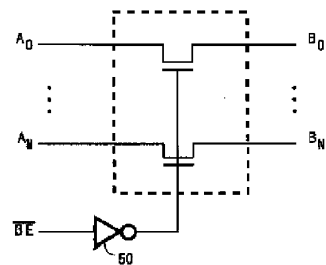
【符号の説明】

- 60 ASIC
- 61 バス・スイッチ
- 62 バス・スイッチ
- 63 カード・データ・バス
- 64 タブ
- 72 バッファ
- 73 ANDゲート
- 74 インバータ
- 75 2入力NANDゲート
- 76 インバータ
- 77 マルチプレクサ
- 78 インバータ
- 79 NANDゲート
- 80 インバータ
- 81 バッファ
- 82 バッファ
- 83 バッファ

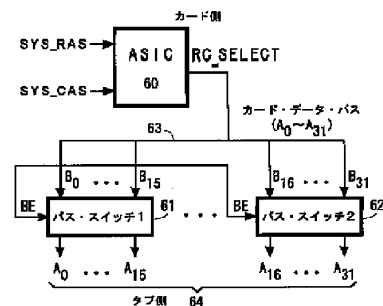
【 1】



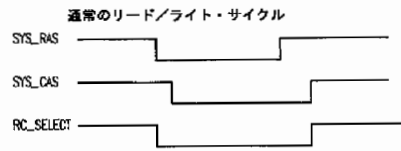
【図2】



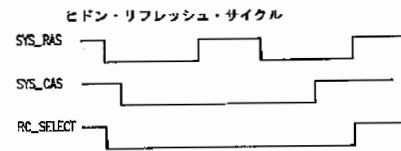
【図3】



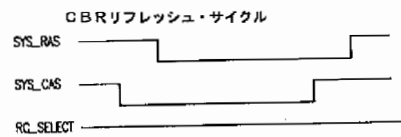
【図4】



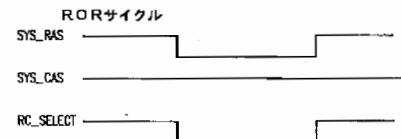
【図5】



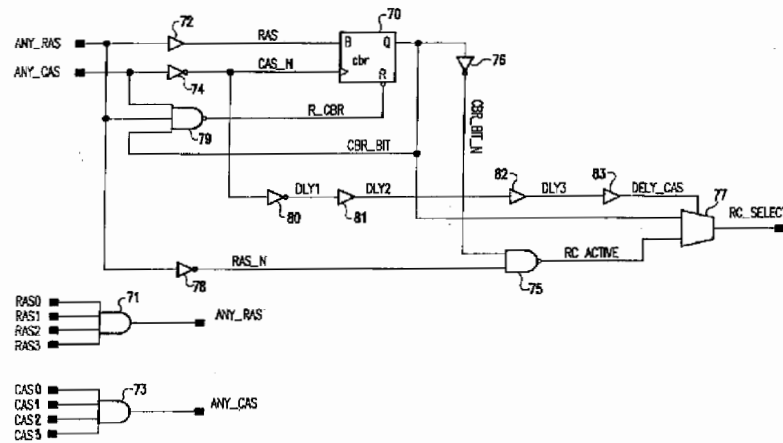
【図6】



【図7】



【図8】



【手続補正書】

【提出日】平成9年7月23日

【手続補正1】

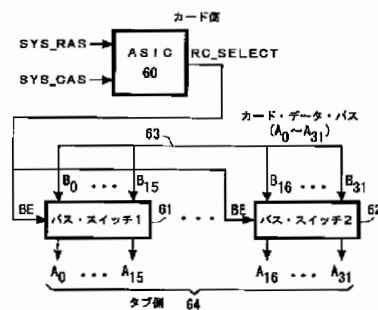
【補正対象書類名】図面

【補正対象項目名】図3

【補正方法】変更

【補正内容】

【図3】



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Espacenet

Bibliographic data: JP2000311485 (A) — 2000-11-07

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**MEMORY MODULE SYSTEM CONNECTING ONLY SELECTED MEMORY MODULE  
TO DATA LINE AND DATA INPUT/OUTPUT METHOD UTILIZING THE SYSTEM**

No documents available for this priority number.

**Inventor(s):** KIN CHIKYOKU ± (KIN CHIKYOKU)

**Applicant(s):** SAMSUNG ELECTRONICS CO LTD ± (SAMSUNG ELECTRONICS  
CO LTD)

**Classification:** - international: **G06F12/00; G06F12/06; G06F13/16; G11C11/401;  
G11C11/407; G11C5/00; G11C7/10;** (IPC1-  
7): G06F13/16; G11C11/401; G11C11/407  
- cooperative: **G11C5/04; G11C7/1006**

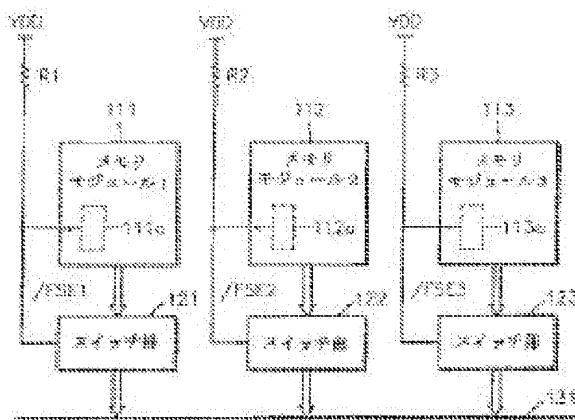
**Application  
number:** JP20000072737 20000315

**Priority  
number(s):** KR19990012027 19990407

**Also  
published as:** JP4319320 (B2) GB2348722 (A) GB2348722 (B) US6526473 (B1)  
TW475110 (B) KR20000065601 (A) FR2792105 (A1)  
FR2792105 (B1) DE19960005 (A1) less

**Abstract of JP2000311485 (A)**

PROBLEM TO BE SOLVED: To improve data write and read rates by generating a connection control signal by activation while data having burst length specified by a write mode is inputted. SOLUTION: As resistors R1-R3 arranged at the outside of memory modules 1-3, 111-113 are made high resistance value, voltage levels of first to third connection control signals /FSE1-/FSE3 are decided by an internal signal of the memory module 1-3, 111-113 connected to the resistors, but when an internal signal is in a floating state, voltage levels of the first to third connection control signal /FSE1-/FSE3 are made external power source voltage VDD through the resistors R1-R3, that is, made a high state.; Therefore, when the module 111 is selected, second, third connection control signals /FSE2, /FSE3 are made non-activated and second, third switches 122, 124 are turned off, loads of data pins of modules 2, 3, 112, 113 are separated from a data base line 131.







US006526473B1

(12) **United States Patent**  
**Kim**

(10) **Patent No.:** **US 6,526,473 B1**  
(45) **Date of Patent:** **Feb. 25, 2003**

(54) **MEMORY MODULE SYSTEM FOR CONTROLLING DATA INPUT AND OUTPUT BY CONNECTING SELECTED MEMORY MODULES TO A DATA LINE**

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(73) Assignee: **Samsung Electronics Co., Ltd., Suwon (KR)**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/440,728**

(22) Filed: **Nov. 16, 1999**

(30) **Foreign Application Priority Data**

Apr. 7, 1999 (KR) ..... 99-12027

(51) **Int. Cl.<sup>7</sup>** ..... **G06F 12/02**

(52) **U.S. Cl.** ..... **711/105; 711/5; 711/111; 711/209; 365/230.03; 710/131**

(58) **Field of Search** ..... **711/5, 105, 111, 711/209; 365/230.03, 230.08; 710/131**

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

|           |     |         |                  |            |
|-----------|-----|---------|------------------|------------|
| 4,881,203 | A   | 11/1989 | Watanabe et al.  | 365/203    |
| 5,513,135 | A * | 4/1996  | Dell et al.      | 365/52     |
| 5,522,064 | A * | 5/1996  | Alderegua et al. | 395/550    |
| 5,555,215 | A   | 9/1996  | Nakagome et al.  | 365/226    |
| 5,586,300 | A * | 12/1996 | Wilcox et al.    | 395/477    |
| 5,715,211 | A   | 2/1998  | Toda             | 365/233    |
| 5,802,395 | A   | 9/1998  | Connolly et al.  | 395/834    |
| 5,850,368 | A * | 12/1998 | Ong et al.       | 365/238.5  |
| 5,940,328 | A * | 8/1999  | Iwamoto et al.   | 365/189.01 |
| 5,953,215 | A * | 9/1999  | Karabatsos       | 361/767    |

|           |      |         |                 |         |
|-----------|------|---------|-----------------|---------|
| 5,987,579 | A *  | 11/1999 | Nishtala et al. | 711/169 |
| 6,070,217 | A *  | 5/2000  | Connolly et al. | 710/131 |
| 6,098,132 | A *  | 8/2000  | Olariu et al.   | 710/103 |
| 6,161,165 | A *  | 12/2000 | Solomon et al.  | 711/114 |
| 6,209,074 | B1   | 3/2001  | Dell et al.     | 711/170 |
| 6,338,113 | B1 * | 1/2002  | Kubo et al.     | 711/105 |

**FOREIGN PATENT DOCUMENTS**

|    |           |         |       |
|----|-----------|---------|-------|
| EP | 0090591   | 10/1983 |       |
| EP | 0335715   | 10/1989 |       |
| JP | 61145629  | 3/1986  |       |
| WO | WO9941667 | 8/1999  | 711/5 |

**OTHER PUBLICATIONS**

Micron technology Inc., Synchronous DRAM (64Mb).  
Micron technology Inc., Synchronous DRAM (256Mb).\*

\* cited by examiner

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*Assistant Examiner*—Jasmine Song

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(57) **ABSTRACT**

A memory module system for connecting only selected memory modules to a data line to control data input and output is disclosed. The memory module system has a multiplicity of memory modules for outputting data to a data bus line, and more particularly, only the memory modules outputting data is electrically connected to the data bus line in response to activation of a predetermined connection control signal. The connection control signal has an activation width corresponding to a burst length of the output data. Only selected memory modules are connected to the data line during the data burst length, so that load per data pin is minimized, to thereby improve speed of writing and reading data.

**27 Claims, 13 Drawing Sheets**

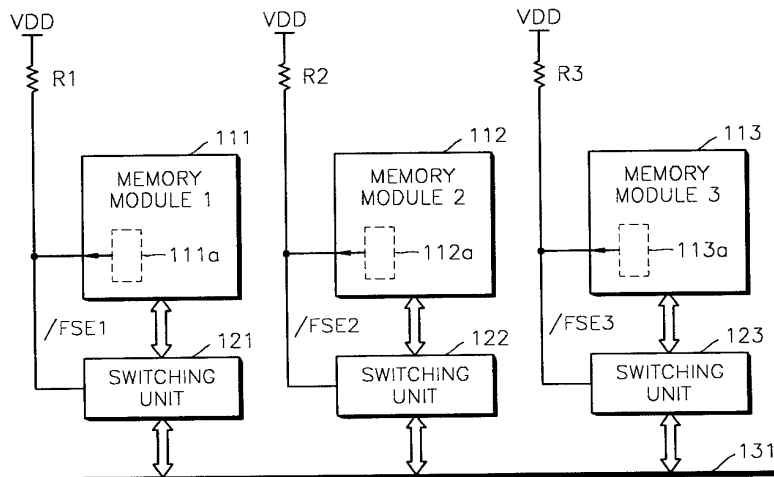


FIG. 1

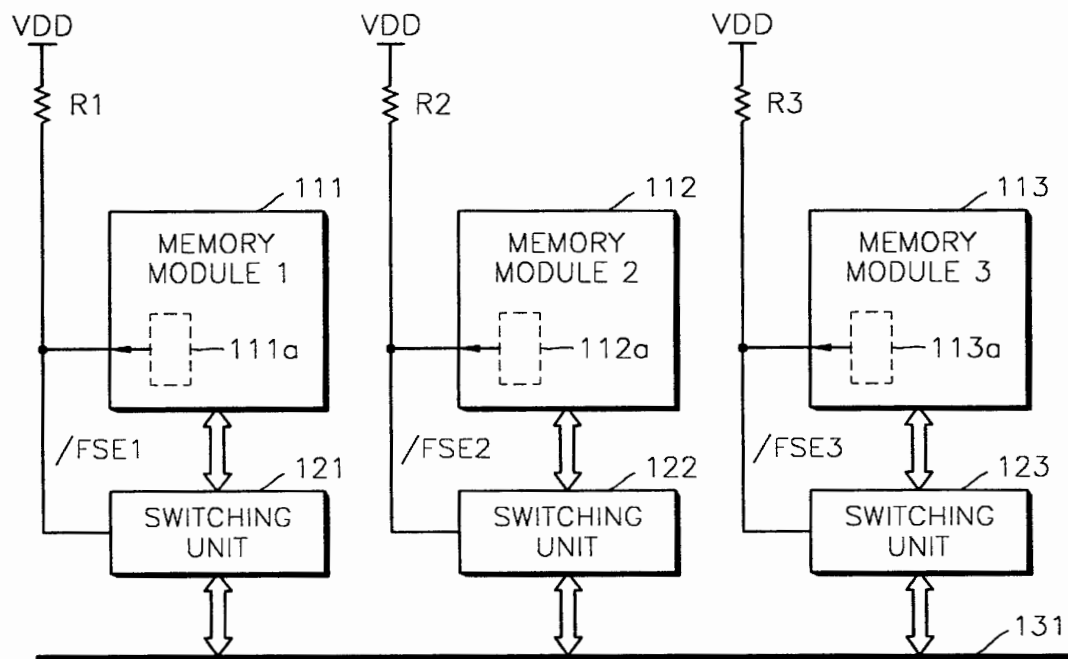


FIG. 2

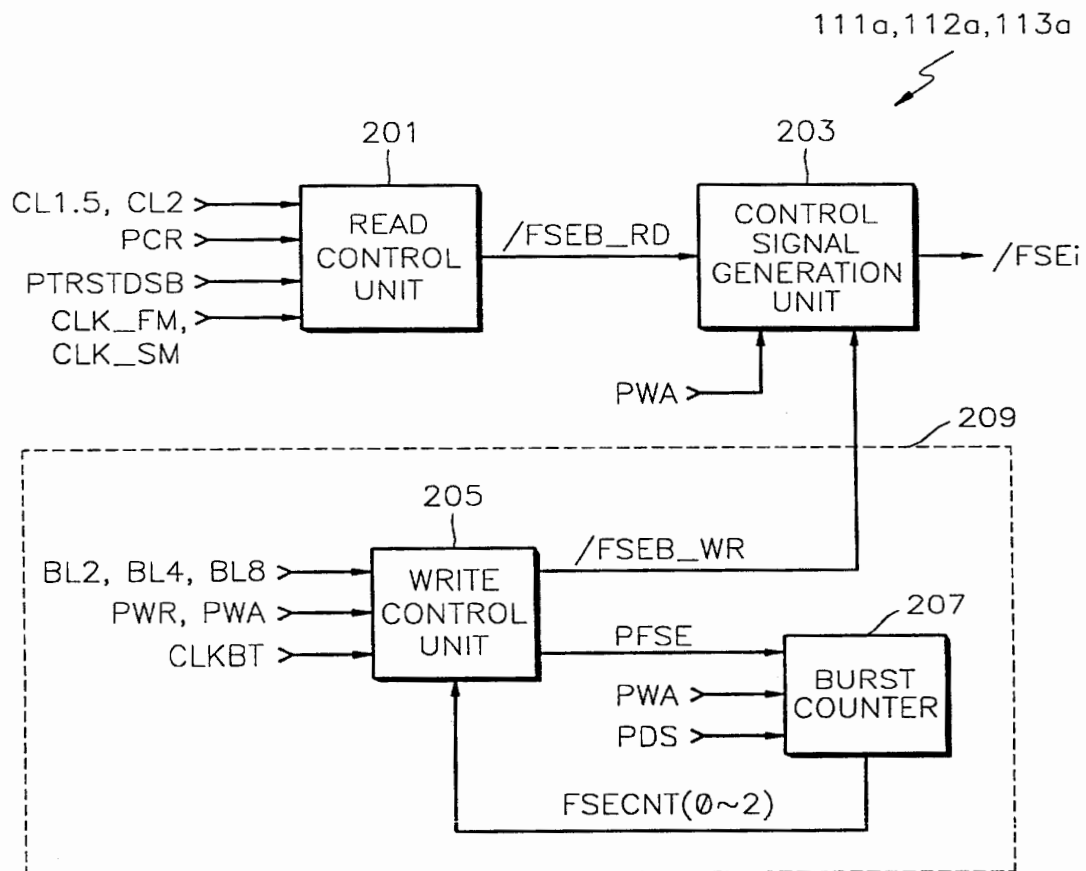


FIG. 3

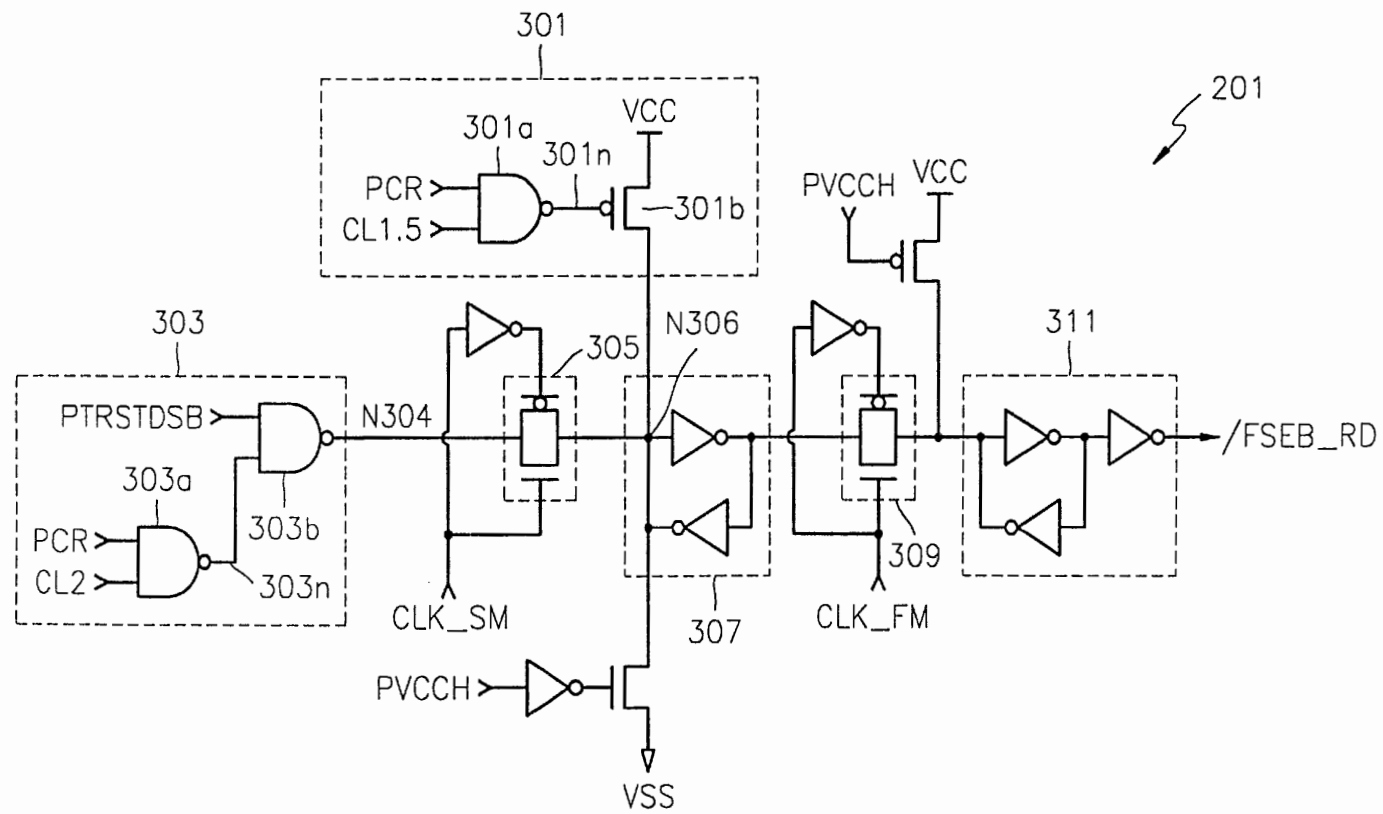


FIG. 4

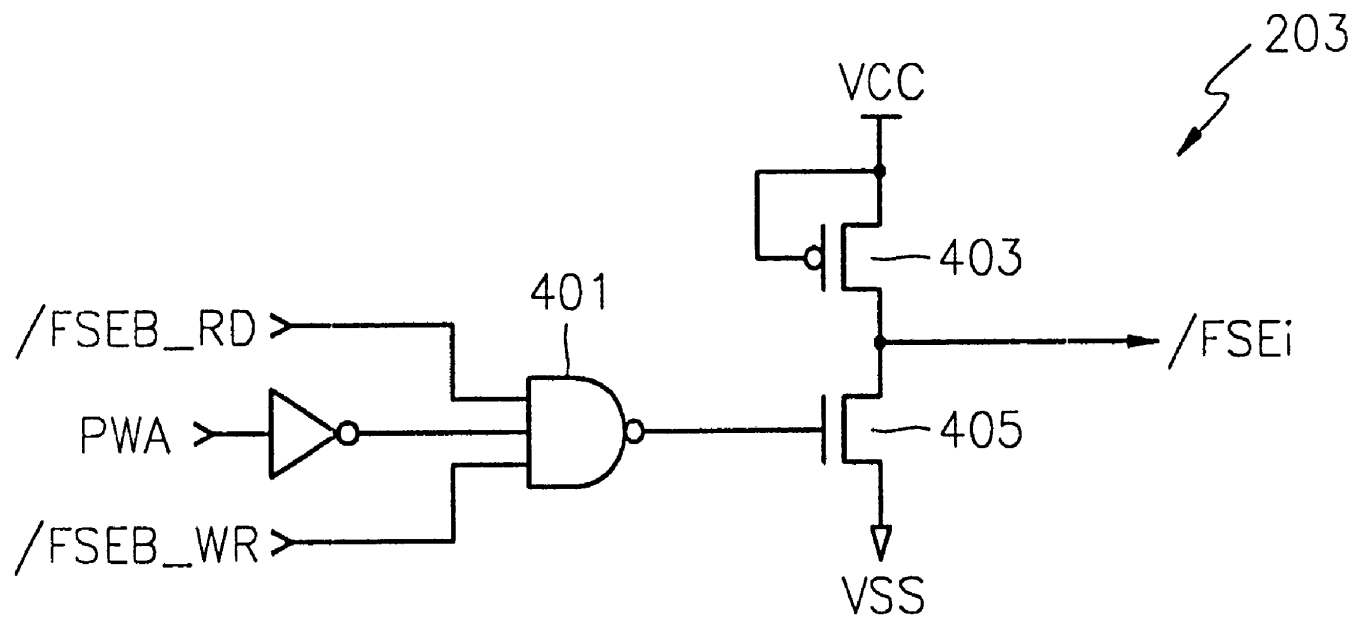


FIG. 5

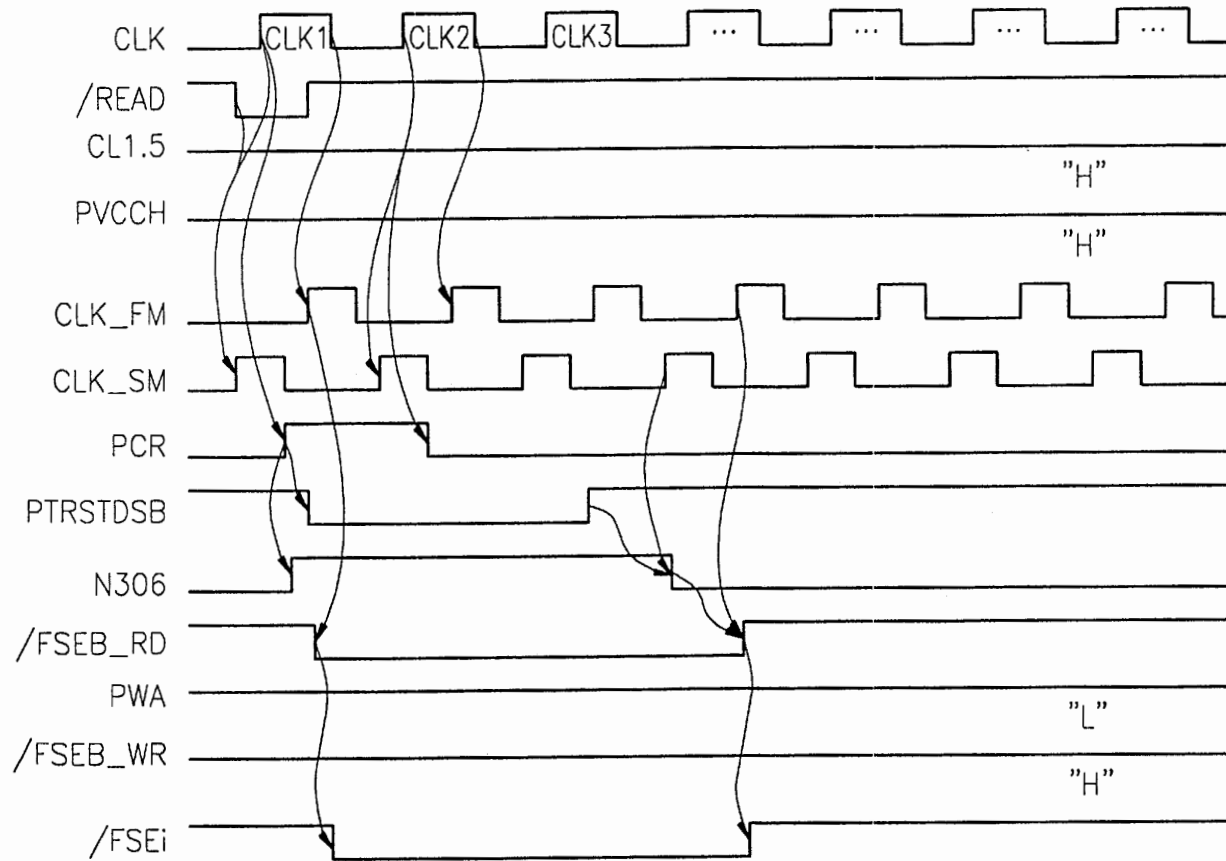


FIG. 6

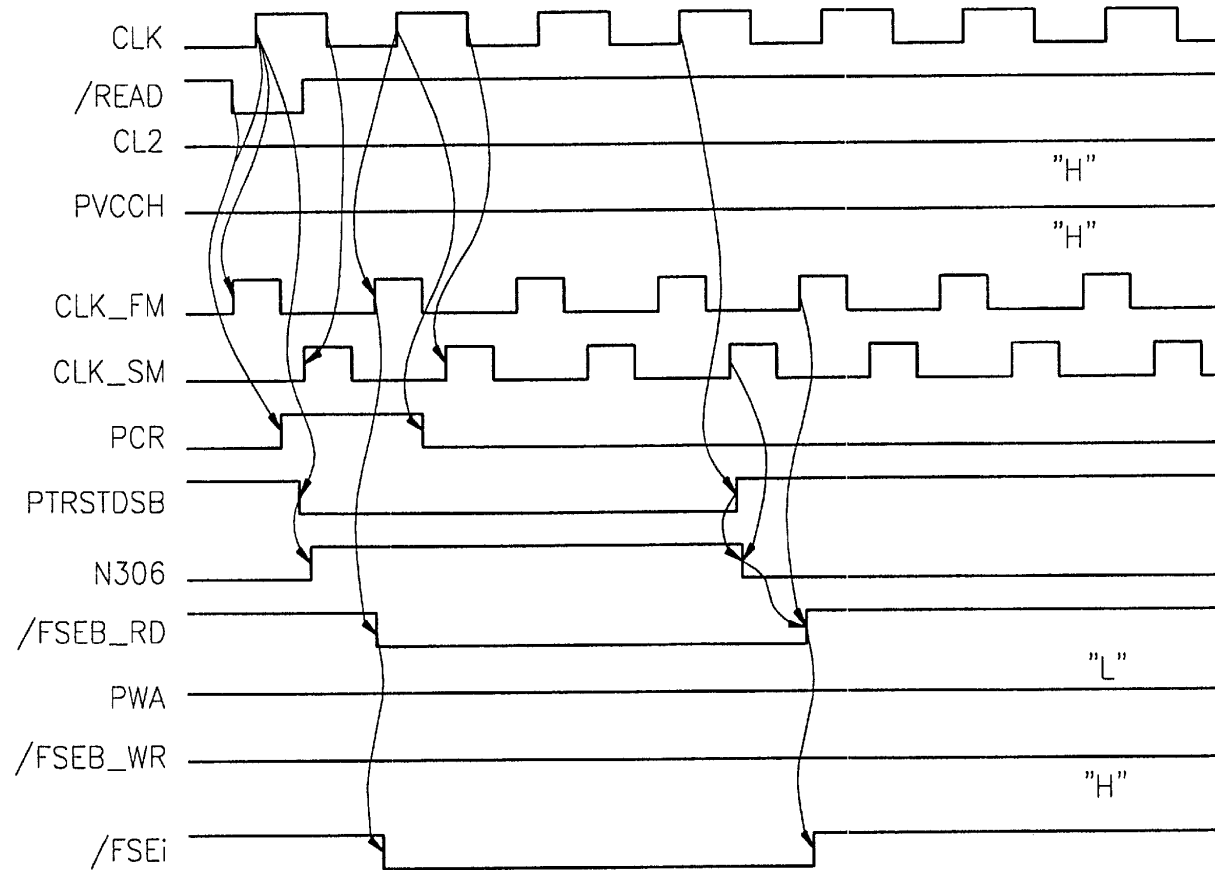


FIG. 7

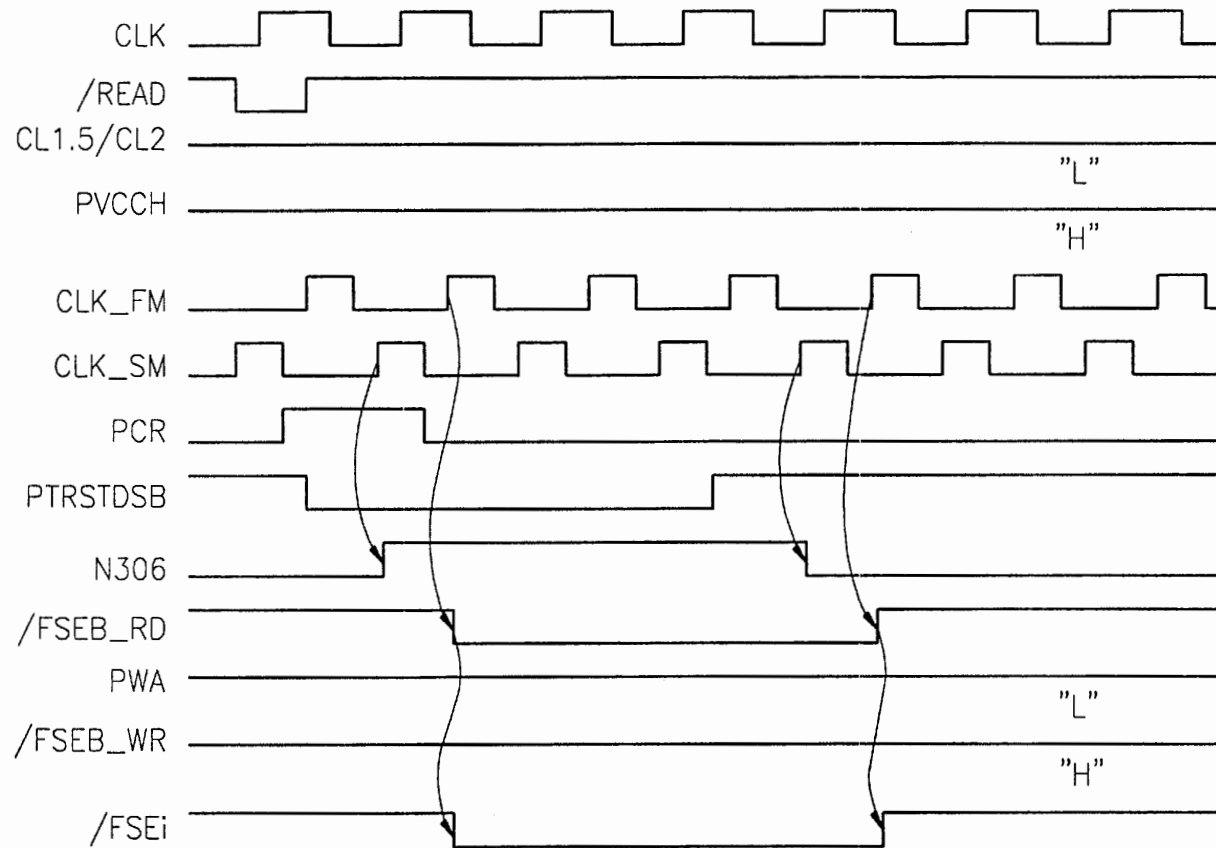






FIG. 9

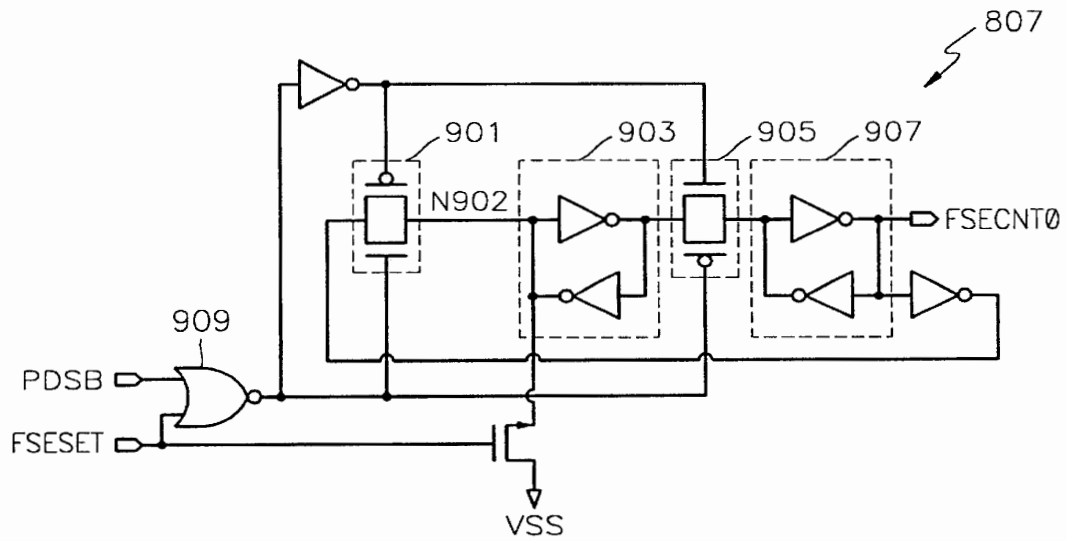


FIG. 10

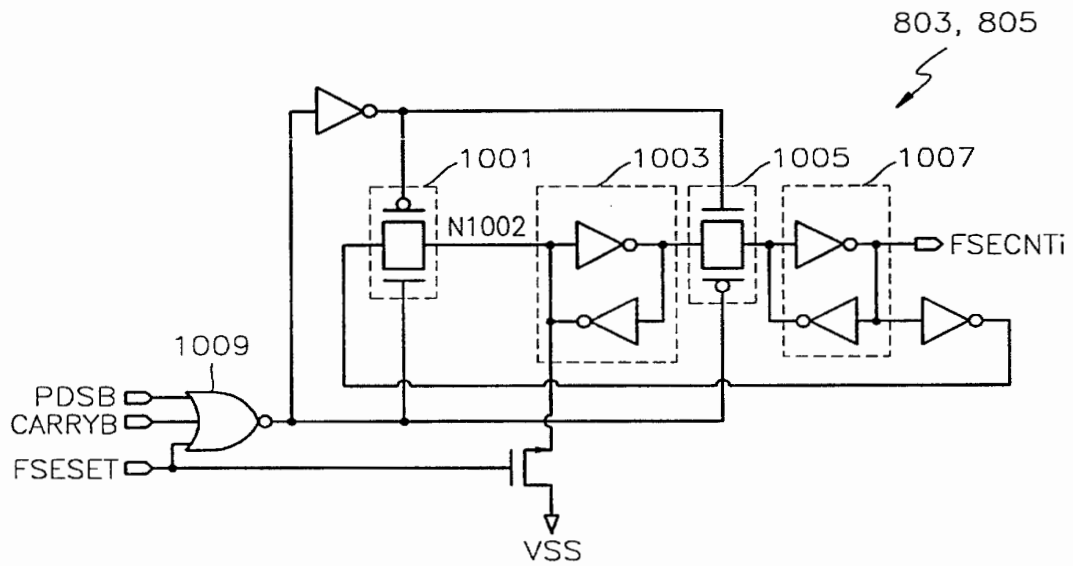


FIG. 11

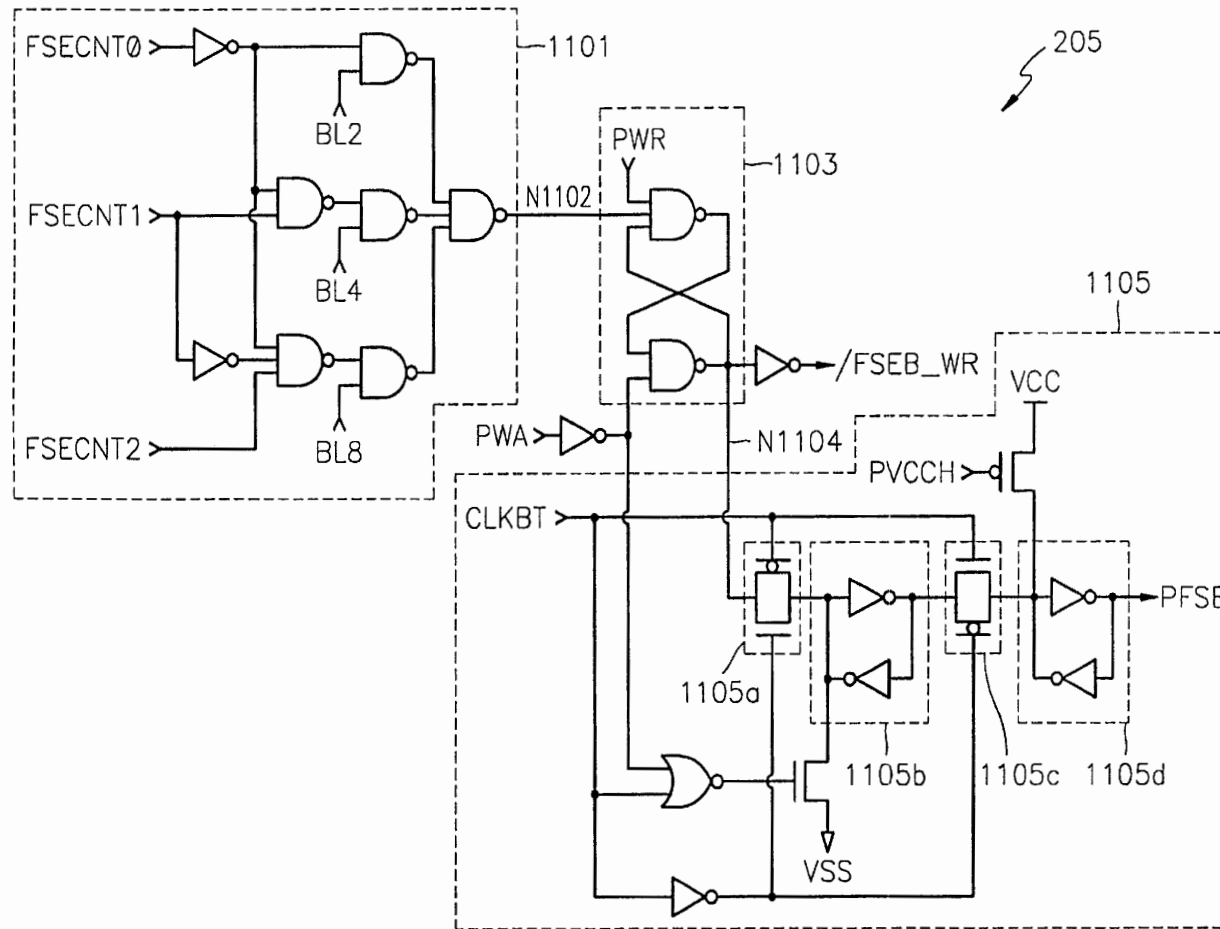


FIG. 12

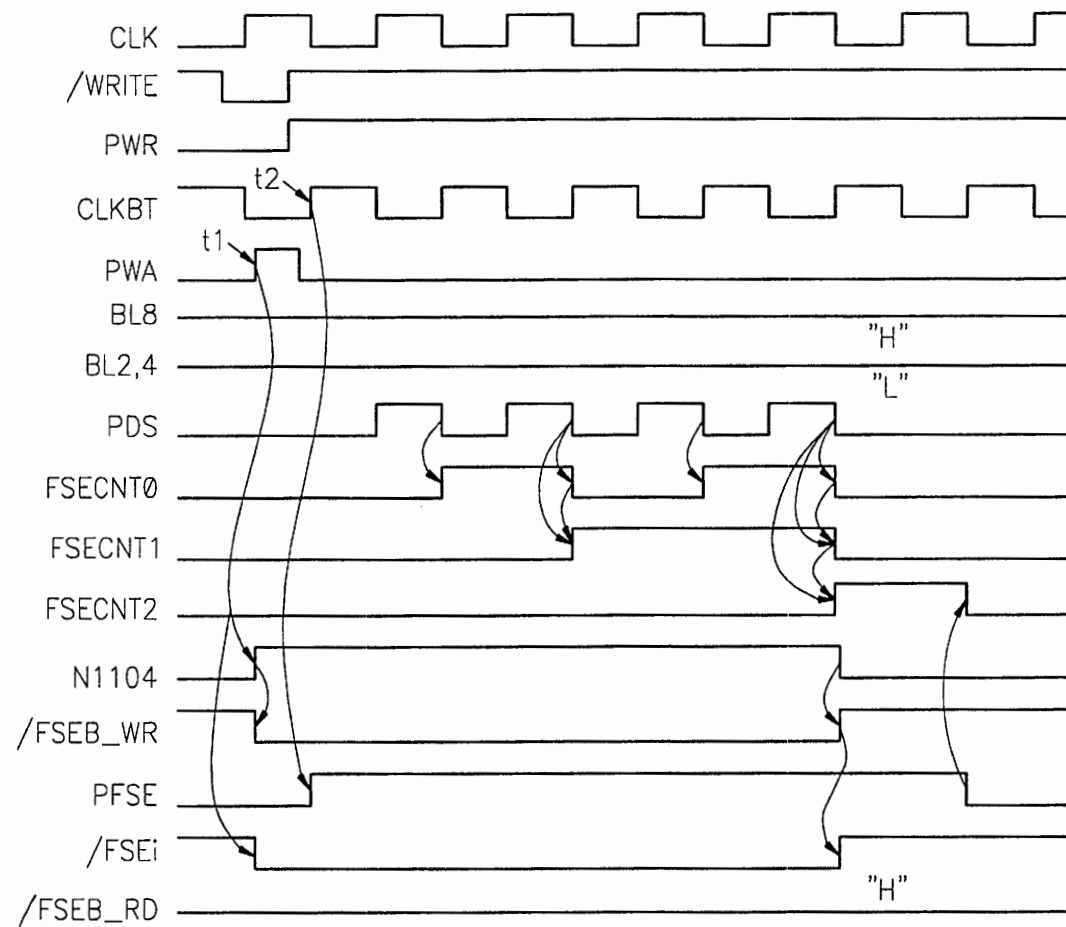


FIG. 13

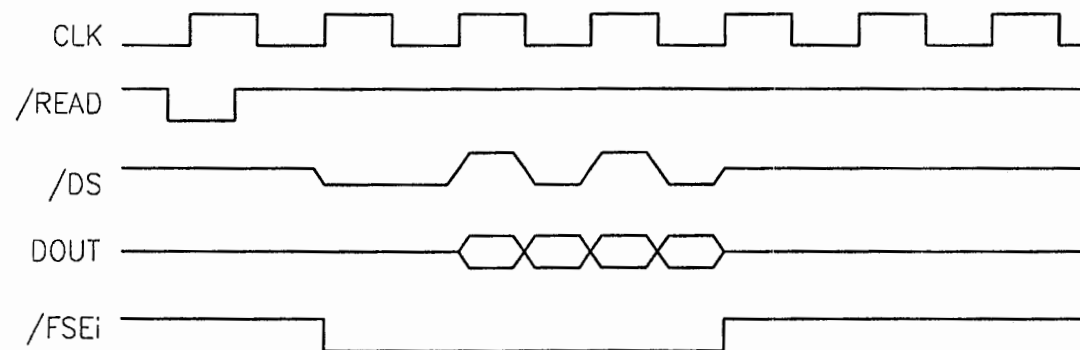


FIG. 14

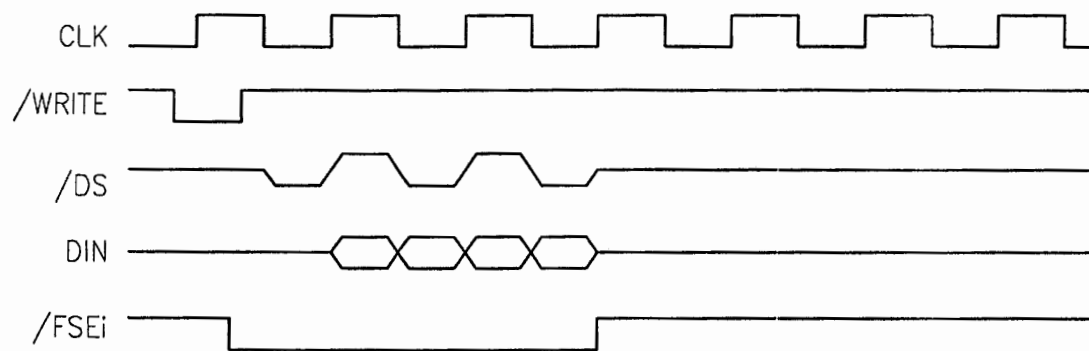
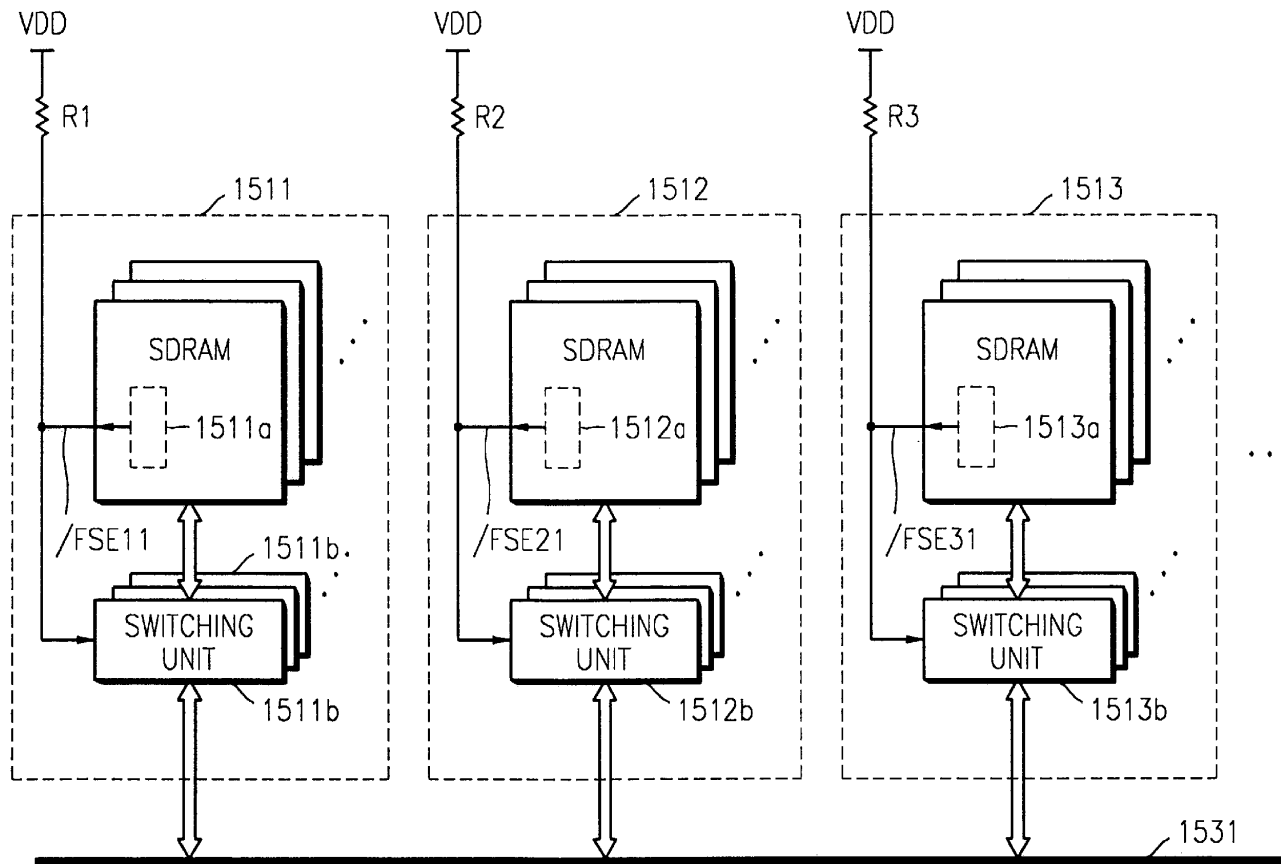


FIG. 15



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# MEMORY MODULE SYSTEM FOR CONTROLLING DATA INPUT AND OUTPUT BY CONNECTING SELECTED MEMORY MODULES TO A DATA LINE

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to a system with memory modules for controlling data input and output, and more particularly, to a system having a multiplicity of memory modules for controlling data input and output from and to a common data line by connecting selected memory modules to the common data line.

### 2. Description of the Related Art

A semiconductor memory device such as a dynamic random access memory (DRAM) can be used as a main memory in a system such as a computer. A memory using semiconductor memory devices generally has memory modules, such as dual in-line memory modules (DIMM) and single in-line memory modules (SIMM). A memory may be required to include a plurality of memory modules for operations of a system. In such a system, each of the memory modules uses a common data line. For instance, assuming that a main memory has a capacity of 32M bytes and is made with DIMMs each of which has a capacity of 8M bytes and made of four 16M (1M×16) DRAMs, the main memory of 32M bytes requires four slots, i.e., four DIMMs. Since the number of data bus lines is 64 and the number of data pins per DIMM is 64, the main memory of 32M bytes requires a multiplicity of data pins. Thus, four DIMMs constituting the main memory of 32M bytes use a common data bus line of a system. As the capacity of the main memory is increased, the necessity of using a common data line is increased.

The capacitance per data pin of a DIMM module is 20~25 pF. Thus, when the 32M byte memory is composed of four DIMMs of 1M×64, the capacitance per data pin becomes approximately 80~100 pF. Thus, the capacitance per data pin is so great that an increase in the load of an output driver increases power consumption, and that speed for writing and reading data is remarkably reduced.

## SUMMARY OF THE INVENTION

It is an object of the present invention to provide a memory module with minimized load capacitance per data pin to improve speed of writing and reading data and of the memory module.

To achieve the above and other objects, according to an aspect of the present invention, there is provided a memory module system for controlling data output to a data bus line, the system comprising a multiplicity of memory modules each of which includes a control signal generation circuit for generating a connection control signal having a width of activation corresponding to a burst length of output data, wherein the control signal generation circuit has a read control unit for activating input data during output of data of a predetermined burst length in a read mode to generate a read control signal, the read control unit receiving CAS latency information, a read command signal and burst length information of read data, and a multiplicity of switching units for electrically connecting output terminals of the memory modules to the data bus line in response to activation of the connection control signal. In the memory module system according to the present invention, the memory

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modules for receiving outputting data are electrically connected to the data bus line in response to activation of the connection control signals. The control signal generation circuit further comprises a write information generation unit. The write information generation unit receives a write command signal and burst length information of write data, and it is activated in a write mode during inputting data of a predetermined burst length to generate a write control signal.

In a memory module system for controlling data input and output according to the present invention, selected memory modules are connected to a data line during a data burst length in which data is input and output. Thus, load is minimized per data pin, so that speed of writing and reading data is improved.

## BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the present invention will become more apparent by describing in detail a preferred embodiment thereof with reference to the attached drawings in which:

FIG. 1 is a block diagram schematically showing a system having a multiplicity of memory modules according to a first embodiment of the present invention;

FIG. 2 is a block diagram of one of the control signal generation circuits of FIG. 1;

FIG. 3 is a circuit diagram of the read control unit of FIG. 2;

FIG. 4 is a circuit diagram of the control signal generation unit of FIG. 2;

FIGS. 5 through 7 are timing diagrams of control and data signals in FIGS. 3 and 4 in a read mode having CAS latencies of 1.5, 2 and 2.5, respectively;

FIG. 8 is a circuit diagram of the burst counter of FIG. 2;

FIG. 9 is a circuit diagram of the preliminary counter of FIG. 8;

FIG. 10 is a detailed circuit diagram of one of the main counters of FIG. 8;

FIG. 11 is a circuit diagram of the write control unit of FIG. 2;

FIG. 12 is a timing diagram of control and data signals related to the burst counter of FIG. 2;

FIG. 13 is a timing diagram of external signals of memory modules in a read mode of a DDR mode in a system of the present invention;

FIG. 14 is a timing diagram of external signals of memory modules in a write mode of a DDR mode in a system of the present invention; and

FIG. 15 is a block diagram schematically showing a system having a multiplicity of memory modules according to a second embodiment of the present invention.

## DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to FIG. 1, a first embodiment of a memory module system according to the present invention has a multiplicity of memory modules. For convenience, three memory modules, i.e., first through third memory modules 111, 112 and 113, are shown. The first through third memory modules 111, 112 and 113 are selected, so that output data is transferred to a common data bus line 131 through switching units 121, 122 and 123.

Each of the switching units includes switches, through which data is output from a corresponding memory module.

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Also, the data output through the switches is transferred to the data line bus 131. Each of the switching units 121, 122 and 123 is turned on when data is input to and output from the corresponding memory module. However, when data is not input to or output from the corresponding memory module, each of the switching units 121, 122 and 123 is turned off. For instance, assuming that the first memory module 111 is selected, to input or output data to or from the first memory module 111, a first connection control signal /FSE1 is activated to logic "low", so that the first switching unit 121 is turned on. Thus, output data of the first memory module 111 is transferred to the data bus line 131 through the first switching unit 121. At this time, second and third connection control signals /FSE2 and /FSE3 are deactivated to logic "high" by an external power supply voltage VDD applied through resistors R2 and R3, respectively. The resistors R2 and R3 may be external to the memory modules 112 and 113.

In detail, the resistors R1 to R3 have relatively high resistances. Thus, voltage levels of the first through third connection control signals /FSE1, /FSE2 and /FSE3 are determined by the first through third memory modules 111, 112 and 113, respectively. However, when signals to determine the voltage levels of the connection control signals /FSE1, /FSE2 and /FSE3 in the respective memory modules are in floating state, the voltage levels of the first through third connection control signals /FSE1, /FSE2 and /FSE3 become an external power supply voltage VDD, i.e., logic "high", applied through the resistors R1 to R3 connected to the respective memory modules. That is, when the first memory module 111 is selected, the second and the third connection control signals /FSE2 and /FSE3 become logic "high". The second and the third connection control signals /FSE2 and /FSE3 deactivated to the "high" then turn off the second and the third switching units 122, 123. Thus, load of data pins of the second and third memory modules 112 and 113 is separated from the data bus line 131. In other words, memory modules other than the selected memory module are separated from the data line 131, to thereby reduce load of the data bus line 131.

Preferably, each of the first through third connection control signals /FSE1, /FSE2 and /FSE3 is generated by the corresponding memory modules 111, 112 and 113. Control signal generation circuits 111a, 112a and 113a which are included in the corresponding memory modules 111, 112 and 113 generate the first through third connection control signals /FSE1, /FSE2 and /FSE3, respectively. Also, activation intervals of the first through third connection control signals /FSE1, /FSE2 and /FSE3 are preferably determined by burst lengths of input or output data. Also, the first through third connection control signals /FSE1, /FSE2 and /FSE3 may be provided from a control unit (not shown) which transfers the input data from the outside of the memory modules.

FIG. 2 is a block diagram illustrating a preferred embodiment of a control signal generation circuit according to the present invention. As described above, the control signal generation circuits 111a, 112a and 113a each having the same configuration as in FIG. 2 are included in the memory modules 111, 112 and 113, respectively. For convenience, the first through third connection control signals /FSE1, /FSE2 and /FSE3 are indicated by /FSEi.

Referring to FIG. 2, the control signal generation circuit includes a read control unit 201, a control signal generation unit 203, a write control unit 205 and a burst counter 207. The read control unit 201 receives column address strobe (CAS) latency signals CL1.5 and CL2, a read command

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signal PCR and a read strobe signal PTRSTDSB, and generates a read control signal /FSEB\_RD. The CAS latency signals CL1.5 and CL2 include /CAS latency information, and the read command signal PCR introduces a read command for a read mode. The read strobe signal PTRSTDSB includes information on a burst length of read data, for example, information on burst signals BL2, BL4 and BL8 input to the write control unit 205. Also, the read control signal /FSEB\_RD is activated in response to the burst length of the read data in the read mode. The read control unit 201 will be described in detail with reference to FIG. 3.

The control signal generation unit 203 supplies the connection control signal /FSEi in response to the read control signal /FSEB\_RD and a write control signal /FSEB\_WR. The write control signal /FSEB\_WR supplied by the write control unit 205, is activated for an interval corresponding to a burst length of data input in a write mode. Thus, the connection control signal /FSEi is activated in response to the read control signal /FSEB\_RD in the read mode, and also activated in response to the write control signal /FSEB\_WR in the write mode. The control signal generation unit 203 will be described in detail, with reference to FIG. 4.

The write control unit 205 receives burst signals BL2, BL4 and BL8 and first and second write command signals PWA and PWR, and generates a write control signal /FSEB\_WR and a counter control signal PFSE. Here, the burst signals BL2, BL4 and BL8 include information on burst lengths of data in a write mode. The first write command signal PWA is a pulse indicating that a memory module enters into a write mode, in response to a write command. The second write command signal PWR indicates that a memory module is in a write mode.

The write control signal /FSEB\_WR which is activated for an interval corresponding to the data burst length in which data is input in the write mode, is supplied to the control signal generation unit 203. Also, the counter control signal PFSE which is supplied to the burst counter 207, is activated in response to an inverted clock signal CLKBT which is firstly generated after generating the write command signal, and deactivated after receiving a predetermined number of data. The inverted clock signal CLKBT is an inverted signal of an external clock signal CLK (not shown). The write control unit 205 will be described in detail with reference to FIG. 11.

The burst counter 207 is enabled in response to the activation of the counter control signal PFSE. The burst counter 207 receives a first write command signal PWA and a data strobe signal PDS, and counts the number of input data. Also, a counting signal FSECNTi (where, i=0 to 2) indicating the number of input data is supplied to the write control unit 205. The data strobe signal PDS indicating an input of data, is formed by an external data strobe signal of a memory module. The data strobe signal PDS indicates an input or output of one of the data by one transition in a double data rate (DDR). The memory module system of the present invention will be described in the DDR mode. The number of input data can be indicated by a combination of the counting signals FSECNTi, where i=0 to 2. The burst counter 207 will be described in detail with reference to FIG. 8.

A control signal generation circuit which generates the connection control signal /FSEi can be realized with the read control unit 201 and the control signal generation unit 203 of FIG. 2 in a read mode. A write information generation unit



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209 for activating the write control signal /FSEB\_WR for an interval corresponding to the burst length of data input may be realized in a write mode with the write control unit 205 and the burst counter 207. Thus, the control signal generation circuit for generating the connection control signal /FSEi may be realized in the write mode with the write information generation unit 209 and the control signal generation unit 203 of FIG. 2.

FIG. 3 is a circuit diagram of a preferred embodiment of the read control unit 201 in FIG. 2. Referring to FIG. 3, the read control unit 201 includes a first latency response unit 301, a second latency response unit 303, a first transfer unit 309, a first latch unit 307, a second transfer unit 305 and a second latch unit 311.

The first latency response unit 301 is enabled in response to a CAS latency shorter than a predetermined latency. According to a preferred embodiment of the present invention, the first latency response unit 301 is enabled, when the CAS latency is 1.5. The first latency response unit 301 includes a logic gate 301a and a drive transistor 301b. The logic gate 301a is enabled by activation of CL1.5 indicating the CAS latency of 1.5, and responds to a read command signal PCR. The read command signal PCR is activated in response to a first clock signal from generation of a read command, and, is maintained in the activated state during a period of one clock. The drive transistor 301b is gated by an output signal 301n of the logic gate 301a. Thus, the transistor 301b outputs an output signal to the first latch unit 307 in response to activation of the read command signal PCR. Preferably, the logic gate 301a is a NAND gate, and the transistor 301b is a PMOS transistor.

When the CAS latency is two or more, the second latency response unit 303 is enabled. An output signal N304 of the second latency response unit 303 maintains a logic "high" state by activation of a read strobe signal PTRSTDSB. The second latency response unit 303 includes logic gates 303a and 303b. The logic gate 303a is enabled by activation of CL2 indicating the CAS latency of 2, and responds to the read command signal PCR. Also, the logic gate 303b is enabled by the output signal 303n of the logic gate 303a, and responds to the read strobe signal PTRSTDSB. Preferably, the logic gates 303a and 303b are NAND gates. The second transfer unit 305 transfers the output signal N304 of the second latency response unit 303 in response to a first clock signal CLK\_SM.

The first latch unit 307 latches either the output signal of the first latency response unit 301 or the output signal N304 of the second latency response unit 303 transferred by the second transfer unit 305. The first transfer unit 309 transfers signals latched by the first latch unit 307 in response to a second clock signal CLK\_FM. The second latch unit 311 latches a signal N306 transferred by the first transfer unit 309, and outputs the latched signal as a read control signal /FSEB\_RD.

Here, the first and the second clock signals CLK\_SM and CLK\_FM are pulse signals generated in response to rising and falling transitions of the external clock signal CLK. The first and the second clock signals CLK\_SM and CLK\_FM which control data output timing, have timing with respect to the external clock signal CLK as shown in FIGS. 5 through 7.

FIG. 4 is a circuit diagram illustrating a preferred embodiment of the control signal generation unit 203 of FIG. 2. Referring to FIG. 4, the control signal generation unit 203 includes a NAND gate 401, a PMOS transistor 403 and an NMOS transistor 405. The NAND gate 401 receives an

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inverted signal of the read control signal /FSEB\_RD, an inverted signal of the write control signal /FSEB\_WR and the first write command signal PWA. That is, the NAND gate 401 is enabled by the first write command signal PWA, and acts as a logic gate responding to the read control signal /FSEB\_RD or the write control signal /FSEB\_WR.

The NMOS transistor 405 is gated by an output signal of the NAND gate 401. Thus, the NMOS transistor 405 acts for driving connection control signal in response to the read control signal /FSEB\_RD or the write control signal /FSEB\_WR.

The PMOS transistor 403 has source and gate terminals which are in common connected. A drain terminal of the PMOS transistor 403 and a drain terminal of the NMOS transistor 405 are in common connected to generate the connection control signal /FSEi.

In a precharge state, the read control signal /FSEB\_RD and the write control signal /FSEB\_WR are both logic "high" and the first write command signal PWA is logic low. Thus, the output signal of the NAND gate 401 becomes low and the NMOS transistor 405 is turned off. The connection control signal /FSEi becomes logic "high" in response to an external power supply voltage VDD applied through a resistor outside a memory module.

An embodiment of a control signal generation circuit for generating a connection control signal can be realized with the read control unit 201 in FIG. 3 and the control signal generation unit 203 in FIG. 4 in a read mode.

FIGS. 5 through 7 are timing diagrams of control signals and data signals in FIGS. 3 and 4 in a read mode in which CAS latencies are 1.5, 2, and 2.5, respectively. Assuming that a data burst length is 4, and the memory modules operate in a DDR mode, the operation of the read control unit 201 when the CAS latency is 1.5, will FIG. 5 be described with reference to FIGS. 3, 4 and 5.

Referring to FIG. 5, a logic state of the CAS latency signal CL1.5 is high, and a logic state of the CAS latency signal CL2 is low. Activation of /READ signal to low state indicates a generation of a read command. The read command signal PCR is activated for one clock period in response to a rising edge of the first clock pulse CLK1 after the generation of the read command. Thus, the output signal N306 of the first latency response unit 301 becomes logic "high" in response to the read command signal PCR, and is latched to high by the first latch unit 307. That is, when the read command is generated, the output signal N306 of the first latency response unit 301 is latched to high by the first latch unit 307, regardless of a level of the clock signal.

The read strobe signal PTRSTDSB is activated to logic "low" in response to activation of the read command signal, and is activated to logic "high" after a period of time corresponding to the data burst length. The output signal N304 of the second latency response unit 303 is transferred to the first latch unit 307 by the second transfer unit 305 turned on in response to the first clock signal CLK\_SM. Thus, when the read strobe signal PTRSTDSB is activated to logic "low", the input signal at the terminal N306 of the first latch unit 307 is maintained at logic "high" even when the read command signal PCR is deactivated to logic "low".

Data latched by the first latch unit 307 is transferred to the second latch unit 311 by the first transfer unit 309 turned on in response to the second clock signal CLK\_FM. The output signal of the second latch unit 311 is connected to an output terminal of the read control signal /FSEB\_RD. Thus, the read control signal /FSEB\_RD is activated to logic "low" in response to the generation of the read command, and then

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deactivated to high in a period of time corresponding to the burst length. That is, a time period of the activation of the read control signal /FSEB\_RD corresponds to that of the burst length.

In a read mode, the first write command signal PWA is maintained at logic "low", and the write control signal /FSEB\_WR is maintained at logic "high". Thus, in the read mode, activation of the connection control signal /FSEi depends on activation of the read control signal /FSEB\_RD.

In a preferred embodiment of the present invention, when the CAS latency is 1.5, the input signal N306 of the first latch unit 307 is activated regardless of the clock signal, and the activation is maintained by the read strobe signal PTRSTDSB. When the read control signal /FSEB\_RD is activated in response to the first clock signal CLK\_SM, the connection control signal /FSEi is not activated until a first data burst is read, despite of the CAS latency of 1.5.

The operation of the read control unit 201 with the CAS latency of 2 will now be described, with reference to FIGS. 3, 4 and 6. A logic state of the CAS latency signal CL2 is high, and a logic state of the CAS latency signal CL1.5 is low. Thus, the output signal N306 of the first latency response unit 301 does not respond to the read command signal PCR.

The output signal N304 of the second latency response unit 303 is activated to high in response to an activation of the read command signal PCR, and is transferred to the first latency unit 307 in response to an activation of the first clock signal CLK\_SM. The logic state of the input signal N306 of the first latch unit 307 is maintained at high in response to activations of both the read strobe signal PTRSTDSB and the first clock signal CLK\_SM.

Thus, the read control signal /FSEB\_RD, similar to the case of the CAS latency of 1.5, is activated to low in response to a generation of the read command, and deactivated to high after a period corresponding to the burst length. That is, the read control signal /FSEB\_RD is activated for an interval corresponding to the burst length.

The operation of the read control unit 201 when the CAS latency is 2 or more, i.e., the logic states of the CAS latency signals CL1.5 and CL2 are low, will now be described with reference to FIGS. 3, 4 and 7. The output signal N304 of the second latency response unit 303 becomes high after the read strobe signal PTRSTDSB is activated to low. The output signal N304 of the second latency response unit 303 is transferred to the first latch unit 307 in response to activation of the first clock signal CLK\_SM. When the read strobe signal PTRSTDSB is deactivated to high, the input signal N306 of the first latch unit 307 becomes low. Thus, the read control signal /FSEB\_RD is activated or deactivated by the read strobe signal PTRSTDSB, unlike the case in which the CAS latency is 1.5 or 2.

As described above, the control signal generation circuit according to a preferred embodiment of the present invention generates a connection control signal activated in response to the data burst length in which data is read from a memory module in a read mode. Also, only the memory module selected by the connection control signal is connected to a data line during the data burst length in which data is output.

FIG. 8 is a circuit diagram illustrating an embodiment of the burst counter 207 of FIG. 2. In FIG. 8, a burst counter capable of counting eight data bursts is shown. The burst counter 207 shown in FIG. 8 includes one preliminary counter 807 and two main counters 803 and 805. The preliminary counter 807 and the main counters 803 and 805

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are reset by activation of a counter control signal PFSE. That is, when a write command is generated so that the counter control signal PFSE is activated to high, the preliminary counter 807 and the main counters 803 and 805 are reset. Output signals of the preliminary counter 807 and the main counters 803 and 805, i.e., first through third counting signals FSECNT0~2 are reset to low.

As described above, a data strobe signal PDS indicates inputs of external data during rising and falling transitions in a DDR mode. Structure and operation of the burst counter 207 in a DDR mode will now be described.

In an embodiment of the present invention, data is input during rising and falling edges of the data strobe signal PDS, and the data is continuously input when a phase transition of the data strobe signal PDS is repeated. The first counting signal FSECNT0 performs the phase transition at every falling edge of the input data strobe signal. Also, when carries CARRYBs of the main counters 803 and 805 are activated to low, the second and the third counting signals FSECNT1~2 repeat the phase transition every two inputs of data.

Referring to FIG. 8, the carry CARRYB of the main counter 805 is activated to low, when the first counting signal FSECNT0 is activated to high. The carry CARRYB of the main counter 803 is activated to low, when the first and the second counting signals FSECNT0~1 are high.

The preliminary counter 807 and the main counters 803 and 805 of FIG. 8 will now be described with reference to FIGS. 9 and 10, respectively. FIG. 9 is a detailed circuit diagram illustrating an embodiment of the preliminary counter 807 of FIG. 8. Referring to FIG. 9, the preliminary counter 807 includes first and second transfer units 901 and 905, first and second latch units 903 and 907, and a NOR gate 909. The NOR gate 909 performs an OR operation on a reset signal FSESET and an inverted signal PDSB of the data strobe signal PDS and inverts the OR-operated signals. The reset signal FSESET is connected to the counter control signal PFSE. Thus, when the reset signal FSESET is disabled to low, the preliminary counter 807 is enabled to respond to the phase transition of the inverted signal PDSB. That is, when a phase of the inverted signal PDSB is transitioned from high to low, the first transfer unit 901 is turned on. When the phase of the inverted signal PDSB is transitioned from low to high, the second transfer unit 905 is turned on. Whenever the inverted signal PDSB is deactivated, the first counting signal FSECNT0 repeats the phase transition.

FIG. 10 is a detailed circuit diagram illustrating an embodiment of the main counters 803 and 805 of FIG. 8. The main counters 803 and 805 may have the same structure as shown in FIG. 10. For convenience, output signals of the main counters 803 and 805, i.e., second and third counting signals FSECNT1~2, are indicated by a counting signal FSECNTi.

A main counter has a structure and operation similar to those of the preliminary counter 807 of FIG. 9. However, a NOR gate 1009 with three input terminals is used, to which a reset signal FSESET, an inverted signal PDSB and a carry CARRYB are provided. Thus, when the reset signal FSESET and the carry CARRYB are low, the main counter is enabled in response to a phase transition of the inverted signal PDSB. That is, when the reset signal FSESET and the carry CARRYB are low, the counting signal FSECNTi repeats the phase transition whenever the inverted signal PDSB is deactivated.

FIG. 11 is a detailed circuit diagram illustrating an embodiment of the write control unit 205 of FIG. 2. Refer-

ring to FIG. 11, the write control unit 205 includes a counting response unit 1101, a latch unit 1103 and a counter control signal generation unit 1105. The counting response unit 1101 indicates a data burst of input data. That is, a phase of an output signal N1102 is transited when a predetermined number of data is input.

When the first write command signal PWA is activated to high, the latch unit 1103 is enabled to respond to the output signal N1102 of the counting response unit 1101. When the second write command signal PWR becomes high, an output signal N1104 of the latch unit 1103 is latched to high. At this time, a write control signal /FSEB\_WR connected to an output terminal inverting the output signal N1104 of the latch unit 1103 is activated to low. When the first write command signal PWA becomes low, the output signal N1104 of the latch unit 1103 is maintained at high. When the second write command signal PWR is high and the predetermined number of data is input so that the output signal N1102 of the counting response unit 1101 is transited to low, the output signal N1104 of the latch unit 1103 becomes low, and the write control signal /FSEB\_WR is deactivated to high.

The counter control signal generation unit 1105 includes first and second transfer units 1105a and 1105b and first and second latches 1105c and 1105d. The first transfer unit 1105a transfers the output signal N1104 of the latch unit 1103 in response to a falling edge of an inverted clock signal CLKBT. The first latch unit 1105c latches a signal transferred by the first transfer unit 1105a. The second transfer unit 1105b transfers an output signal of the first latch 1105c in response to a rising edge of the inverted clock signal CLKBT. Also, the second latch 1105d latches a signal transferred by the second transfer unit 1105b, and generates a counter control signal PFSE. Here, the inverted clock signal CLKBT is an inverted signal of an external clock signal CLK.

FIG. 12 is a timing diagram of signals related to the burst counter illustrated in FIGS. 2 and 8 through 11 in a write mode. FIG. 12 shows a case of a data burst of 8 in a DDR mode. Operation of the write control unit 205, the burst counter 207, the preliminary counter 807 and the main counters 803 and 805 of the burst counter 207 will be described with reference to FIG. 12.

The data burst is 8, that is, burst signal BL8 is high and burst signals BL2 and BL4 are low. The DDR mode indicates that data is input in every phase transition of the data strobe signal PDS. When the first write command signal PWA becomes high (t1), the output signal N104 of the latch unit 1103 is latched to high, and the write control signal /FSEB\_WR is activated to low. When the second write command signal PWR is activated to high and activation and deactivation of the data strobe signal PDS are performed four times, i.e., 8 data are input, both the first and second counting signals FSECNT0~1 become low and the third counting signal FSECNT2 becomes high. At this time, the phase of the output signal N1102 of the counting response unit 1101 is transited to low from high, and the output signal N1104 of the latch unit 1103 becomes low. The write control signal /FSEB\_WR is deactivated to high. The counter control signal PFSE is deactivated to low in response to a rising edge of the inverted clock signal CLKBT. The preliminary counter 807 and the main counters 803 and 805 are reset, so that the first through third counting signals FSECNT0~2 become low.

Referring to FIG. 4 again, a connection control signal /FSEi is activated and deactivated in response to the write control signal /FSEB\_WR in a write mode. During the write mode the read control signal /FSEB\_RD is deactivated to high.

FIG. 13 is a timing diagram of external signals of memory modules when reading data in a DDR mode in a system of the present invention. Referring to FIG. 13, the CAS latency is 2, and the burst length is 4. When a predetermined preamble interval, i.e., 1 clock cycle, passes after a read command is input, i.e., a signal /READ is activated, an external data strobe signal /DS is activated to low. The connection control signal /FSEi is also enabled to low, so that switching units 121, 122 and 123 (see FIG. 1) connected to the activated memory modules are turned on. First, data are output from the memory modules, and then the output data are transferred to the data line 131 (see FIG. 1). When a postamble interval, i.e., a half clock, passes after the last data of a data burst is output, the external data strobe signal /DS becomes high impedance state. At this time, the connection control signal /FSEi of low is disabled to high, to thereby turn off the switching units 121, 122 and 123.

FIG. 14 is a timing diagram of external signals of memory modules in a write mode of a DDR mode in a system of the present invention. In FIG. 14, the burst length is 4. In a ¼ clock cycle after a write command is input, i.e., a signal /WRITE is activated, the connection control signal /FSEi is enabled to low. Activated memory modules receive data corresponding to the burst length from a control unit (not shown) through the data bus line 131 (see FIG. 1). When data holding time passes after last data is received, the connection control signal /FSEi of low is disabled to high to turn off the corresponding switching units 121, 122 and 123.

As described above, a control signal generation circuit according to a preferred embodiment of the present invention generates a connection control signal activated during an interval corresponding to the burst length in which data is written in a write mode. Only the memory module selected by the connection control signal is connected to a data line during the data burst length in which data is input.

FIG. 15 is a block diagram illustrating a second embodiment of the memory module system according to the present invention. Structure and operation of the memory module system according to the second embodiment are similar to those of the first embodiment. Switching units 1511b, 1512b and 1513b corresponding to the switching units 121, 122 and 123 of FIG. 1 are installed in memory modules 1511, 1512 and 1513, respectively.

As shown in FIG. 15, a multiplicity of SDRAMs (synchronous DRAMs) are installed in each of the memory modules. Also, a multiplicity of switching units each corresponding to each of the SDRAMs are installed in each of the memory modules. Connection control signals /FSE11, /FSE21 and /FSE31 controlling the switching units are generated by the SDRAMs included in the memory modules. For convenience, the connection control signals /FSE11, /FSE21 and /FSE31 are shown for controlling the switching units 1511b, 1512b and 1513b, respectively, each of which connects with a first SDRAM in a memory module. In FIG. 15, although not shown, switching units connected to other SDRAMs exist, and connection control signals for controlling the switching units are generated from the corresponding SDRAMs. A switching unit may preferably have as many switches as output terminals for outputting data from an SDRAM corresponding to the switching unit. The data output through the multiple switches are transferred to a data bus line 1531. Structure and operation of control signal generation circuits 1511a, 1512a and 1513a of the second embodiment in FIG. 15 are the same as those of the control signal generation circuits 111a, 112a and 113a of the first embodiment in FIGS. 2 through 14.

Having described preferred embodiments of a memory module system of the present invention, it is noted that

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modification and variations can be made by persons skilled in the art in light of the above teachings. For example, the switches which are arranged outside the SDRAM may be arranged in the SDRAM. Also, other integrated memory circuit devices such as DRAMs or SRAMs may be used instead of SDRAMs. In a DDR mode, the counter circuit of the first embodiment of the present invention counts eight data by using one preliminary counter and two main counters. However, the number of main counters may be increased to increase the number of counted data.

Also, in a memory module system of the present invention, only selected memory modules are connected to a data line during a time period of data burst length in which data is input and output, so that load per data pin is minimized and data writing and reading speed is improved.

What is claimed is:

1. A memory module system for controlling data output to a data bus, the system comprising:

- a multiplicity of memory modules each of which includes a control signal generation circuit for generating a connection control signal having a width of activation corresponding to a burst length of output data, wherein the control signal generation circuit has a read control unit for activating input data during output of data of a predetermined burst length in a read mode to generate a read control signal, the read control unit receiving CAS latency information, a read command signal and burst length information of read data; and
- a multiplicity of switching units for electrically connecting output terminals of the memory modules to the data bus in response to activation of the connection control signal;

wherein the read control unit comprises:

- a first latency response unit for being enabled in a first CAS latency;
- a second latency response unit for being enabled in a second CAS latency;
- a first latch unit for latching one of an output signal of the first latency response unit and an output signal of the second latency response unit; and
- a first transfer unit for transferring a latched signal by the first latch unit to generate the read control signal in response to a first internal clock signal that is synchronized with a first external clock signal.

2. The memory module system of claim 1, wherein the first CAS latency is 1.5, and the second CAS latency is 2.

3. The memory module system of claim 2, wherein the connection control signal is activated in response to activation of a read strobe signal including the burst length information in case of a third CAS latency that is greater than the first and the second CAS latencies.

4. The memory module system of claim 1, wherein the first latency response unit comprises:

- a logic gate responding to activation of the first CAS latency and a read command signal; and
- a drive transistor for driving an output signal to the first latch unit in response to an output signal of the logic gate.

5. The memory module system of claim 1, wherein the second latency response unit comprises a logic gate responding to a predetermined read strobe signal which is activated during a period corresponding to the burst length of data.

6. The memory module system of claim 1, wherein the memory modules are synchronized with a second external clock signal, and the read control unit further comprises:

- a second transfer unit for transferring the output signal of the second latency response unit in response to a

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second internal clock signal synchronized with the second external clock signal; and

a second latch unit for latching a signal transferred by the first transfer unit to generate the read control signal.

7. The memory module system of claim 1, wherein the connection control signal is activated by a read strobe signal including the first CAS latency and the burst length information.

8. The memory module system of claim 1, wherein the control signal generation circuit further comprising a control signal generation unit for generating the connection control signal in response to activation of the read control signal output from the read control unit.

9. The memory module system of claim 8, wherein the control signal generation unit comprises:

- a logic gate responding to the read control signal; and
- a drive transistor for activating the connection control signal in accordance with the activation of the read control signal, the drive transistor being gated by an output signal of the logic gate.

10. A memory module system for controlling data output to a data bus, comprising:

- a multiplicity of memory modules; and
- a multiplicity of switching units for electrically connecting only memory module outputting data to the data bus in response to activation of a connection control signal, wherein the connection control signal is generated in the memory module outputting data and has a width of activation corresponding to a burst length of the output data;

wherein the connection control signal, with respect to a first and a second CAS latencies, is activated in response to a CAS latency and a read command signal, and the activation is maintained by a read strobe signal including the burst length information, and the connection control signal, with respect to a third CAS latency longer than the first and the second CAS latencies, is activated in response to activation of the read strobe signal.

11. A memory module system for controlling data input from a data bus, comprising:

- a multiplicity of memory modules each of which includes a control signal generation circuit for generating a connection control signal having an activation width corresponding to a burst length of input data, wherein the control signal generation circuit includes a write information generation unit for receiving a write command signal and burst length information of write data, the write information generation unit being activated in a write mode during inputting data of a predetermined burst length to generate a write control signal; and
- a multiplicity of switches for electrically connecting input terminals of the memory modules to the data bus in response to activation of the connection control signal;

wherein the write information generation unit comprises: a write control unit for receiving the write command signal and for supplying the write control signal and a counter control signal; and

a burst counter for counting the number of external input data to supply the counted data to the write control unit, wherein the burst counter is enabled in response to activation of the counter control signal;

wherein the write control unit comprises:

- a counting response unit for generating an output signal in response to input of data of a predetermined burst length in response to an output signal of the burst counter;

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a latch unit for being enabled in response to the write command signal, for latching the output signal of the counting response unit, and for supplying the write control signal; and

a counting control signal generation unit for being enabled in response to the write command signal and for inputting the write control signal to supply the counter control signal.

12. The memory module system of claim 11, wherein the memory modules are synchronized with an external clock signal, and the latch unit comprises:

a first logic gate for being enabled by a first write command signal to generate the write control signal; and

a second logic gate for being enabled by a second write command signal and for responding to an output signal of the counting response unit;

wherein the data of the burst length is input, and then the write control signal is deactivated by the output signal of the counting response unit.

13. The memory module system of claim 11, wherein the counting control signal generation unit comprises:

a first transfer unit for transferring an output signal of the latch unit in response to a first transition of the external clock signal;

a first latch for latching a signal transferred by the first transfer unit;

a second transfer unit for transferring the signal latched by the first latch in response to a second transition of the external clock signal; and

a second latch for latching the signal transferred by the first transfer unit to generate the counter control signal; wherein a direction of the first transition is opposite to that of the second transition.

14. The memory module system of claim 11, wherein the control signal generation circuit further comprises a control signal generation unit for being activated in response to the write command signal, and the activation is maintained by the write control signal.

15. The memory module system of claim 14, wherein the control signal generation unit comprises:

a logic gate responding to the write information signal; and

a drive transistor for activating the connection control signal in response to the activation of the write control signal, the drive transistor being gated by an output signal of the logic gate.

16. A semiconductor memory device comprising:

a multiplicity of integrated memory circuit devices including a control signal generation circuit for generating a connection control signal having an activation width corresponding to a burst length of output data, wherein the control signal generation circuit comprises a read control unit for activating input data during output of data of a predetermined burst length in a read mode to generate a read control signal, the read control unit receiving CAS latency information, a read command signal and burst length information of data to be read; and

at least one switching unit for connecting output terminals of the integrated memory circuit devices where data is output and a data bus in response to activation of the connection control signal;

wherein the read control unit comprises:

a first latency response unit for being enabled in a first CAS latency;

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a second latency response unit for being enabled in a second CAS latency;

a first latch unit for latching one of an output signal of the first latency response unit and an output signal of the second latency response unit; and

a first transfer unit for transferring a latched signal by the first latch unit to generate the read control signal in response to a first internal clock signal that is synchronized with a first external clock signal.

17. The semiconductor memory device of claim 16, wherein the first CAS latency is 1.5, and the second CAS latency is 2.

18. The semiconductor memory device of claim 16, wherein the first latency response unit comprises:

a logic gate responding to the activation of the first CAS latency and a predetermined read command signal; and

a drive transistor for driving an output signal to the first latch unit in response to an output signal of the logic gate.

19. The semiconductor memory device of claim 16, wherein the second latency response unit comprises a logic gate responding to a predetermined read strobe signal, wherein activation of the read strobe signal is maintained during a period corresponding to a burst length of minimum data.

20. The semiconductor memory device of claim 16, wherein the semiconductor memory device is synchronized with a second external clock signal, and the read control further comprises:

a second transfer unit for transferring the output signal of the second latency response unit to the first latch unit in response to a second internal clock signal synchronized with the second external clock signal; and

a second latch unit for latching a signal transferred by the first transfer unit to generate the read control signal.

21. The semiconductor memory device of claim 16, wherein activation of the read control signal is maintained by a read strobe signal including the first CAS latency and the burst length information.

22. The semiconductor memory device of claim 21, wherein the read control signal, with respect to a third CAS latency longer than the first and the second CAS latencies, is activated in response to activation of the read strobe signal including the burst length information.

23. A semiconductor memory device comprising:

a multiplicity of the integrated memory circuits including at least one control signal generation circuit for generating a connection control signal having an activation width corresponding to a burst length of input data, wherein the control signal generation circuit includes a write information generation unit for receiving burst length information of write command and write data, the control signal generation circuit being activated during input of data of a predetermined burst length in a write mode to generate a write control signal; and

at least one switching unit for connecting input terminals of the integrated memory circuits where data is input and a data bus in response to activation of the connection control signal;

wherein the write information generation unit comprises:

a write control unit for receiving the write command signal to supply the write control signal and a counter control signal; and

a burst counter for counting the number of external input data to supply the counted data to the write control unit, wherein the burst counter is enabled in response to activation of the counter control signal;

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wherein the write control unit comprises:

- a counting response unit for generating an output signal responding to input of data having a predetermined burst length in response to an output signal of the burst counter;
- a latch unit for being enabled in response to the write command signal to latch the output signal of the counting response unit, and for supplying the write control signal; and
- a counting control signal generation unit for being enabled in response to the write command signal and for inputting the write control signal to supply the counter control signal.

**24.** The semiconductor memory device of claim **23**, wherein the semiconductor memory device is synchronized with an external clock signal, and the latch unit comprises:

- a first logic gate for being enabled by a first write command signal to generate the write control signal; and
- a second logic gate for being enabled by a second write command signal to respond to an output signal of the counting response unit;

wherein the write control signal is deactivated by the output signal of the counting response unit after input of data having a predetermined burst length.

**25.** The semiconductor memory device of claim **23**, wherein the counting control signal generation unit comprises:

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a first transfer unit for transferring an output signal of the latch unit in response to a first transition of the external clock signal;

a first latch for latching a signal transferred by the first transfer unit;

a second transfer unit for transferring a signal latched by the first latch in response to a second transition of the external clock signal; and

a second latch for latching a signal transferred by the first transfer unit, to generate the counter control signal; wherein a direction of the first transition is opposite to that of the second transition.

**26.** The semiconductor memory device of claim **23**, wherein the control signal generation circuit further comprises a control signal generation unit for generating the connection control signal activated in response to the write command signal and for maintaining the activation in accordance with the write control signal.

**27.** The semiconductor memory device of claim **26**, wherein the control signal generation unit comprises:

a logic gate responding to the write information signal; and

a drive transistor for activating the connection control signal in accordance with activation of the write control signal, the drive transistor being gated by an output signal by the logic gate.

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| Electronic Acknowledgement Receipt   |                                         |
|--------------------------------------|-----------------------------------------|
| EFS ID:                              | 18832310                                |
| Application Number:                  | 13971231                                |
| International Application Number:    |                                         |
| Confirmation Number:                 | 2072                                    |
| Title of Invention:                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                     |
| Customer Number:                     | 79141                                   |
| Filer:                               | Jamie Jie Zheng                         |
| Filer Authorized By:                 |                                         |
| Attorney Docket Number:              | NETL.018P2C7                            |
| Receipt Date:                        | 22-APR-2014                             |
| Filing Date:                         | 20-AUG-2013                             |
| Time Stamp:                          | 20:39:04                                |
| Application Type:                    | Utility under 35 USC 111(a)             |

**Payment information:**

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

**File Listing:**

| Document Number | Document Description | File Name                            | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|--------------------------------------|---------------------------------------------------|------------------|------------------|
| 1               | Transmittal Letter   | 2014-04-22_IDS_Cover_NETL018P2C7.pdf | 58274<br>69dc86a78547a0d577ae92c57302778c1ef8210d | no               | 2                |

**Warnings:**

**Information:**

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| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Information Disclosure Statement (IDS) Form (SB08) | 2014-04-22_IDS_NETL018P2C7.pdf         | 93754<br>1dbbda6f5e7c888e7d3d2f9a22cd50c76ad53f9    | no | 1  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |                                        |                                                     |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |                                        |                                                     |    |    |
| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                    |                                        |                                                     |    |    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Non Patent Literature                              | 4_1998-10-04_JP10-092169_A.pdf         | 401788<br>be7f040f479b2883e24237de412322657033e4f   | no | 8  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |                                        |                                                     |    |    |
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| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Non Patent Literature                              | 5_JP2000311485.pdf                     | 1419060<br>724c6967dfd9e530d631995c0a61eebc313563ea | no | 24 |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |                                        |                                                     |    |    |
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| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Non Patent Literature                              | 6_2014-04-17_Office_Action_NT001JP.pdf | 215909<br>58be10b16ae80bc1f78bfdfbfabb14a44a1bc3c   | no | 7  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                    |                                        |                                                     |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |                                        |                                                     |    |    |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                    |                                        | 2188785                                             |    |    |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                    |                                        |                                                     |    |    |



INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : BHAKTA et al.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : Unknown                                    |
| Art Unit  | : 2189                                       |
| Conf No.  | : 2072                                       |

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application is a Form PTO/SB/08a/b Equivalent listing 6 references. Copies of foreign documents and/or their translation and non-patent literature are submitted herewith.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

This Information Disclosure Statement is being filed before the receipt of a first Office Action on the merits, and presumably no fee is required. If a first Office Action on the merits

Application No.: 13/971,231  
Filing Date: August 20, 2013

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was mailed before the mailing date of this Statement, the Commissioner is authorized to charge the fee set forth in 37 C.F.R. § 1.17(p) to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: April 22, 2014

/Jamie J. Zheng/

51167

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Jamie J. Zheng  
Customer No. 79141  
(650) 273-6008

(Reg. No.)



# UNITED STATES PATENT AND TRADEMARK OFFICE

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| APPLICATION NO.                                                                   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------------------------------------------------------------------------|-------------|----------------------|---------------------|------------------|
| 13/971,231                                                                        | 08/20/2013  | Jefferey C. Solomon  | NETL018P2C7         | 2072             |
| 79141                                                                             | 7590        | 05/20/2014           |                     |                  |
| The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306 |             |                      | EXAMINER            |                  |
|                                                                                   |             |                      | BANSAL, GURTEJ      |                  |
|                                                                                   |             |                      | ART UNIT            | PAPER NUMBER     |
|                                                                                   |             |                      | 2189                |                  |
|                                                                                   |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                                                                                   |             |                      | 05/20/2014          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jz@jzpatent.com

|                              |                                      |                                       |                                                  |
|------------------------------|--------------------------------------|---------------------------------------|--------------------------------------------------|
| <b>Office Action Summary</b> | <b>Application No.</b><br>13/971,231 | <b>Applicant(s)</b><br>SOLOMON ET AL. |                                                  |
|                              | <b>Examiner</b><br>GURTEJ BANSAL     | <b>Art Unit</b><br>2189               | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08/20/2013.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims\***

- 5) ☒ Claim(s) 1-10 is/are pending in the application.  
5a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 6) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 7) ☒ Claim(s) 1-10 is/are rejected.
- 8) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 9) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

\* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

**Application Papers**

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 08/20/2013 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

- a) ☐ All    b) ☐ Some\*\*    c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)  
Paper No(s)/Mail Date 04/07/2014; 04/07/2014; 04/07/2014; 04/08/2014; 04/22/2014.
- 3) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- 4) ☐ Other: \_\_\_\_.

## **DETAILED ACTION**

### ***Remarks***

The present application is being examined under the pre-AIA first to invent provisions.

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the claims at issue are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the reference application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of

activities undertaken within the scope of a joint research agreement. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO internet Web site contains terminal disclaimer forms which may be used. Please visit <http://www.uspto.gov/forms/>. The filing date of the application will determine what form should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to <http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp>.

1. Claims 1-10 are provisionally rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 6 and 8 of copending Application No. 13/287,042. Although the claims at issue are not identical, they are not patentably distinct from each other because claims 1, 6 and 8 of 13/287,042 anticipate the claims of present application.

"A later patent claim is not patentably distinct from an earlier patent claim if the later claim is obvious over, or anticipated by, the earlier claim. In re Longi, 759 F.2d at 896,225 USPQ at 651 (affirming a holding of obviousness-type double patenting because the claims at issue were obvious over claims in four prior art patents); In re Berq, 140 F.3d at 1437, 46 USPQ2d at 1233 (Fed. Cir. 1998) (affirming a holding of obviousness-type double patenting where a patent application claim to a genus is anticipated by a patent claim to a species within that genus). " ELI LILLY AND COMPANY v BARR LABORATORIES, INC., United States Court of Appeals for the

Art Unit: 2189

Federal Circuit, ON PETITION FOR REHEARING EN BANC (DECIDED: May 30, 2001).

This is a provisional nonstatutory double patenting rejection because the patentably indistinct claims have not in fact been patented.

***Claim Rejections - 35 USC § 103***

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-10 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lai (US 2003/0070052), in view of Janzen (US 2004/0098528).

As per claims 1 and 10, Lai teaches a circuit for use on a memory module, the memory module including a plurality of memory devices and operable in a computer system to perform memory operations in response to memory commands from a memory controller, the circuit comprising:

Lai teaches logic (fig. 3, 108) to monitor the memory commands from the memory controller ([0012], describes a memory controller reading and writing) and to selectively isolate one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with

the memory controller in response to the set of output signals (As illustrated in fig. 3 with each memory device being isolated from the common set of DQ and DQS lines; [0035]).

Lai does not explicitly teach a register device to receive a set of control/address input signals associated with a respective memory command from the memory controller and to generate a set of control/address output signals in response to the set of control/address input signals, the set of control/address output signals being provided to the plurality of memory devices.

However, Janzen teaches a register device to receive a set of control/address input signals associated with a respective memory command from the memory controller (As illustrated in fig. 2 and described in [0025], lines 1-6) and to generate a set of control/address output signals in response to the set of control/address input signals, the set of control/address output signals being provided to the plurality of memory devices ([0025], lines 1-6 describe how the signals are reclocked).

It would have been obvious to a person of ordinary skill in the art at the time of the invention to have combined the register device of Janzen with the with the circuit of Lai because it allows for heavier loads to be placed on system buses without making the address and control lines too heavily loaded ([0025]).

As per claim 2, Lai teaches wherein the circuit further comprises multiple groups of DQ-DQS paths, and wherein the logic selectively isolate one or more first memory devices by disabling at least one first group of DQ-DQS paths corresponding to the one or more first memory devices (As illustrated in fig. 2, wherein when data is sent to one, the DQ-DQS would be disabled because no data would be transmitted thereon).



As per claim 3, Lai teaches wherein the logic is further configured to enable at least one second group of DQ-DQS paths in response to the respective memory command so as to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals (As illustrated in fig. 2, wherein when data is sent to one, the DQ-DQS would be disabled because no data would be transmitted thereon).

As per claim 4, Janzen teaches wherein the logic is further configured to translate between a system memory domain and a physical memory device domain such that a number of signals in the set of output control/address signals is greater than a number of signals in the set of input control/address signals (As illustrated in fig. 2 with input signals 260 being reclocked to each of the memory modules on both DIMMS).

As per claim 5, Lai teaches wherein the set of input control/address signals include at least one chip-select signal and the set of output control/address signals include a greater number of chip-select signals (As illustrated in fig. 2, one of the signals must be used to indicate which memory module is to receive data and as illustrated in fig. 4 and fig. 5 each respective memory module has a chip-select signal).

As per claim 6, Lai teaches wherein the logic element includes a buffer circuit to electrically and selectively isolate the one or more first memory devices from the memory controller and to selectively allow one or more second memory devices to communicate data with the memory controller (As illustrated in fig. 2), the buffer circuit adding a time delay to a data signal from the one or more second memory devices to

the memory controller ([0037] describes how the buffer implements a time delay when reading data).

As per claim 7, Lai teaches wherein the logic provides functions of a data path multiplexer /demultiplexer using the time delay (As illustrated in fig. 10).

As per claim 8, Lai teaches wherein the time delay is about one clock cycle ([0037]-[0038], describes a delay of  $\frac{1}{4}$  clock cycle which is about 1 clock cycle).

As per claim 9, Lai teaches wherein the respective memory command is a read command or a write command (fig. 4 and fig. 5).

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GURTEJ BANSAL whose telephone number is (571)270-5588. The examiner can normally be reached on Monday - Friday, 7:30 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Reginald Bragdon can be reached on (571)272-4204. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

GURTEJ BANSAL  
Examiner  
Art Unit 2189

/GURTEJ BANSAL/  
Examiner, Art Unit 2189

|                                   |                                       |                                                              |             |
|-----------------------------------|---------------------------------------|--------------------------------------------------------------|-------------|
| <b>Notice of References Cited</b> | Application/Control No.<br>13/971,231 | Applicant(s)/Patent Under<br>Reexamination<br>SOLOMON ET AL. |             |
|                                   | Examiner<br>GURTEJ BANSAL             | Art Unit<br>2189                                             | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name               | Classification |
|---|---|--------------------------------------------------|-----------------|--------------------|----------------|
| * | A | US-2003/0070052                                  | 04-2003         | Lai, Jiin          | 711/167        |
| * | B | US-2004/0098528                                  | 05-2004         | Janzen, Jeffery W. | 710/305        |
|   | C | US-                                              |                 |                    |                |
|   | D | US-                                              |                 |                    |                |
|   | E | US-                                              |                 |                    |                |
|   | F | US-                                              |                 |                    |                |
|   | G | US-                                              |                 |                    |                |
|   | H | US-                                              |                 |                    |                |
|   | I | US-                                              |                 |                    |                |
|   | J | US-                                              |                 |                    |                |
|   | K | US-                                              |                 |                    |                |
|   | L | US-                                              |                 |                    |                |
|   | M | US-                                              |                 |                    |                |

**FOREIGN PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Country | Name | Classification |
|---|---|--------------------------------------------------|-----------------|---------|------|----------------|
|   | N |                                                  |                 |         |      |                |
|   | O |                                                  |                 |         |      |                |
|   | P |                                                  |                 |         |      |                |
|   | Q |                                                  |                 |         |      |                |
|   | R |                                                  |                 |         |      |                |
|   | S |                                                  |                 |         |      |                |
|   | T |                                                  |                 |         |      |                |

**NON-PATENT DOCUMENTS**

| * |   | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|-------------------------------------------------------------------------------------------|
|   | U |                                                                                           |
|   | V |                                                                                           |
|   | W |                                                                                           |
|   | X |                                                                                           |

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Receipt date: 04/22/2014

13971231 - GAU: 2189

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012. OMB 0651-0031

US Patent &amp; Trademark Office; U.S. DEPARTMENT OF COMMERCE

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 20060262586                              | 11-23-2006                       | Solomon, et al                                     |                                                                                 |
|                        | 2.                       | 20080162790                              | 07-03-2008                       | Im, Jeon-Taek                                      |                                                                                 |
|                        | 3.                       | 20090103387                              | 04-23-2009                       | Shau, Jeng-Jye                                     |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          | 4.                       | JPH10092169 A           | 9/9/97                              | Toshiba Corp.                                         |                                                                                    |                |
|                          | 5.                       | JP2000311485 A          | 10/13/00                            | Fujitsu Ltd.                                          |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*           | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 6.                       | Office Action mailed April 2, 2014, for Japanese Patent Application No. 2012-520662 and English translation thereof, 7 pages                                                                                                                                    |                |

EXAMINER

/Gurtej Bansal/ (05/11/2014)

DATE CONSIDERED

05/11/2014

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./

Receipt date: 04/07/2014

13971231 - GAU: 2189

PTO/SB/08a/b(07-09)

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 5345412                                  | 09-06-1994                       | Shiratsuchi                                        |                                                                                 |
|                        | 2                        | 5537584                                  | 07-16-1996                       | Miyai et al.                                       |                                                                                 |
|                        | 3                        | 5617559                                  | 04-01-1997                       | Le et al.                                          |                                                                                 |
|                        | 4                        | 5649159                                  | 07-15-1997                       | Le et al.                                          |                                                                                 |
|                        | 5                        | 5717851                                  | 02-10-1998                       | Yishay et al.                                      |                                                                                 |
|                        | 6                        | 5724604                                  | 03-03-1998                       | Moyer                                              |                                                                                 |
|                        | 7                        | 5729716                                  | 05-17-1998                       | Lee et al.                                         |                                                                                 |
|                        | 8                        | 5784705                                  | 07-21-1998                       | Leung, Wingyu                                      |                                                                                 |
|                        | 9                        | 5802541                                  | 09-01-1998                       | Reed                                               |                                                                                 |
|                        | 10                       | 5973392                                  | 10-26-1999                       | Senba et al.                                       |                                                                                 |
|                        | 11                       | 6173357                                  | 01-09-2011                       | Ju                                                 |                                                                                 |
|                        | 12                       | 6260127                                  | 07-10-2001                       | Olarig et al.                                      |                                                                                 |
|                        | 13                       | 6446158                                  | 09-03-2002                       | Karabatsos                                         |                                                                                 |
|                        | 14                       | 6553449                                  | 04-22-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 15                       | 6618791                                  | 09-09-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 16                       | 6717855                                  | 04-06-2004                       | Underwood                                          |                                                                                 |
|                        | 17                       | 6788592                                  | 09-07-2004                       | Nakata et al.                                      |                                                                                 |
|                        | 18                       | 6948084                                  | 09-20-2005                       | Manapat et al                                      |                                                                                 |
|                        | 19                       | 7130308                                  | 10-31-2006                       | Haddock et al.                                     |                                                                                 |
|                        | 20                       | 7133960                                  | 11-07-2006                       | Thompson et al.                                    |                                                                                 |
|                        | 21                       | 7379361                                  | 05-27-2008                       | Co et al.                                          |                                                                                 |
|                        | 22                       | 20050010737                              | 01-01-2005                       | Ware et al.                                        |                                                                                 |
|                        | 23                       | 20070293094                              | 12-01-2007                       | Aekins, Robert A.                                  |                                                                                 |

| US PATENT APPLICATIONS |                          |                                          |                             |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                             |                                                    |                                                                                 |
|                        | 24                       | 95/001,758                               | 09-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 25                       | 13/154,172                               | 06-06-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 26                       | 13/287,042                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 27                       | 13/473,413                               | 05-16-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 28                       | 13/032,470                               | 02-22-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 29                       | 13/287,081                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 30                       | 13/971,231                               | 08-20-2013                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 31                       | 13/412,243                               | 03-05-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 32                       | 13/183,253                               | 07-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 33                       | 13/745,790                               | 01-19-2013                  | Owned by Netlist, Inc.                             |                                                                                 |

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 2 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT APPLICATIONS |                       |                                                             |                             |                                                    |                                                                                 |
|------------------------|-----------------------|-------------------------------------------------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner Initials *    | Cite No. <sup>1</sup> | Document Number<br>Number-Kind Code <sup>2</sup> (if known) | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        | 34                    | 14/229,844                                                  | 3/29/2014                   | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 35                    | 12/504,131                                                  | 7/16/2009                   | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 36                    | 12/761,179                                                  | 4/15/2010                   | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 37                    | 13/970,606                                                  | 8/20/2013                   | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 38                    | 13/288,850                                                  | 11/3/2011                   | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 39                    | 13/411,344                                                  | 3/2/2012                    | Owned by Netlist, Inc.                             |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                       |                                                                                                                 |                                  |                                                    |                                                                                 |                |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|----------------|
| Examiner Initials *      | Cite No. <sup>1</sup> | Foreign Patent Document<br>Country Code <sup>3</sup> -Number <sup>4</sup> -Kind Code <sup>5</sup><br>(if known) | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines,<br>Where Relevant Passages<br>or Relevant Figures Appear | T <sup>6</sup> |
|                          | 40                    | JP2009237492                                                                                                    | 9/9/97                           | Toshiba Corp.                                      |                                                                                 |                |
|                          | 41                    | JP2000285674                                                                                                    | 10/13/00                         | Fujitsu Ltd.                                       |                                                                                 |                |
|                          | 42                    | JP2002184176                                                                                                    | 6/28/02                          | NEC Tohoku Ltd.                                    |                                                                                 |                |
|                          | 43                    | JP2003007963                                                                                                    | 1/10/03                          | Hitachi, Ltd.                                      |                                                                                 |                |
|                          | 44                    | JP2008046989                                                                                                    | 2/28/08                          | Fujitsu Ltd.                                       |                                                                                 |                |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |  |  | T <sup>2</sup> |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|----------------|
| Examiner Initials *             | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |  |  |                |
|                                 | 45                    | Anonymous. (December 1996). "Applications Note: Understanding DRAM Operation," IBM, 10 pages.                                                                                                                                                                   |  |  |                |
|                                 | 46                    | Behrens, S. "HP Printer Memory Explained", The ZonkPage, Last Updated 01-21-2004. Accessed 02-10-2013, Retrieved from the Internet: URL < <a href="http://warshaft.com/hpmem.htm">http://warshaft.com/hpmem.htm</a> >. 7pp.                                     |  |  |                |
|                                 | 47                    | Non-Final Office Action, U.S. Pat. App. 13/412,243, January 2, 2014, 20 pages                                                                                                                                                                                   |  |  |                |
|                                 | 48                    | Non-Final Office Action, U.S. Pat. App. 12/761,179, September 13, 2012, 20 pages                                                                                                                                                                                |  |  |                |
|                                 | 49                    | Non-final office action, U.S. Patent Application No. 13/288,850, October 14, 2013, 24 pages                                                                                                                                                                     |  |  |                |
|                                 | 50                    | Non-final office action, U.S. Patent Application No. 13/411,344, December 31, 2013, 28 pages                                                                                                                                                                    |  |  |                |
|                                 | 51                    | Non-final office action, U.S. Patent Application No. 13/473,413, November 17, 2011, 46 pages                                                                                                                                                                    |  |  |                |
|                                 | 52                    | Response to non-final office action dated September 13, 2012 for U.S. Patent Application No. 12/761,179, filed March 13, 2013, 16 pages                                                                                                                         |  |  |                |

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 3 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 53                    | Response to non-final office action dated October 14, 2013 for U.S. Patent Application No. 13/288,850, filed January 14, 2014, 15 pages                                                                                                                         |                |
|                                 | 54                    | Response to non-final office action dated 12/31/2013 for U.S. Patent Application No. 13/411,344, filed March 31, 2014, 12 pages                                                                                                                                 |                |
|                                 | 55                    | Patent Owner's Response to Office Action mailed November 13, 2012 for Reexamination Control Nos.95/000,578; 95/000,579, and 95/001,339, filed January 14, 2013, 96 pages.                                                                                       |                |
|                                 | 56                    | Patent Owner's Response to Office Action mailed December 19, 2012 for Reexamination Control No. 95/001,758, filed March 19, 2013, 61 pages                                                                                                                      |                |
|                                 | 57                    | Patent Owner's Response to Office Action mailed September 26, 2013 for Reexamination Control No. 95/001,758, filed November 26, 2013, 85 pages                                                                                                                  |                |
|                                 | 58                    | Third Party Requester's Comments after Non-Final Action mailed September 26, 2013 for Reexamination Control No. 95/001,758, filed December 26, 2013,                                                                                                            |                |
|                                 | 59                    | Reexamination Control No. 95/002,399, filed April 25, 2013, and its entire file history                                                                                                                                                                         |                |
|                                 | 60                    | Patent Owner's Appeal Brief for Reexamination Control Nos. 95/000,546 and 95/000,577, filed October 2, 2013, 46 pages                                                                                                                                           |                |
|                                 | 61                    | Patent Trial and Appeal Board Decision on Appeal for Reexamination Control No.95/001/337, mailed January 16, 2014, 30 pages                                                                                                                                     |                |
|                                 | 62                    | Patent Trial and Appeal Board Decision on Appeal for Reexamination Control No.95/001/381, mailed January 16, 2014, 24 pages                                                                                                                                     |                |
|                                 | 63                    | Action Closing Prosecution mailed March 27, 2014 for Reexamination Control No. 95/001,758, filed September 14, 2011, 40 pages                                                                                                                                   |                |
|                                 | 64                    | Action Closing Prosecution mailed March 27, 2014 for Reexamination Control No. 95/001,339, filed June 8, 2010, 106 pages                                                                                                                                        |                |
|                                 | 65                    | Notice of Allowance, U.S. Pat. App. 12/761,179, July 11, 2013, 37 pages                                                                                                                                                                                         |                |
|                                 | 66                    | Notice of Allowance, U.S. Pat. App. 12/504,131, February 12, 2013, 52 pages                                                                                                                                                                                     |                |

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 20080025137                              | 01-31-2008                       | Natarajan et al.                                   |                                                                                 |
|                        | 2                        | 2006233012                               | 10-19-2006                       | Tomonori et al.                                    |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          | 3                        | EP 1 816 570 A2         | 08-08-2007                          | Rambus, Inc.                                          |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |  |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. |  | T <sup>2</sup> |
|                                 | 4                     | International Search Report and Written Opinion, PCT/US2011/059209, January 31, 2013                                                                                                                                                                            |  |                |

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
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|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                               |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|-------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                               |                                                    |                                                                                 |
|                        | 1                        | 2003/0070052                             | 04-2003                       | Lai, Jiin                                          |                                                                                 |
|                        | 2                        | 2004/0098528                             | 05-2004                       | Janzen, Jefferey W.                                |                                                                                 |
|                        | 3                        | 2002/0048195                             | 04-2002                       | Klein, Dean A.                                     |                                                                                 |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *          | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 4                        | Non-Final Office Action, dated January 2, 2014, for U.S. Pat. App. No. 13/287,042 filed November 1, 2011, 42 pages                                                                                                                                              |                |
|                                 | 5                        | Response to Non-Final Office Action dated January 2, 2014 for U.S. Pat. App. No. 13/287,042, filed April 2, 2014, 12 pages                                                                                                                                      |                |

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| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 6717855                                  | 04-06-2004                       | Underwood                                          |                                                                                 |

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          |                          |                         |                                     |                                                       |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |  |  |  |                |
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|                                 | 2                        | Action Closing Prosecution mailed October 1, 2012, for Control Nos. 95/000,546 and 95/000,577, filed May 11, '2010 and October 20, 2010 respectively, 39 pages.                                                                                                 |  |  |  |                |
|                                 | 3                        | Non-Final Office Action mailed November 13, 2012, for Control Nos. 95/001,339, 95/000,578 and 95/000,579, filed April 20, 2010, October 20, 2010 and October 21, 2010 respectively, 81 pages                                                                    |  |  |  |                |
|                                 | 4                        | Order Granting Request for Inter Partes Reexamination and Non-Final Office Action mailed December 7, 2012, for Control No. 95/002,399, filed September 15, 2012, 89 pages.                                                                                      |  |  |  |                |
|                                 | 5                        | Non-Final Office Action mailed December 19, 2012, for Control No. 95/001,758, filed September 14, 2011, 36 Pages.                                                                                                                                               |  |  |  |                |
|                                 | 6                        | Request for Inter Partes Reexamination; Reexam U.S. Patent Application No. 95/001,758, for U.S. Patent No. 7,864,627, filed September 15, 2011, 814 pages (submitted in four parts.)                                                                            |  |  |  |                |
|                                 | 7                        | Request for Inter Partes Reexamination; Reexam U.S. Patent Application No. 95/001,381, for U.S. Patent No. 7,532,537, filed June 9, 2010, 247 pages                                                                                                             |  |  |  |                |

EXAMINER /Gurtej Bansal/ (05/11/2014)

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\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./

|                                                                                                          |                                            |                                                                  |
|----------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b>Search Notes</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                          | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2189                                          |

| CPC- SEARCHED |      |          |
|---------------|------|----------|
| Symbol        | Date | Examiner |
|               |      |          |

| CPC COMBINATION SETS - SEARCHED |      |          |
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| US CLASSIFICATION SEARCHED |          |            |          |
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| Class                      | Subclass | Date       | Examiner |
| 711                        | 5; 147   | 05/15/2014 | GB       |

| SEARCH NOTES                                |            |          |
|---------------------------------------------|------------|----------|
| Search Notes                                | Date       | Examiner |
| Text Search in EAST (See Attached)          | 05/15/2014 | GB       |
| NPL Search in Google Scholar (See Attached) | 05/15/2014 | GB       |
| Inventor Search in eDAN                     | 05/15/2014 | GB       |
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| INTERFERENCE SEARCH     |                         |      |          |
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CONFIRMATION NO. 2072

| SERIAL NUMBER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | FILING or 371(c)<br>DATE                                                                                          | CLASS                                                    | GROUP ART UNIT                | ATTORNEY DOCKET<br>NO.                                                                                                                                                                                                                 |                           |                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|
| 13/971,231                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 08/20/2013                                                                                                        | 711                                                      | 2189                          | NETL.018P2C7                                                                                                                                                                                                                           |                           |                                |
| <b>APPLICANTS</b><br>Netlist, Inc., Irvine, CA, Assignee (with 37 CFR 1.172 Interest);<br><b>INVENTORS</b><br>Jefferey C. Solomon, Irvine, CA;<br>Jayesh R. Bhakta, Cerritos, CA;<br><b>** CONTINUING DATA *****</b><br>This application is a CON of 13/287,081 11/01/2011 PAT 8516188<br>which is a CON of 13/032,470 02/22/2011 PAT 8081536<br>which is a CON of 12/955,711 11/29/2010 PAT 7916574<br>which is a CON of 12/629,827 12/02/2009 PAT 7881150<br>which is a CON of 12/408,652 03/20/2009 PAT 7636274<br>which is a CON of 11/335,875 01/19/2006 PAT 7532537<br>which claims benefit of 60/645,087 01/19/2005<br>and is a CIP of 11/173,175 07/01/2005 PAT 7289386<br>which claims benefit of 60/588,244 07/15/2004<br>and is a CIP of 11/075,395 03/07/2005 PAT 7286436<br>which claims benefit of 60/550,668 03/05/2004<br>and claims benefit of 60/575,595 05/28/2004<br>and claims benefit of 60/590,038 07/21/2004<br><b>** FOREIGN APPLICATIONS *****</b><br><b>** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY **</b><br>09/11/2013 |                                                                                                                   |                                                          |                               |                                                                                                                                                                                                                                        |                           |                                |
| Foreign Priority claimed <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>35 USC 119(a-d) conditions met <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Verified and /GURTEJ BANSAL/<br>Acknowledged Examiner's Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                   | <input type="checkbox"/> Met after Allowance<br>Initials | <b>STATE OR COUNTRY</b><br>CA | <b>SHEETS DRAWINGS</b><br>23                                                                                                                                                                                                           | <b>TOTAL CLAIMS</b><br>10 | <b>INDEPENDENT CLAIMS</b><br>2 |
| <b>ADDRESS</b><br>The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306<br>UNITED STATES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                   |                                                          |                               |                                                                                                                                                                                                                                        |                           |                                |
| <b>TITLE</b><br>LOAD-REDUCING CIRCUIT FOR MEMORY MODULE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                   |                                                          |                               |                                                                                                                                                                                                                                        |                           |                                |
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BIB (Rev. 05/07).



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... 5. **Ranking DQs**. ... This part **rank**s the target organisation and its competitor(s) based on how they meet each of the selected **DQs**. ... From the **rank** order, the twenty highest-ranked **DQs** were selected with approximately 70 per cent cumulative weight, to design a three-part ...

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M. Langille, A. Bernard, O. Rodgers, S. Hughes... - *Clinical* ... 2010 - Elsevier

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... Table 3. Top 6 Websites as Ranked by the **DQS** With the Corresponding QQS and Google **Rank** Positions. ... In general, there was a low to moderate relationship between the **ranking** within the Google search and **ranking** according to the **DQS** ( $r = 0.39, 0.64$ , and  $0.35$  for the first ...

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VE Dmitrienko, EN Ovchinnikova - *Acta Crystallographica Section A* ... 2001 - scripts.euro.org☒ include patents... **rank** tensors might also appear for dipole-dipole transitions owing to thermal atomic motion or point defects (Dmitrienko et al., 1999 [Dmitrienko, VE, Ovchinnikova, EN & Ishida, K. (1999)]. ... In the Cartesian coordinates, the symmetric part of the third-**rank** tensor,  $f_{dqs}^{jmn} = f_{jmn}^{dqs}$  ...☒ include citations

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[Memory module](#)

JH Cho, JJ Lee, JJ Lee, B So - US Patent 7,072,201, 2006 - Google Patents

... The CA signals, **rank** control signals RCs, and the data signals **DQs** are buffered by the buffer 38 ... signals RC1, RC2, RC3 and RC4 are buffered signals supplied to each of the **rank**s RC1-RC4 ... signals CA2 a and CA2 b and also buffers the third and fourth **rank** control signals ...

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[DDR DRAM data coherence scheme](#)

DM Yuan, GB Wang - US Patent 6,453,391, 2002 - Google Patents

... burst address is odd 74, data from the register strobed with a positive **DQS** edge is connected to odd BLA's and data from the register strobed with a negative **DQS** edge is ... Multi-**rank** memory module that emulates a memory module having a different number of **rank**s. ...

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[On the quantification of robot redundancy](#)J. Lianovic - *Robotics and Automation*, 1999, Proceedings, 1999 ... 1999 - IEEE Xplore, IEEE.org... 0-7803-51 80-0-5199 \$10.00 0 1999 IEEE ... Let the joint increment corresponding to the secondary tasks be collected in vector **dqs** and let the secondary tasks be entirely ... in the null space of J, ... The degree of redundancy  $D < 1$  can mathematically be determined as  $D = \text{rank}(N, 1) \dots$ 

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{PPT} from postech.ac.kr

B. Ruyys - New Jersey: Prentice, 1999 - dpm.postech.ac.kr

... The Commodity Supercomputing! Cluster Computing - Research Projects: Beowulf (CalTech and NASA) - USA, CCS (Computing Centre Software) - Paderborn, Germany; Condor - Wisconsin State University, USA; **DQS** (Distributed Queuing System) - Florida State University, US ...

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[Circuit for providing chip-select signals to a plurality of ranks of a DDR memory module](#)

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[System and method for dynamic rank specific timing adjustments for double data rate \(DDR\) components](#)

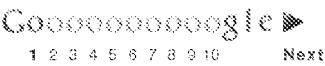
DS McGinnis, DA Thompson, JF Zumkat - US Patent 7,127,584, 2006 - Google Patents

... The timing measurements are then passed to a **DQS** Measurement Function, which calculates a **DQS\_OFFSET** ... For example, memories are typically arranged in multiple **rank**s of components, which are usually ... time to be used with the data tenure for any given **rank** within the ...

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| L1    | 4529   | 711/5.ccls. 711/147.ccls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR               | OFF     | 2014/05/15 16:09 |
| S1    | 4386   | 711/5.ccls. 711/147.ccls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR               | OFF     | 2013/12/02 23:37 |
| S2    | 4481   | DQS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT        | OR               | OFF     | 2013/12/02 23:38 |
| S3    | 88990  | DS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US-PGPUB; USPAT        | OR               | OFF     | 2013/12/02 23:38 |
| S4    | 32759  | DQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US-PGPUB; USPAT        | OR               | OFF     | 2013/12/02 23:38 |
| S5    | 3171   | S2 and S4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR               | OFF     | 2013/12/02 23:38 |
| S6    | 134822 | rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US-PGPUB; USPAT        | OR               | ON      | 2013/12/02 23:38 |
| S7    | 329    | S5 and S6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT        | OR               | ON      | 2013/12/02 23:38 |
| S8    | 201    | US-4218740-\$.DID. OR US-4368515-\$.DID. OR US-4392212-\$.DID. OR US-4633429-\$.DID. OR US-4670748-\$.DID. OR US-4706214-\$.DID. OR US-4866603-\$.DID. OR US-4958322-\$.DID. OR US-4961172-\$.DID. OR US-4961204-\$.DID. OR US-4980850-\$.DID. OR US-5247643-\$.DID. OR US-5272664-\$.DID. OR US-5345412-\$.DID. OR US-5357478-\$.DID. OR US-5388072-\$.DID. OR US-5392252-\$.DID. OR US-5426753-\$.DID. OR US-5483497-\$.DID. OR US-5485589-\$.DID. OR US-5495435-\$.DID. OR US-5513135-\$.DID. OR US-5532954-\$.DID. OR US-5541448-\$.DID. OR US-5572691-\$.DID. OR US-5581498-\$.DID. OR US-5590071-\$.DID. OR US-5602999-\$.DID. OR US-5638534-\$.DID. OR US-5655153-\$.DID. OR US-5699542-\$.DID. OR US-5702984-\$.DID. OR US-5703826-\$.DID. OR US-5745914-\$.DID. OR US-5764590-\$.DID. OR US-5784705-\$.DID. OR US-5802395-\$.DID. OR US-5805520-\$.DID. OR US-5822251-\$.DID. OR US-5909388-\$.DID. OR US-5926827-\$.DID. OR US-5926839-\$.DID. OR US-5953215-\$.DID. OR US- | US-PGPUB; USPAT; USOCR | OR               | OFF     | 2013/12/03 00:02 |



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\$.DID. OR US-6097652-\$.DID. OR US-  
6108745-\$.DID. OR US-6115278-\$.DID.  
OR US-6134638-\$.DID. OR US-6151271-  
\$.DID. OR US-6154418-\$.DID. OR US-  
6154419-\$.DID. OR US-6185654-\$.DID.  
OR US-6209074-\$.DID. OR US-6226709-  
\$.DID. OR US-6226736-\$.DID. OR US-  
6233650-\$.DID. OR US-6247088-\$.DID.  
OR US-6317352-\$.DID. OR US-6349051-  
\$.DID. OR US-6400637-\$.DID. OR US-  
6408356-\$.DID. OR US-6414868-\$.DID.  
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\$.DID. OR US-6446158-\$.DID. OR US-  
6446184-\$.DID. OR US-6453381-\$.DID.  
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\$.DID. OR US-6502161-\$.DID. OR US-  
6518794-\$.DID. OR US-6526473-\$.DID.  
OR US-6530007-\$.DID. OR US-6530033-  
\$.DID. OR US-6553450-\$.DID. OR US-  
6618320-\$.DID. OR US-6621496-\$.DID.  
OR US-6625081-\$.DID. OR US-6625687-  
\$.DID. OR US-6636935-\$.DID. OR US-  
6646949-\$.DID. OR US-6658509-\$.DID.  
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\$.DID. OR US-6683372-\$.DID. OR US-  
6697888-\$.DID. OR US-6705877-\$.DID.  
OR US-6717885-\$.DID. OR US-6721843-  
\$.DID. OR US-6721860-\$.DID. OR US-  
6738880-\$.DID. OR US-6742098-\$.DID.  
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\$.DID. OR US-6788592-\$.DID. OR US-  
6807125-\$.DID. OR US-6807650-\$.DID.  
OR US-6813196-\$.DID. OR US-6832284-  
\$.DID. OR US-6834014-\$.DID. OR US-  
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\$.DID. OR US-6912628-\$.DID. OR US-  
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\$.DID. OR US-6961281-\$.DID. OR US-  
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\$.DID. OR US-6996686-\$.DID. OR US-  
7007130-\$.DID. OR US-7007175-\$.DID.  
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\$.DID. OR US-7054179-\$.DID. OR US-  
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7124260-\$.DID. OR US-7127584-\$.DID.  
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|     |      | OR US-7356639-\$.DID. OR US-7370238-\$.DID. OR US-7437591-\$.DID. OR US-7461182-\$.DID. OR US-7471538-\$.DID. OR US-7532537-\$.DID. OR US-7619912-\$.DID. OR US-7636274-\$.DID. OR US-7864627-\$.DID. OR US-7881150-\$.DID. OR US-7916574-\$.DID. OR US-8001434-\$.DID. OR US-20010003198-\$.DID. OR US-20010050857-\$.DID. OR US-20010052057-\$.DID. OR US-20020088633-\$.DID. OR US-20030063514-\$.DID. OR US-20030090359-\$.DID. OR US-20030090879-\$.DID. OR US-20030191995-\$.DID. OR US-20030210575-\$.DID. OR US-20040000708-\$.DID. OR US-20040037158-\$.DID. OR US-20040201968-\$.DID. OR US-20050036378-\$.DID. OR US-20050154820-\$.DID. OR US-20050281096-\$.DID. OR US-20060044860-\$.DID. OR US-20060117152-\$.DID. OR US-20060126369-\$.DID. OR US-20060129755-\$.DID. OR US-20060179206-\$.DID. OR US-20060259711-\$.DID. OR US-20060262586-\$.DID. OR US-20060267172-\$.DID. OR US-20060277355-\$.DID. OR US-20080162790-\$.DID. OR US-20090103387-\$.DID. OR US-20100070690-\$.DID. OR US-20100091540-\$.DID. OR US-20100128507-\$.DID. OR US-20110016250-\$.DID. OR US-20110016269-\$.DID. OR US-20110090749-\$.DID. OR US-20110125966-\$.DID. OR WO-1992002879-\$.DID. OR WO-1994007242-\$.DID. OR WO-1995034030-\$.DID. OR WO-1999000734-\$.DID. OR WO-2002058069-\$.DID. OR WO-2002063804-\$.DID. OR WO-2003017283-\$.DID. OR WO-2003069484-\$.DID. OR WO-2006055497-\$.DID. OR US-2003254-\$.DID. OR US-1969279-\$.DID. OR US-2097152-\$.DID. OR US-4194204-\$.DID. |                 |    |    |                  |
| S9  | 1184 | multiplex\$3 with (DQS and DQ)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:07 |
| S10 | 359  | multiplex\$3 with (DQS and DQ) with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:08 |
| S11 | 850  | multiplex\$3 with DQS and delay with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S12 | 562  | multiplex\$3 with DQS and DQ with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S13 | 401  | multiplex\$3 with DQS same DQ with                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-             | OR | ON | 2013/12/03       |

|     |      |                                                                                |                        |    |    |                     |
|-----|------|--------------------------------------------------------------------------------|------------------------|----|----|---------------------|
|     |      | delay\$3                                                                       | PGPUB;<br>USPAT        |    |    | 00:12               |
| S14 | 0    | 13/287042.app.                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:25 |
| S15 | 0    | 13/287042.ap.                                                                  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:25 |
| S16 | 0    | "13287042".ap.                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:25 |
| S17 | 0    | "13287042".app.                                                                | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:25 |
| S18 | 294  | multiplex\$3 with DQS same delay\$3 with data with signals                     | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:28 |
| S19 | 307  | multiplex\$3 with DQS same delay\$3 with data with (signals lines)             | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:28 |
| S20 | 9    | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same2 rank  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:28 |
| S21 | 26   | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:29 |
| S22 | 238  | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same memory | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:30 |
| S23 | 347  | isolat\$3 with DQ with DQS                                                     | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:47 |
| S24 | 21   | isolat\$3 with DQ with DQS same Rank                                           | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:47 |
| S25 | 1353 | DQS with select\$3 with (memory rank)                                          | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:50 |
| S26 | 54   | chip\$1select with rank and DQ and DQS                                         | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:25 |
| S27 | 56   | chip\$1select same rank and DQ and DQS                                         | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:26 |
| S28 | 61   | chip\$1select and rank and DQ and DQS                                          | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:27 |
| S29 | 5    | rank with DQ with DQS with low                                                 | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:39 |
| S30 | 300  | rank with DQ with DQS                                                          | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:40 |
| S31 | 82   | rank and (DQ with DQS) with off                                                | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:03 |
| S32 | 271  | rank and (DQ with DQS) with high                                               | US-                    | OR | ON | 2013/12/03          |

|     |      |                                                     |                        |    |     |                     |
|-----|------|-----------------------------------------------------|------------------------|----|-----|---------------------|
|     |      |                                                     | PGPUB;<br>USPAT        |    |     | 19:07               |
| S33 | 29   | rank with (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:07 |
| S34 | 1    | "6873533".pn.                                       | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:07 |
| S35 | 7    | rank with (DQ with DQS) with terminat\$3            | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:10 |
| S36 | 20   | rank with (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:11 |
| S37 | 21   | rank same (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:11 |
| S38 | 57   | rank same (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:11 |
| S39 | 7    | rank same (DQ with DQS) with (mux<br>multiplexer)   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:15 |
| S40 | 37   | rank and (DQ with DQS) with (mux<br>multiplexer)    | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:16 |
| S41 | 1040 | (DQ with DQS) with (mux multiplexer)                | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S42 | 1024 | (DQ with DQS) with (mux multiplexer) and<br>memory  | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S43 | 634  | (DQ with DQS) with (mux multiplexer)<br>same memory | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S44 | 231  | (DQ with DQS) with (mux multiplexer)<br>with memory | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S45 | 1    | "20040098428".pn.                                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:40 |
| S46 | 1    | "20040098528".pn.                                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:41 |
| S47 | 1    | "20030070052".pn.                                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:42 |
| S48 | 1    | "20050047250".pn.                                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>20:07 |
| S49 | 1599 | G06F12/0607.cpc. G06F12/0813.cpc.                   | US-<br>PGPUB;<br>USPAT | OR | OFF | 2013/12/20<br>11:11 |
| S50 | 2437 | latency with memory adj controller with<br>memory   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:15 |
| S51 | 59   | latency with memory adj controller with             | US-                    | OR | ON  | 2014/04/04          |

|     |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |    |     |                     |
|-----|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|---------------------|
|     |         | (measur\$3 test\$3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PGPUB;<br>USPAT        |    |     | 14:16               |
| S52 | 22      | rank same (DQ with DQS) with isolat\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:16 |
| S53 | 22      | isolat\$3 with DQ with DQS same Rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S54 | 26      | multiplex\$3 with DQS same delay\$3 with<br>data with (signals lines) and rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S55 | 1       | "6553450".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:33 |
| S56 | 1       | "6742098".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:48 |
| S60 | 644     | isolat\$3 with load with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S61 | 46      | isolat\$3 with load with memory with<br>controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S62 | 28      | US-5345412-\$.DID. OR US-5537584-<br>\$.DID. OR US-5617559-\$.DID. OR US-<br>5649159-\$.DID. OR US-5717851-\$.DID.<br>OR US-5724604-\$.DID. OR US-5729716-<br>\$.DID. OR US-5784705-\$.DID. OR US-<br>5802541-\$.DID. OR US-5973392-\$.DID.<br>OR US-6173357-\$.DID. OR US-6260127-<br>\$.DID. OR US-6446158-\$.DID. OR US-<br>6553449-\$.DID. OR US-6618791-\$.DID.<br>OR US-6717855-\$.DID. OR US-6788592-<br>\$.DID. OR US-6948084-\$.DID. OR US-<br>7130308-\$.DID. OR US-7133960-\$.DID.<br>OR US-7379361-\$.DID. OR US-<br>20050010737-\$.DID. OR US-<br>20070293094-\$.DID. OR US-3412243-<br>\$.DID. OR US-2201420-\$.DID. OR US-<br>2761179-\$.DID. OR US-2201346-\$.DID.<br>OR US-2504131-\$.DID. | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/05/05<br>00:39 |
| S63 | 2355572 | read\$only with non\$1volatile with main<br>memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-<br>PGPUB;<br>USPAT | OR | OFF | 2014/05/08<br>19:12 |
| S64 | 2126    | read\$only with non\$1volatile with main<br>with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT | OR | OFF | 2014/05/08<br>19:12 |
| S65 | 1       | "20080080261".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | OFF | 2014/05/11<br>20:14 |

**EAST Search History (Interference)**

| Ref<br># | Hits   | Search Query                 | DBs            | Default<br>Operator | Plurals | Time Stamp          |
|----------|--------|------------------------------|----------------|---------------------|---------|---------------------|
| S57      | 3448   | 711/5.ccls.<br>711/147.ccls. | USPAT;<br>UPAD | OR                  | OFF     | 2014/04/04<br>15:50 |
| S58      | 171076 | isolat\$3.clm.               | USPAT;<br>UPAD | OR                  | OFF     | 2014/04/04<br>15:52 |

EAST Search History

|     |    |             |                |    |     |                     |
|-----|----|-------------|----------------|----|-----|---------------------|
| S59 | 45 | S57 and S58 | USPAT;<br>UPAD | OR | OFF | 2014/04/04<br>15:52 |
|-----|----|-------------|----------------|----|-----|---------------------|

5/ 15/ 2014 4:14:14 PM  
C:\ Users\ gbansal\ Documents\ EAST\ Workspaces\ 13971231.wsp

|                                                                                                                    |                                            |                                                                  |
|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                                    | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2189                                          |

|   |                 |   |                   |   |                     |   |                 |
|---|-----------------|---|-------------------|---|---------------------|---|-----------------|
| ✓ | <b>Rejected</b> | - | <b>Cancelled</b>  | N | <b>Non-Elected</b>  | A | <b>Appeal</b>   |
| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

|                                                                                        |                              |                               |                                 |
|----------------------------------------------------------------------------------------|------------------------------|-------------------------------|---------------------------------|
| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant | <input type="checkbox"/> CPA | <input type="checkbox"/> T.D. | <input type="checkbox"/> R.1.47 |
|----------------------------------------------------------------------------------------|------------------------------|-------------------------------|---------------------------------|

| CLAIM |          | DATE       |  |  |  |  |  |  |  |  |
|-------|----------|------------|--|--|--|--|--|--|--|--|
| Final | Original | 05/15/2014 |  |  |  |  |  |  |  |  |
|       | 1        | ✓          |  |  |  |  |  |  |  |  |
|       | 2        | ✓          |  |  |  |  |  |  |  |  |
|       | 3        | ✓          |  |  |  |  |  |  |  |  |
|       | 4        | ✓          |  |  |  |  |  |  |  |  |
|       | 5        | ✓          |  |  |  |  |  |  |  |  |
|       | 6        | ✓          |  |  |  |  |  |  |  |  |
|       | 7        | ✓          |  |  |  |  |  |  |  |  |
|       | 8        | ✓          |  |  |  |  |  |  |  |  |
|       | 9        | ✓          |  |  |  |  |  |  |  |  |
|       | 10       | ✓          |  |  |  |  |  |  |  |  |

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| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | <b>Complete if Known</b> |                        |              |
|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 6011710                                  | 01-04-2000                       | Wiggers                                            |                                                                                 |
|                        | 2.                       | 20010008006                              | 07-12-2001                       | Klein                                              |                                                                                 |
|                        | 3.                       | 20050257109                              | 11-17-2005                       | Averbuj                                            |                                                                                 |
|                        | 4.                       | 20070070669                              | 03-29-2007                       | Tsern                                              |                                                                                 |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                                                                           |                |
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|                                 | 5.                       | Petition for Inter Partes Review filed on 6/24/2014 for U.S. Patent No. 8,516,185, IPR Case Number IPR2014-01029, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a>                                   |                |
|                                 | 6.                       | Petition for Inter Partes Review filed on 6/22/2014 for U.S. Patent No. 7,881,150, IPR Case Number IPR2014-00882 and IPR Case Number IPR2014-01011, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a> |                |
|                                 | 7.                       | Petition for Inter Partes Review filed on 6/24/2014 for U.S. Patent No. 8,081,536, IPR Case Number IPR2014-00883, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a>                                   |                |
|                                 | 8.                       | Altera, ACEX iK, Programmable Logic Device Family, Data Sheet, May 2003, Ver 3.4                                                                                                                                                                                                                                          |                |
|                                 | 9.                       | Horowitz, "The Art of Electronics," Cambridge Univ. Press, 1989, selected pages                                                                                                                                                                                                                                           |                |
|                                 | 10.                      | Jacob, Bruce L.; "Synchronous DRAM Architectures, Organizations, and Alternative Technologies". University of Maryland, Dec. 10, 2002.                                                                                                                                                                                    |                |
|                                 | 11.                      | JEDEC Standard No. 21-C Section 4.5.7, 168 Pin Registered SDRAM DIMM Family, Release 7                                                                                                                                                                                                                                    |                |
|                                 | 12.                      | JEDEC 21-C, Section 4.6.1, 278 Pin Buffered SDRAM DIMM Family                                                                                                                                                                                                                                                             |                |
|                                 | 13.                      | JEDEC Standard No. 21-C Section 4.1.2.5, Appendix E, "Specific PD's for Synchronous DRAM (SDRAM)," pp. 1-25,                                                                                                                                                                                                              |                |

EXAMINER

DATE CONSIDERED

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.



| Electronic Acknowledgement Receipt   |                                         |
|--------------------------------------|-----------------------------------------|
| EFS ID:                              | 19804557                                |
| Application Number:                  | 13971231                                |
| International Application Number:    |                                         |
| Confirmation Number:                 | 2072                                    |
| Title of Invention:                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                     |
| Customer Number:                     | 79141                                   |
| Filer:                               | Jamie Jie Zheng                         |
| Filer Authorized By:                 |                                         |
| Attorney Docket Number:              | NETL.018P2C7                            |
| Receipt Date:                        | 07-AUG-2014                             |
| Filing Date:                         | 20-AUG-2013                             |
| Time Stamp:                          | 15:04:45                                |
| Application Type:                    | Utility under 35 USC 111(a)             |

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| 1               | Transmittal Letter   | 2014-08-07_IDS_Cover_NETL018P2C7.pdf | 69133<br>7fd42a789c9c54bab3e3bfb790e98918312a2eba | no               | 2                |

**Warnings:**

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------|------------------------------------------------------|----|----|
| 2                                                                                                                                                                                                          | Information Disclosure Statement (IDS) Form (SB08) | 2014-08-07_IDS_NETL018P2C7.pdf           | 99609<br>5f620d727d73b8124f5aef3ffa2ed15213f53efe    | no | 1  |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
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| 3                                                                                                                                                                                                          | Non Patent Literature                              | 2003-05_Altera_ACEX_1K_Data sheet.pdf    | 23673114<br>d3153cf33657081c125ece8a06e13d43ffad67cd | no | 86 |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
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| <b>Information:</b>                                                                                                                                                                                        |                                                    |                                          |                                                      |    |    |
| 4                                                                                                                                                                                                          | Non Patent Literature                              | 1989_Horowitz_Art_of_Electronics.pdf     | 804824<br>4fe58ae9db8168f345983f24ffe9b752877cd2c4   | no | 15 |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
| <b>Information:</b>                                                                                                                                                                                        |                                                    |                                          |                                                      |    |    |
| 5                                                                                                                                                                                                          | Non Patent Literature                              | 2002-12-10_Jacob_SDRAM_Architectures.pdf | 5974132<br>f24bc23ec4f9e3bb8affeb17f74c9bc8fe428859  | no | 22 |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
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| <b>Information:</b>                                                                                                                                                                                        |                                                    |                                          |                                                      |    |    |
| 6                                                                                                                                                                                                          | Non Patent Literature                              | 0000_JEDEC_21-C_4-5-7_168_Pin_RSDRAM.pdf | 801227<br>346b9c985eafce6da69a3ad7b3fca4d79e5ff7b    | no | 8  |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
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| <b>Information:</b>                                                                                                                                                                                        |                                                    |                                          |                                                      |    |    |
| 7                                                                                                                                                                                                          | Non Patent Literature                              | 0000_JEDEC_21C_4-6-1-278_Pi n.pdf        | 4025672<br>757e358ba523ebc1c7f068d3e3cf05349542c252  | no | 24 |
| <b>Warnings:</b>                                                                                                                                                                                           |                                                    |                                          |                                                      |    |    |
| <b>Information:</b>                                                                                                                                                                                        |                                                    |                                          |                                                      |    |    |
| 8                                                                                                                                                                                                          | Non Patent Literature                              | 0000_JEDEC_21-C_4-1-2-5_Appendix_E.pdf   | 3114809<br>cff2ebcddb681dc41dd4ad0494d49109d2e25e34d | no | 25 |
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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : Netlist, Inc.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : Unknown                                    |
| Art Unit  | : 2189                                       |
| Conf No.  | : 2072                                       |

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application is a Form PTO/SB/08a/b Equivalent listing 13 references. Copies of foreign documents and/or their translation and non-patent literature are submitted herewith.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

No item of information contained in this information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of

Application No.: 13/971,231  
Filing Date: August 20, 2013

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information contained in this information disclosure statement was known to any individual designated in 37 CFR § 1.56(c) more than three months prior to the filing of this information disclosure statement. Therefore, no fee should be required. The Commissioner is authorized to charge the fee set forth in 37 C.F.R. § 1.17(p) to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: August 7, 2014

/Jamie J. Zheng/

Jamie J. Zheng  
Customer No. 79141  
(650) 273-6008

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51167  
(Reg. No.)

Document code: WFEE

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Electronically filed \*\*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Netlist, Inc.  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : LOAD-REDUCING CIRCUIT FOR  
MEMORY MODULE  
  
Examiner : BANSAL, GURTEJ  
Art Unit : 2189  
Conf. No. : 2072  
Docket No. : NETL.018P2C7

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November 20, 2014

(Date)

/Jamie J. Zheng/

Jamie J. Zheng, Reg. No. 51167

RESPONSE TO NON-FINAL OFFICE ACTION DATED MAY 20, 2014

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

The enclosed Amendment is in response to the Non-Final Office Action dated May 20, 2014 for the above-identified patent application.

The Commissioner is hereby authorized to charge any required fee(s) to Deposit Account No. 50-5963.

AMENDMENTS to the SPECIFICATION begin on Page 2 of this paper.

AMENDMENTS to the CLAIMS begin on Page 4 of this paper.

REMARKS begin on Page 11 of this paper.

## **IN THE SPECIFICATION**

Please replace the title with the following:

“MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION”

Please amend the Abstract as follows:

A ~~circuit is mountable on a~~ memory module ~~that~~ includes a plurality of memory devices and ~~that~~ is operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system. The ~~circuit~~ memory module comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of output control/address signals are provided to the plurality of memory devices. The ~~circuit~~ memory module further comprises ~~logic a circuit to monitor the memory commands from the memory controller and~~ to selectively isolate one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

Please amend paragraph [0011] under the Summary of the Invention as follows:

In certain embodiments, a ~~circuit is mountable on a~~ memory module ~~that~~ includes a plurality of memory devices and ~~that~~ is operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system. The ~~circuit~~ memory module comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of



output control/address signals are provided to the plurality of memory devices. The ~~circuit-~~  
~~memory module~~ further comprises ~~logic-a circuit to monitor the memory commands from the~~  
~~memory controller and~~ to selectively isolate one or more first memory devices among the  
plurality of memory devices from the memory controller in response to the respective  
memory command so as to reduce a load of the memory module to the computer system  
while one or more second memory devices among the plurality of memory devices are  
communicating with the memory controller in response to the set of output control/address  
signals.

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## **AMENDMENTS TO THE CLAIMS**

1-10. (Cancelled)

11. A memory module operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system, the memory module being coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus, the data bus including a set of data (DQ) and data strobe (DQS) signal lines, comprising:

a plurality of memory devices including a first set of memory devices and a second set of memory devices;

a register device to receive from the memory controller a first set of input C/A signals associated with a first memory command via the C/A bus and subsequently a second set of input C/A signals associated with a second memory command via the C/A bus, the first memory command to make the memory module receive or output a first data burst and the second memory command to make the memory module receive or output a second data burst, the register to generate a first set of output C/A signals in response to the first set of input C/A signals and a second set of output C/A signals in response to the second set of input C/A signals, the first set of output C/A signals causing the first set of memory devices to receive or output the first data burst, the second set of output C/A signals causing the second set of memory devices to receive or output the second data burst; and

a circuit coupled between the data bus and the plurality of memory devices, the circuit being coupled to the first set of memory devices via a first set of module DQ and DQS signal lines and to the second set of memory devices via a second set of module DQ and DQS signal lines, wherein the circuit in response to the first memory command couples the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and isolates the second set of module DQ and DQS signal lines from the data bus as the memory module is receiving or outputting the first data burst in response to the first memory command, and wherein the circuit in response to the second memory command couples the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and isolates the first set of module DQ and DQS signal lines from the data bus as the

memory module is receiving or outputting the second data burst in response to the second memory command.

12. The memory module of claim 11, wherein the circuit isolates both the first set of module DQ and DQS signal lines and the second set of module DQ and DQS signal lines from the data bus when the memory module is not being accessed by the memory system.

13. The memory module of claim 11, wherein the circuit further comprises multiple groups of DQ-DQS paths including a first group of DQ-DQS paths corresponding to the first set of module DQ and DQS signal lines and a second group of DQ-DQS paths corresponding to the second set of module DQ and DQS signal lines, wherein the circuit enables the first group of DQ-DQS paths as disabling the second group of DQ-DQS paths in response to the first memory command, and wherein the circuit enables the second group of DQ-DQS paths as disabling the first group of DQ-DQS paths in response to the second memory command.

14. The memory module of claim 13, wherein the register device is to translate between a system memory domain of the computer system and a physical memory device domain of the memory module, the system memory domain having a smaller number of ranks than the physical memory device domain, and wherein the first set of the plurality of memory devices and the second set of the plurality of memory devices belong to a same rank in the system memory domain and to different ranks in the physical memory device domain.

15. The memory module of claim 14, wherein the first set of input C/A signals include at least one chip-select signal and the register device outputs a greater number of chip-select signals than the at least one chip-select signal, the greater number of chip-select signals including a first chip select signal and a second chip select signal, the first chip-select signal being provided to the first set of memory devices and having an active value to select the first set of memory devices to receive or output the first data burst in response to the first memory command, the second chip-select signal being provided to the second set of memory devices and having a non-active value to keep the second set of memory devices from receiving or outputting data as the first set of memory devices are receiving or outputting the first data burst in response to the first memory command.

16. The memory module of claim 11, wherein the first memory command is a first read command and the second memory command is a second read command, wherein the first read command and the second read command are back to back adjacent read commands, and

wherein the first set of memory devices output the first data burst together with a first burst of data strobes in response to the first read command, wherein the second set of memory devices output the second data burst together with a second burst of data strobes in response to the second read command, wherein the second data burst follows the first data burst on the data bus, and wherein the circuit prevents the first burst of data strobes and the second burst of data strobes from colliding with each other.

17. The memory module of claim 16, wherein each of the first burst of data strobes and the second burst of data strobes includes a pre-ambler interval and a post-ambler interval, and wherein the circuit combines the first burst of data strobes and the second burst of data strobes by skipping the post-ambler interval of the first burst of data strobes and the pre-ambler interval of the second burst of data strobes.

18. The memory module of claim 11, wherein the memory bus further includes an on-die termination (ODT) bus for conveying an ODT signal from the memory controller, each ODT signal corresponding to a respective memory command from the memory controller, wherein each memory device of the plurality of memory devices includes an ODT control input to allow a signal at the control input to enable or disable an ODT circuit in the memory device, and wherein the plurality of memory devices include at least one memory device having its respective control input configured to keep the ODT circuits in the at least one memory device disabled regardless of the ODT signal from the memory controller.

19. The memory module of claim 17, further comprising a termination assembly external to the plurality of memory devices and controlled in response to the ODT signal, wherein one or more DQ pins of the at least one memory device are coupled to the termination assembly so that one or more DQ signal paths between the at least one memory device and the memory controller can be terminated by the termination assembly.

20. The memory module of claim 11, wherein the circuit is to receive from the memory controller a third set of input C/A signals associated with a third memory command via the C/A bus, the third memory command being one of a refresh or precharge command, wherein the register to generate a third set of output C/A signals in response to the third set of input C/A signals, the third set of output C/A signals causing both the first set of memory devices and the second set of memory devices to perform one of a refresh operation and a pre-charge operation, and wherein the circuit in response to the third memory command couples the first

set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and couples the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus.

21. A method of operating a memory module in response to memory commands from a memory controller, the memory module having a plurality of memory devices including a first set of memory devices and a second set of memory devices, the memory module being coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus, the data bus including a set of data (DQ) and data strobe (DQS) signal lines, the first set of memory devices having a first set of DQ and DQS pins, the second set of memory devices having a second set of DQ and DQS pins, the method comprising:

- receiving from the memory controller a first set of input C/A signals associated with a first memory command via the C/A bus, the first memory command to cause the memory module to receive or output a first data burst;

- generating a first set of output C/A signals in response to the first set of input C/A signals, the first set of output C/A signals causing the first set of memory devices to receive or output the first data burst,;

- receiving from the memory controller a second set of input control/address signals associated with a second memory command via the C/A bus, the second memory command to cause the memory module to receive or output a second data burst

- generating a second set of output C/A signals in response to the second set of input C/A signals, the second set of output C/A signals causing the second set of memory devices to receive or output the second data burst;

- in response to the first memory command, coupling the first set DQ and DQS pins to respective DQ and DQS signal lines of the data bus and isolating the second set of module DQ and DQS pins from the data bus as the memory module is receiving or outputting the first data burst in response to the first memory command; and

- in response to the second memory command, coupling the second set DQ and DQS pins to respective DQ and DQS signal lines of the data bus and isolating the first set of DQ and DQS pins from the data bus as the memory module is receiving or outputting the second data burst in response to the second memory command.

22. The method of claim 21, further comprising isolating both the first set of DQ and DQS pins and the second set of DQ and DQS pins from the data bus when the memory module is not being accessed by the memory system.

23. The method of claim 21, wherein the memory module further comprises multiple groups of DQ-DQS paths including a first group of DQ-DQS paths corresponding to the first set of DQ and DQS pins and a second group of DQ-DQS paths corresponding to the second set of DQ and DQS pins, the method further comprising enabling the first group of DQ-DQS paths as disabling the second group of DQ-DQS paths in response to the first memory command, and enabling the second group of DQ-DQS paths as disabling the first group of DQ-DQS paths in response to the second memory command.

24. The method of claim 23, further comprising translating between a system memory domain and a physical memory device domain, the system memory domain having a smaller number of ranks than the physical memory device domain, and wherein the first set of the plurality of memory devices and the second set of the plurality of memory devices belong to a same rank in the system memory domain and to different ranks in the physical memory device domain.

25. The method of claim 24, wherein the first set of input C/A signals include at least one chip-select signal and the register device outputs a greater number of chip-select signals than the at least one chip-select signal, the greater number of chip-select signals including a first chip select signal and a second chip select signal, the first chip-select signal being provided to the first set of memory devices and having an active value to select the first set of memory devices to receive or output the first data burst in response to the first memory command, the second chip-select signal being provided to the second set of memory devices and having a non-active value to keep the second set of memory devices from receiving or outputting data as the first set of memory devices are receiving or outputting the first data burst in response to the first memory command.

26. The method of claim 21, wherein the first memory command is a first read command and the second memory command is a second read command, wherein the first read command and the second read command are back to back adjacent read commands, and wherein the first set of memory devices output the first data burst together with a first burst of data strobes in response to the first read command, wherein the second set of memory devices

output the second data burst together with a second burst of data strobes in response to the second read command, wherein the second data burst follows the first data burst on the data bus, the method further comprising combining the first burst of data strobes and the second burst of data strobes to form a third burst of data strobes on the data bus.

27. The method of claim 26, wherein each of the first burst of data strobes and the second burst of data strobes includes a pre-amble interval and a post-amble interval, and wherein combining the first burst of data strobes and the second burst of data strobes comprises skipping the post-amble interval of the first burst of data strobes and the pre-amble interval of the second burst of data strobes.

28. The method of claim 21, wherein the memory bus further includes an on-die termination (ODT) bus for conveying an ODT signal corresponding to each memory command from the memory controller, wherein each of the plurality of memory devices includes ODT circuits and an ODT control input to allow a signal at the control input to enable or disable the ODT circuits in the memory device, the method further comprising keeping the ODT circuits in at least one of the plurality of memory devices disabled regardless of the ODT signal from the memory controller.

29. The method of claim 27, further comprising controlling a termination assembly external to the plurality of memory devices according to the ODT signal, wherein one or more DQ pins of the at least one memory device are coupled to the termination assembly so that one or more DQ signal paths between the at least one memory device and the memory controller can be terminated by the termination assembly.

30. The method of claim 21, further comprising:

receiving from the memory controller a third set of input C/A signals associated with a third memory command via the C/A bus, the third memory command being one of a refresh or precharge command;

generating a third set of output C/A signals in response to the third set of input C/A signals, the third set of output C/A signals causing both the first set of memory devices and the second set of memory devices to perform one of a refresh operation and a pre-charge operation; and

in response to the third memory command, coupling the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and coupling the

second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus.



## REMARKS

This amendment responds to the Non-Final Office Action mailed May 20, 2014. In the Office Action, the Examiner:

- provisionally rejected claims 1-10 on the ground of nonstatutory double patenting as being unpatentable over claims 1, 6 and 8 of co-pending Application No. 13/287,042; and
- rejected claims 1-10 under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Lai (US 2003/0070052), in view of Janzen (US 2004/0098528);

### **I. AMENDMENTS TO THE SPECIFICATION**

The title has been changed, and the Abstract and the Summary of the Invention have been amended. No new matter is added.

### **II. AMENDMENTS TO THE CLAIMS**

Claims 1-20 are cancelled, and new claims 11-30 are presented. No new matter is added.

### **III. REJECTION OF CLAIMS 1-10 ON THE GROUND OF NONSTATUTORY DOUBLE PATENTING**

Claims 1-10 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1, 6 and 8 of co-pending Application No. 13/287,042, now U.S. Patent No. 8,756,364.

Claims 1-10 are cancelled. Applicant files herewith a terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) to overcome any nonstatutory double patenting rejection the Examiner may raise with regard to the new claims 11-30.

### **IV. REJECTION OF CLAIMS 1-10 UNDER PRE-AIA 35 U.S.C. 103(A) AS BEING UNPATENTABLE OVER LAI, IN VIEW OF JANZEN**

New claims 11-30 are presented to replace original claims 1-10, which are cancelled. New claim 11 recites a memory module comprising a plurality of memory devices including a first set of memory devices and a second set of memory devices and a register device to

receive from the memory controller a first set of input C/A signals associated with a first memory command via the C/A bus and subsequently a second set of input control/address signals associated with a second memory command via the C/A bus, the first memory command to cause the memory module to receive or output a first data burst and the second memory command to cause the memory module to receive or output a second data burst.

New claim 11 then requires the register to generate a first set of output C/A signals in response to the first set of input C/A signals and a second set of output C/A signals in response to the second set of input C/A signals, the first set of output C/A signals causing the first set of memory devices to receive or output the first data burst, the second set of output C/A signals causing the second set of memory devices to receive or output the second data burst.

New claim 11 further requires a circuit coupled between the data bus and the plurality of memory devices. The circuit is coupled to the first set of memory devices via a first set of module DQ and DQS signal lines and to the second set of memory devices via a second set of module DQ and DQS signal lines. New claim 11 further requires the circuit to respond to the first memory command by coupling the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and by isolating the second set of module DQ and DQS signal lines from the data bus as the memory module is receiving or outputting the first data burst in response to the first memory command (*emphasis added*). New claim 11 then requires the circuit to respond to the second memory command by coupling the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and by isolating the first set of module DQ and DQS signal lines from the data bus as the memory module is receiving or outputting the second data burst in response to the second memory command (*emphasis added*).

The above features of new claim 11 are not disclosed or taught by Lai in view of Janzen. In Lai, the buffer chip 108 or FET switch circuit 118 does not isolate either one of the two memory banks 104 and 106 from the data bus in response to a memory command. Instead, the buffer chip 108 comprises “a plurality of first-in first-out (FIFO) buffers” to “double the data rate for reading and writing” of each of the two memory banks 104 and 106, which are of DDR SDRAM structure (Lai, paragraph [0035]). Similarly, the FET switches 118 is “to double the transmission rate of the first data selection signal (DQSA) and the data

selection (*sic*) signal (MDA) of the first memory bank 114” and the second memory bank 116 (Lai, paragraph [0039]).

Nowhere in Lai it is mentioned that the buffer chip 108 or FET switch circuit 118 chooses which of the two memory banks 104 and 106 to connect to the memory bus, or which of the two memory banks 104 and 106 to isolate from the memory bus, based on a memory command. Instead, the buffer chip may lock data of the memory data signal MD and transmit the respective data units in the data signal MD to the two memory banks 104, 106 respectively according to data selection signal (DQS) and the data mask signal (DQM)” (Lai, FIG. 5; paragraph [0038]). Neither of the data selection signal (DQS) and the data mask signal (DQM) constitutes a memory command, which, according to the Specification of the instant application and to the common understanding of DDR memory operations, involves a number of command signals that define memory operations such as read, write, refresh, precharge, and other operations (Specification, Table 1 and Table 2).

Lai also does not isolate either one of the two memory banks 104 and 106 as the memory module is receiving or outputting a data burst in response a memory command. In fact, to make the memory module of Lai receive or output data units at quad data rate, Lai requires both memory banks be activated by the chip select signal (0,1) at the same time (Lai, FIGS. 4, 5, 7, and 8, showing chip select signal (0,1) being pulled low). Thus, for each memory command, Lai requires both of the two memory banks 104 and 106 to receive or output units of data, because otherwise the memory module in Lai with the double data rate memory banks 104, 106 would not be able to receive or output a quad data rate data signal (MD).

Thus, during a read operation, the buffer chip 108 or FET switch circuit 118 interleaves units of data from the two memory banks 104, 106 and outputs the read data MD onto the data bus at twice the frequency as each of the two memory banks 104 and 106 outputs read data MDA and MDB, respectively (Lai, FIGS. 4 and 7; paragraphs [0037] and [0039]). As stated in Lai, the “signals between the memory controller 102 and buffer chip 108 operate and (*sic*) four times faster than a baseline rate.” “Therefore, four units of data are capable of being transmitted within one memory clock cycle” (Lai, paragraph [0036]). Note that the memory banks 104, 106 are of the DDR SDRAM structure (paragraph [0035]), so each of the memory banks 104, 106 can only transmit two units of data per memory clock cycle. Therefore, for each read command, both of the two memory banks 104, 106 need to

feed data units to the buffer chip 108 or FET switch circuit 118. Thus, unlike what is claimed in new claim 11, neither of the memory banks 104, 106 can be isolated from the memory bus as the memory module of Lai is outputting read data MD onto the data bus.

During a write operation, the buffer chip may lock data of the memory data signal MD and transmit the respective data units in the data signal MD to the two memory banks 104, 106 respectively according to data selection signal (DQS) and the data mask signal (DQM" (Lai, FIG. 5; paragraph [0038]). As discussed above, the memory data signal has four units of data per memory cycle while each of the memory banks 104, 106 can only receive two units of data per memory cycle. Thus, if only one of the memory banks 104, 106 is receiving the memory data signal MD, half of the data units in the memory data signal would be lost. Therefore, unlike what is claimed in claim 11, neither of the memory banks 104, 106 can be isolated from the memory bus as the memory module in Lai is receiving the memory data signal MD.

Since Janzen does not make up for the above deficiencies of Lai, new claim 11 is patentable over Lai in view of Janzen.

New claims 12-20 depend from new claim 11 and include further limitations in addition to the limitations in new claim 11. Therefore, new claims 12-20 are patentable for at least the same reasons new claim 11 is patentable.

The above arguments with regard to new claim 11 apply to new claim 21. Therefore, new claim 21 is also patentable.

New claims 22-30 depend from new claim 21 and include further limitations in addition to the limitations in new claim 21. Therefore, new claims 22-30 are patentable for at least the same reasons new claim 21 is patentable.

By responding in the foregoing remarks only to particular positions asserted by the Examiner, the Applicants do not necessarily acquiesce in other positions that have not been explicitly addressed. In addition, the Applicants' arguments for the patentability of a claim should not be understood as implying that no other reasons for the patentability of that claim exist.

In light of the above amendments and remarks, the Applicants respectfully request that the Examiner reconsider this application with a view towards allowance. The Examiner

is invited to call the undersigned attorney at (650) 273-6008, if a telephone call could help resolve any remaining items.

|                                |                                         |            |
|--------------------------------|-----------------------------------------|------------|
| Date: <u>November 20, 2014</u> | Respectfully submitted,                 |            |
|                                | /Jamie J. Zheng/                        | 51167      |
|                                | Jamie J. Zheng<br>Customer Number 79141 | (Reg. No.) |

| Electronic Patent Application Fee Transmittal  |                 |                                         |               |                             |
|------------------------------------------------|-----------------|-----------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                     |                 | 13971231                                |               |                             |
| <b>Filing Date:</b>                            |                 | 20-Aug-2013                             |               |                             |
| <b>Title of Invention:</b>                     |                 | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |               |                             |
| <b>First Named Inventor/Applicant Name:</b>    |                 | Jefferey C. Solomon                     |               |                             |
| <b>Filer:</b>                                  |                 | Jamie Jie Zheng                         |               |                             |
| <b>Attorney Docket Number:</b>                 |                 | NETL.018P2C7                            |               |                             |
| Filed as Small Entity                          |                 |                                         |               |                             |
| <b>Utility under 35 USC 111(a) Filing Fees</b> |                 |                                         |               |                             |
| <b>Description</b>                             | <b>Fee Code</b> | <b>Quantity</b>                         | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                           |                 |                                         |               |                             |
| <b>Pages:</b>                                  |                 |                                         |               |                             |
| <b>Claims:</b>                                 |                 |                                         |               |                             |
| <b>Miscellaneous-Filing:</b>                   |                 |                                         |               |                             |
| <b>Petition:</b>                               |                 |                                         |               |                             |
| <b>Patent-Appeals-and-Interference:</b>        |                 |                                         |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>       |                 |                                         |               |                             |
| <b>Extension-of-Time:</b>                      |                 |                                         |               |                             |
| Extension - 3 months with \$0 paid             | 2253            | 1                                       | 700           | 700                         |

| Description                      | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|----------------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>            |          |          |        |                      |
| Statutory or Terminal Disclaimer | 1814     | 1        | 160    | 160                  |
| <b>Total in USD (\$)</b>         |          |          |        | <b>860</b>           |

| Electronic Acknowledgement Receipt          |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>EFS ID:</b>                              | 20760901                                |
| <b>Application Number:</b>                  | 13971231                                |
| <b>International Application Number:</b>    |                                         |
| <b>Confirmation Number:</b>                 | 2072                                    |
| <b>Title of Invention:</b>                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                     |
| <b>Customer Number:</b>                     | 79141                                   |
| <b>Filer:</b>                               | Jamie Jie Zheng                         |
| <b>Filer Authorized By:</b>                 |                                         |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                            |
| <b>Receipt Date:</b>                        | 20-NOV-2014                             |
| <b>Filing Date:</b>                         | 20-AUG-2013                             |
| <b>Time Stamp:</b>                          | 22:37:54                                |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)             |

**Payment information:**

|                                          |             |
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| Submitted with Payment                   | yes         |
| Payment Type                             | Credit Card |
| Payment was successfully received in RAM | \$ 860      |
| RAM confirmation Number                  | 7579        |
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| Authorized User                          |             |

**File Listing:**

| Document Number | Document Description | File Name | File Size(Bytes)/<br>Message Digest | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------|-------------------------------------|------------------|------------------|
|-----------------|----------------------|-----------|-------------------------------------|------------------|------------------|



|                                                                                                                                                                                                            |                                                       |                                                   |                                                    |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------|----------------------------------------------------|-----|----|
| 1                                                                                                                                                                                                          | Power of Attorney                                     | 2014-11-20_AIA82A_transmittal_POA_NETL018P2C7.pdf | 195878<br>9810e347cb8c574bb978a1df7199b060a06c8688 | no  | 3  |
| Warnings:                                                                                                                                                                                                  |                                                       |                                                   |                                                    |     |    |
| Information:                                                                                                                                                                                               |                                                       |                                                   |                                                    |     |    |
| 2                                                                                                                                                                                                          | Power of Attorney                                     | AIA_General_POA_Netlist.pdf                       | 133545<br>f8258889ee9edc63b1cc17705b3158faaed49e9e | no  | 1  |
| Warnings:                                                                                                                                                                                                  |                                                       |                                                   |                                                    |     |    |
| The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing |                                                       |                                                   |                                                    |     |    |
| Information:                                                                                                                                                                                               |                                                       |                                                   |                                                    |     |    |
| 3                                                                                                                                                                                                          | Terminal Disclaimer Filed                             | 11-20-2014_Terminal_Disclaimer_NETL018P2C7.pdf    | 159887<br>e42c26b67482b7efc5d165a8de3bc715302560da | no  | 2  |
| Warnings:                                                                                                                                                                                                  |                                                       |                                                   |                                                    |     |    |
| Information:                                                                                                                                                                                               |                                                       |                                                   |                                                    |     |    |
| 4                                                                                                                                                                                                          |                                                       | 2014-11-20_Rsps_NFOA_NETL018P2C7.pdf              | 152528<br>22b8b5afe9f405ac53df7376b0421feff39da133 | yes | 15 |
|                                                                                                                                                                                                            | Multipart Description/PDF files in .zip description   |                                                   |                                                    |     |    |
|                                                                                                                                                                                                            | Document Description                                  |                                                   | Start                                              | End |    |
|                                                                                                                                                                                                            | Amendment/Req. Reconsideration-After Non-Final Reject |                                                   | 1                                                  | 1   |    |
|                                                                                                                                                                                                            | Specification                                         |                                                   | 2                                                  | 3   |    |
|                                                                                                                                                                                                            | Claims                                                |                                                   | 4                                                  | 10  |    |
|                                                                                                                                                                                                            | Applicant Arguments/Remarks Made in an Amendment      |                                                   | 11                                                 | 15  |    |
| Warnings:                                                                                                                                                                                                  |                                                       |                                                   |                                                    |     |    |
| Information:                                                                                                                                                                                               |                                                       |                                                   |                                                    |     |    |
| 5                                                                                                                                                                                                          | Fee Worksheet (SB06)                                  | fee-info.pdf                                      | 32358<br>1331c26e6f22b02efbfdf7e0ebf1f4da40bd4ade4 | no  | 2  |
| Warnings:                                                                                                                                                                                                  |                                                       |                                                   |                                                    |     |    |
| Information:                                                                                                                                                                                               |                                                       |                                                   |                                                    |     |    |
| Total Files Size (in bytes):                                                                                                                                                                               |                                                       |                                                   | 674196                                             |     |    |

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING  
REJECTION OVER A "PRIOR" PATENT**

Docket Number (Optional)  
NETL.018P2C7

In re Application of: Netlist, Inc.

Application No.: 13/971,231

Filed: August 20, 2013

For: LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

The applicant, Netlist, Inc., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 8,756,364 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

- expires for failure to pay a maintenance fee;
- is held unenforceable;
- is found invalid by a court of competent jurisdiction;
- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;
- has all claims canceled by a reexamination certificate;
- is reissued; or
- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☒ The undersigned is an attorney or agent of record. Reg. No. 51167

/Jamie J. Zheng/  
Signature

November 20, 2014  
Date

Jamie J. Zheng  
Typed or printed name

Title

650-273-6008  
Telephone Number

☒ Terminal disclaimer fee under 37 CFR 1.20(d) included.

**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

This collection of information is required by 37 CFR 1.321. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
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## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

**NOTE:** This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

|                        |                                         |
|------------------------|-----------------------------------------|
| Application Number     | 13/971,231                              |
| Filing Date            | 8/20/2013                               |
| First Named Inventor   | Jefferey C. Solomon                     |
| Title                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| Art Unit               | 2072                                    |
| Examiner Name          | BANSAL, GURTEJ                          |
| Attorney Docket Number | NETL.018P2C7                            |

### SIGNATURE of Applicant or Patent Practitioner

|                     |                  |           |                   |
|---------------------|------------------|-----------|-------------------|
| Signature           | /Jamie J. Zheng/ | Date      | NOVEMBER 11, 2014 |
| Name                | Jamie J. Zheng   | Telephone | 650-273-6008      |
| Registration Number | 51,167           |           |                   |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications.

☐ \*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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## POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

- ☐ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

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**OR**

- ☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

| Name | Registration Number |  | Name | Registration Number |
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| Address                                          |  |       |  |     |
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| Country                                          |  |       |  |     |
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I am the Applicant:

- ☐ Inventor or Joint Inventor
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor
- ☐ Assignee or Person to Whom the Inventor is Under an Obligation to Assign
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

### SIGNATURE of Applicant for Patent

|                   |  |           |  |
|-------------------|--|-----------|--|
| Signature         |  | Date      |  |
| Name              |  | Telephone |  |
| Title and Company |  |           |  |

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- ☐ \*Total of \_\_\_\_\_ forms are submitted.

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**GENERAL POWER OF ATTORNEY BY APPLICANT  
FOR UNITED STATES PATENT**

I hereby revoke all previous powers of attorney given in the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent).

I hereby appoint the practitioner associated with the following Customer Number  
:

79141

as my/our attorney or agent, and to transact all business in the United States Patent and Trademark Office in connection with the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent).

Please recognize or change the correspondence address for the application referenced in the attached transmittal letter to the address associated with the above-mentioned Customer Number.

I am the Applicant:

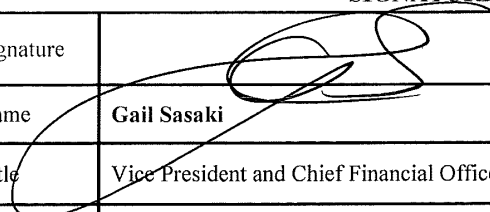
☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is currently being filed in this document)

**SIGNATURE of Applicant for Patent**

|           |                                                                                     |                       |
|-----------|-------------------------------------------------------------------------------------|-----------------------|
| Signature |  | Date: January 9, 2013 |
| Name      | Gail Sasaki                                                                         |                       |
| Title     | Vice President and Chief Financial Officer                                          |                       |
| Company   | Netlist, Inc.                                                                       |                       |

Note: Signature - this form must be signed by the Applicant or a person authorized to act on behalf of Applicant.

Submit multiple forms for more than one signature  
Total of \_\_\_ forms are submitted.



|                                                                                   |  |  |  |                                                   |  |                                  |  |                                       |  |
|-----------------------------------------------------------------------------------|--|--|--|---------------------------------------------------|--|----------------------------------|--|---------------------------------------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875 |  |  |  | Application or Docket Number<br><b>13/971,231</b> |  | Filing Date<br><b>08/20/2013</b> |  | <input type="checkbox"/> To be Mailed |  |
|-----------------------------------------------------------------------------------|--|--|--|---------------------------------------------------|--|----------------------------------|--|---------------------------------------|--|

**ENTITY:**   ☐ LARGE   ☒ SMALL   ☐ MICRO

| APPLICATION AS FILED – PART I                                              |                                                                                                                                                                                                                               |              |            |  |           |          |  |  |  |
|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|--|-----------|----------|--|--|--|
| (Column 1)                                                                 |                                                                                                                                                                                                                               |              | (Column 2) |  |           |          |  |  |  |
| FOR                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA |            |  | RATE (\$) | FEE (\$) |  |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))        | N/A                                                                                                                                                                                                                           | N/A          |            |  | N/A       |          |  |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (j), or (m))       | N/A                                                                                                                                                                                                                           | N/A          |            |  | N/A       |          |  |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A                                                                                                                                                                                                                           | N/A          |            |  | N/A       |          |  |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                           | minus 20 =                                                                                                                                                                                                                    | *            |            |  | X \$      | =        |  |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                     | minus 3 =                                                                                                                                                                                                                     | *            |            |  | X \$      | =        |  |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |              |            |  |           |          |  |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |              |            |  |           |          |  |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.  |                                                                                                                                                                                                                               |              |            |  |           | TOTAL    |  |  |  |

| APPLICATION AS AMENDED – PART II |                                                                                          |                                  |            |                                    |               |                 |  |           |                     |  |
|----------------------------------|------------------------------------------------------------------------------------------|----------------------------------|------------|------------------------------------|---------------|-----------------|--|-----------|---------------------|--|
| (Column 1)                       |                                                                                          |                                  | (Column 2) |                                    |               | (Column 3)      |  |           |                     |  |
| AMENDMENT                        | 11/20/2014                                                                               | CLAIMS REMAINING AFTER AMENDMENT |            | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                 |  | RATE (\$) | ADDITIONAL FEE (\$) |  |
|                                  | Total (37 CFR 1.16(i))                                                                   | * 20                             | Minus      | ** 20                              | = 0           |                 |  | x \$40 =  | 0                   |  |
|                                  | Independent (37 CFR 1.16(h))                                                             | * 2                              | Minus      | ***3                               | = 0           |                 |  | x \$210 = | 0                   |  |
|                                  | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |            |                                    |               |                 |  |           |                     |  |
|                                  | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |            |                                    |               |                 |  |           |                     |  |
|                                  |                                                                                          |                                  |            |                                    |               | TOTAL ADD'L FEE |  | <b>0</b>  |                     |  |

| (Column 1) |                                                                                          |                                  | (Column 2) |                                    |               | (Column 3)      |  |           |                     |  |
|------------|------------------------------------------------------------------------------------------|----------------------------------|------------|------------------------------------|---------------|-----------------|--|-----------|---------------------|--|
| AMENDMENT  |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT |            | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                 |  | RATE (\$) | ADDITIONAL FEE (\$) |  |
|            | Total (37 CFR 1.16(i))                                                                   | *                                | Minus      | **                                 | =             |                 |  | X \$      | =                   |  |
|            | Independent (37 CFR 1.16(h))                                                             | *                                | Minus      | ***                                | =             |                 |  | X \$      | =                   |  |
|            | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |            |                                    |               |                 |  |           |                     |  |
|            | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |            |                                    |               |                 |  |           |                     |  |
|            |                                                                                          |                                  |            |                                    |               | TOTAL ADD'L FEE |  |           |                     |  |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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|                                                                                                                                          |   |    |                          |                        |              |
|------------------------------------------------------------------------------------------------------------------------------------------|---|----|--------------------------|------------------------|--------------|
| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | <b>Complete if Known</b> |                        |              |
|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | BANSAL, GURTEJ         |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 6747887                                  | 06-08-2004                       | Halbert et al.                                     |                                                                                 |
|                        | 2.                       | 7093066                                  | 08-15-2006                       | Klein                                              |                                                                                 |
|                        | 3.                       | 6832303                                  | 12/14/2004                       | Tanaka                                             |                                                                                 |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                       |  |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.       |  | T <sup>2</sup> |
|                                 | 4.                    | Inter Partes Review Case No. IPR2014-00882, Corrected Petition for Inter Partes Review of U.S. Patent No. 7,881,150, filed on July 8, 2014.                                                                                                                           |  |                |
|                                 | 5.                    | Inter Partes Review Case No. IPR2014-00882, Exhibit 1007 to Petition for Inter Partes Review, “Declaration of Dr. Srinivasan Jagannathan,” filed on June 22, 2014.                                                                                                    |  |                |
|                                 | 6.                    | Inter Partes Review Case No. IPR2014-00883, Corrected Petition for Inter Partes Review of U.S. Patent No. 8,081,536, filed on July 8, 2014.                                                                                                                           |  |                |
|                                 | 7.                    | Inter Partes Review Case No. IPR2014-00883, Exhibit 1011 to Petition for Inter Partes Review, “Declaration of Dr. Srinivasan Jagannathan,” filed on June 21, 2014.                                                                                                    |  |                |
|                                 | 8.                    | Inter Partes Review Case No. IPR2014-01011, Corrected Petition for Inter Partes Review of U.S. Patent No. 7,881,150, filed on July 8, 2014.                                                                                                                           |  |                |
|                                 | 9.                    | Inter Partes Review Case No. IPR2014-01011, Exhibit 1007 to Petition for Inter Partes Review, “Declaration of Dr. Srinivasan Jagannathan.” filed on June 22, 2014.                                                                                                    |  |                |
|                                 | 10.                   | McCluskey, Edward J., <i>Logic Design Principles with Emphasis on Testable Semicustom Circuits</i> , Prentice Hall, 1986, pp. 104-107 and 119-120.                                                                                                                    |  |                |
|                                 | 11.                   | MICRON, DDR SDRAM DIMM Module: MT16VDDT3264A – 256 MB; MT16VDDT6464A – 512 MB, Data Sheet, 2002, Micron Technology, Inc.                                                                                                                                              |  |                |
|                                 | 12.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Smart Storage Systems, Inc.’s Invalidity Contentions, dated June 6, 2014                        |  |                |
|                                 | 13.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits F.1-F.5 to “Smart Storage Systems, Inc.’s Invalidity Contentions,” dated June 6, 2014. |  |                |
|                                 | 14.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits G.1-G.6 to “Smart Storage Systems, Inc.’s Invalidity Contentions,” dated June 6, 2014. |  |                |
|                                 | 15.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibit H to “Smart Storage Systems, Inc.’s Invalidity Contentions,” dated June 6, 2014.        |  |                |

## EXAMINER

## DATE CONSIDERED

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

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|                                                                                                                                          |   |    |   |                          |                  |
|------------------------------------------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------|
| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    |   | <b>Complete if Known</b> |                  |
|                                                                                                                                          |   |    |   | Application Number       | 13/971,231       |
|                                                                                                                                          |   |    |   | Filing Date              | August 20, 2013  |
|                                                                                                                                          |   |    |   | First Named Inventor     | Jayesh R. Bhakta |
|                                                                                                                                          |   |    |   | Art Unit                 | 2189             |
|                                                                                                                                          |   |    |   | Examiner Name            | BANSAL, GURTEJ   |
| Sheet                                                                                                                                    | 2 | of | 1 | Attorney Docket Number   | NETL.018P2C7     |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                        |                |
|---------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.        | T <sup>2</sup> |
|                                 | 16.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Diablo Technologies, Inc.'s Invalidity Contentions, dated June 6, 2014.                          |                |
|                                 | 17.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits F-1 to F-5 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |
|                                 | 18.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits G-1 to G-6 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |
|                                 | 19.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibit H to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014.           |                |

EXAMINER

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| Electronic Patent Application Fee Transmittal |          |                                         |        |                      |
|-----------------------------------------------|----------|-----------------------------------------|--------|----------------------|
| Application Number:                           |          | 13971231                                |        |                      |
| Filing Date:                                  |          | 20-Aug-2013                             |        |                      |
| Title of Invention:                           |          | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |        |                      |
| First Named Inventor/Applicant Name:          |          | Jefferey C. Solomon                     |        |                      |
| Filer:                                        |          | Jamie Jie Zheng                         |        |                      |
| Attorney Docket Number:                       |          | NETL.018P2C7                            |        |                      |
| Filed as Small Entity                         |          |                                         |        |                      |
| Utility under 35 USC 111(a) Filing Fees       |          |                                         |        |                      |
| Description                                   | Fee Code | Quantity                                | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                         |        |                      |
| Pages:                                        |          |                                         |        |                      |
| Claims:                                       |          |                                         |        |                      |
| Miscellaneous-Filing:                         |          |                                         |        |                      |
| Petition:                                     |          |                                         |        |                      |
| Patent-Appeals-and-Interference:              |          |                                         |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                         |        |                      |
| Extension-of-Time:                            |          |                                         |        |                      |

| Description                             | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>                   |          |          |        |                      |
| Submission- Information Disclosure Stmt | 2806     | 1        | 90     | 90                   |
| <b>Total in USD (\$)</b>                |          |          |        | <b>90</b>            |

| Electronic Acknowledgement Receipt          |                                         |
|---------------------------------------------|-----------------------------------------|
| <b>EFS ID:</b>                              | 20816951                                |
| <b>Application Number:</b>                  | 13971231                                |
| <b>International Application Number:</b>    |                                         |
| <b>Confirmation Number:</b>                 | 2072                                    |
| <b>Title of Invention:</b>                  | LOAD-REDUCING CIRCUIT FOR MEMORY MODULE |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                     |
| <b>Customer Number:</b>                     | 79141                                   |
| <b>Filer:</b>                               | Jamie Jie Zheng                         |
| <b>Filer Authorized By:</b>                 |                                         |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                            |
| <b>Receipt Date:</b>                        | 27-NOV-2014                             |
| <b>Filing Date:</b>                         | 20-AUG-2013                             |
| <b>Time Stamp:</b>                          | 01:47:09                                |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)             |

**Payment information:**

|                                          |             |
|------------------------------------------|-------------|
| Submitted with Payment                   | yes         |
| Payment Type                             | Credit Card |
| Payment was successfully received in RAM | \$ 90       |
| RAM confirmation Number                  | 8168        |
| Deposit Account                          |             |
| Authorized User                          |             |

**File Listing:**

| Document Number | Document Description | File Name | File Size(Bytes)/<br>Message Digest | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------|-------------------------------------|------------------|------------------|
|-----------------|----------------------|-----------|-------------------------------------|------------------|------------------|

|                                                 |                                                    |                                                                       |                                                      |    |     |
|-------------------------------------------------|----------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------|----|-----|
| 1                                               | Transmittal Letter                                 | 2014-11-26_IDS_Cover_NETL018P2C7.pdf                                  | 54357<br>901eec77f9e61a9b47a11bd1763390dd3502daf5    | no | 2   |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 2                                               | Information Disclosure Statement (IDS) Form (SB08) | 2014-11-26_IDS_NETL018P2C7.pdf                                        | 124611<br>7ff94f702e4e8209808f97d89a0e651bf2510c0d   | no | 2   |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| This is not an USPTO supplied IDS fillable form |                                                    |                                                                       |                                                      |    |     |
| 3                                               | Non Patent Literature                              | 20140708_Corrected_Petition_for_Inter_Parties_Review_IPR201400882.pdf | 5916394<br>ca7955bd18406ea9f2ef6a8ef2a1589895a0b43a4 | no | 67  |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 4                                               | Non Patent Literature                              | Exhibit_1007_Declaration_IPR201400882.pdf                             | 23268956<br>d5246ffbde107498b9ef92db0dcff1b8260eb27a | no | 392 |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 5                                               | Non Patent Literature                              | 20140708_Corrected_Petition_for_Inter_Parties_Review_IPR201400883.pdf | 6432014<br>d0e71763e1fea5859087c84c1ee77fcc75618896  | no | 68  |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 6                                               | Non Patent Literature                              | Exhibit_1011_IPR201400883.pdf                                         | 14560728<br>fb06579024a277e530bb09684f84c99d8ba6d629 | no | 266 |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 7                                               | Non Patent Literature                              | 20140708_Corrected_Petition_for_Inter_Parties_Review_IPR201401011.pdf | 6392456<br>7ac563fe82a2624343712ca50ac41363d6c50fe3  | no | 68  |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 8                                               | Non Patent Literature                              | McCluskey_1986.pdf                                                    | 2063520<br>65a221b1bdf55ee1a8405d71c7abad8727c74168  | no | 9   |
| <b>Warnings:</b>                                |                                                    |                                                                       |                                                      |    |     |
| <b>Information:</b>                             |                                                    |                                                                       |                                                      |    |     |
| 9                                               | Non Patent Literature                              | Micron_2002.pdf                                                       | 625881<br>5e9f78c41b214887c1f21776a02eac5ac96a605    | no | 26  |

|              |                       |                                                   |                                          |    |     |
|--------------|-----------------------|---------------------------------------------------|------------------------------------------|----|-----|
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 10           | Non Patent Literature | 20140606_Smart_Storage_Invalidity_Contentions.pdf | 13104462                                 | no | 85  |
|              |                       |                                                   | 83f1b654d7f616ae16cad08de64a38f023f7b    |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 11           | Non Patent Literature | Exhibit_F1_F5.pdf                                 | 2996579                                  | no | 154 |
|              |                       |                                                   | 6dd1be41b8dd93ee6334946c9a6217b76c857dce |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 12           | Non Patent Literature | Exhibit_G1_G6.pdf                                 | 814795                                   | no | 79  |
|              |                       |                                                   | f3816f131e6647c738db336a28043f2ba245fa3  |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 13           | Non Patent Literature | Exhibit_H_Smart_Storage.pdf                       | 452099                                   | no | 3   |
|              |                       |                                                   | b3c4e028d034619877dbee4afa57879e9dbfb613 |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 14           | Non Patent Literature | 20140606_DIABLO_Invalidity_Contentions.pdf        | 1703900                                  | no | 41  |
|              |                       |                                                   | ed2e5f22373448111011661f8139988b2fa4464  |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 15           | Non Patent Literature | Exhibit_F.pdf                                     | 2358744                                  | no | 178 |
|              |                       |                                                   | 9d1ee457c9c36d7ca24b6cf55b8044d6b370205  |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 16           | Non Patent Literature | Exhibit_G.pdf                                     | 1201560                                  | no | 137 |
|              |                       |                                                   | d2cc352a3768ba3172145adbea8b7b0147a8ca58 |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 17           | Non Patent Literature | Exhibit_H_Diablo.pdf                              | 45048                                    | no | 3   |
|              |                       |                                                   | 81f1e4da57ee373a3d87d4c1e42a28642560bda9 |    |     |
| Warnings:    |                       |                                                   |                                          |    |     |
| Information: |                       |                                                   |                                          |    |     |
| 18           | Fee Worksheet (SB06)  | fee-info.pdf                                      | 30183                                    | no | 2   |
|              |                       |                                                   | c573c381d01822ce77b07ca8151f37385bb41e   |    |     |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 82146287 |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |          |

INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : Netlist, Inc.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : BANSAL, GURTEJ                             |
| Art Unit  | : 2189                                       |
| Conf No.  | : 2072                                       |

---

Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application is a Form PTO/SB/08a/b Equivalent listing 19 references. Copies of foreign documents and/or their translation and non-patent literature are submitted herewith.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

Application No.: 13/971,231  
Filing Date: August 20, 2013

---

The Commissioner is authorized to charge any required fees to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: November 26, 2014

/Jamie J. Zheng/

Jamie J. Zheng  
Customer No. 79141  
(650) 273-6008

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51167  
(Reg. No.)



UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 13/971,231         | 08/20/2013            | Jefferey C. Solomon   | NETL.018P2C7           |

**CONFIRMATION NO. 2072**

**POA ACCEPTANCE LETTER**



Date Mailed: 12/03/2014

79141

The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

**NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY**

This is in response to the Power of Attorney filed 11/20/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/dtdinh/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

|                                                                                                                |                         |                                         |  |
|----------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------|--|
| <b>Application Number</b><br> | Application/Control No. | Applicant(s)/Patent under Reexamination |  |
|                                                                                                                | 13/971,231              | SOLOMON ET AL.                          |  |
| <b>Document Code - DISQ</b>                                                                                    |                         | <b>Internal Document – DO NOT MAIL</b>  |  |

|                                |                                                       |                                      |
|--------------------------------|-------------------------------------------------------|--------------------------------------|
| <b>TERMINAL<br/>DISCLAIMER</b> | <input checked="" type="checkbox"/> APPROVED          | <input type="checkbox"/> DISAPPROVED |
| Date Filed : 11/20/14          | This patent is subject<br>to a Terminal<br>Disclaimer |                                      |

|                                 |
|---------------------------------|
| <b>Approved/Disapproved by:</b> |
| Lawana Hixon                    |

U.S. Patent and Trademark Office



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NOTICE OF ALLOWANCE AND FEE(S) DUE

79141 7590 01/09/2015  
The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

EXAMINER

BANSAL, GURTEJ

ART UNIT

PAPER NUMBER

2139

DATE MAILED: 01/09/2015

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/971,231      | 08/20/2013  | Jefferey C. Solomon  | NEIL.018P2C7        | 2072             |

TITLE OF INVENTION: LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$480         | \$0                 | \$0                  | \$480            | 04/09/2015 |

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

# PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

79141 7590 01/09/2015  
The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/971,231      | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7        | 2072             |

TITLE OF INVENTION: LOAD-REDUCING CIRCUIT FOR MEMORY MODULE

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$480         | \$0                 | \$0                  | \$480            | 04/09/2015 |

| EXAMINER       | ART UNIT | CLASS-SUBCLASS |
|----------------|----------|----------------|
| BANSAL, GURTEJ | 2139     | 711-105000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**NOTE:** This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_



# UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO.                                                                                            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.        | CONFIRMATION NO. |
|------------------------------------------------------------------------------------------------------------|-------------|----------------------|----------------------------|------------------|
| 13/971,231                                                                                                 | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7               | 2072             |
| 79141 7590 01/09/2015<br>The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306 |             |                      | EXAMINER<br>BANSAL, GURTEJ |                  |
|                                                                                                            |             |                      | ART UNIT<br>2139           | PAPER NUMBER     |

DATE MAILED: 01/09/2015

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.



## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

|                               |                                                                              |                                                                      |                                                  |
|-------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------|
| <b>Notice of Allowability</b> | <b>Application No.</b><br>13/971,231<br><br><b>Examiner</b><br>GURTEJ BANSAL | <b>Applicant(s)</b><br>SOLOMON ET AL.<br><br><b>Art Unit</b><br>2139 | <b>AIA (First Inventor to File) Status</b><br>No |
|-------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------|--------------------------------------------------|

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to Applicant Amendment dated 12/03/2014.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 11-30. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
**Certified copies:**  
 a) ☐ All    b) ☐ Some    \*c) ☐ None of the:  
     1. ☐ Certified copies of the priority documents have been received.  
     2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_ .  
     3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).  
     \* Certified copies not received: \_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

|                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)<br>2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date <u>08/07/2014; 11/27/2014</u><br>3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material<br>4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date ____ . | 5. <input type="checkbox"/> Examiner's Amendment/Comment<br>6. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance<br>7. <input type="checkbox"/> Other _____. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                    |  |
|----------------------------------------------------|--|
| /GURTEJ BANSAL/<br>Primary Examiner, Art Unit 2139 |  |
|----------------------------------------------------|--|

### Memory module with a **circuit** providing load **isolation** and memory domain translation

JC Solomon, JR Bhakta - US Patent 7,636,274, 2009 - Google Patents

... Memory module with a **circuit** providing load **isolation** and memory domain translation US 7636274 B2. Abstract. ... memory module of claim 39, wherein the **circuit** is configurable to selectively **isolate** both the ... to be responsive to the set of input signals by selectively **isolating** one or ...

Cited by 74 Related articles All 4 versions Cite Save

### Programmable dynamic random access memory (DRAM)

S Schaefer - US Patent 5,457,659, 1995 - Google Patents

... Programmable **DQS** preamble. US7349269, Aug 31, 2005, Mar 25, 2008, Micron Technology, Inc. Programmable **DQS** preamble. ... **isolation circuit**. ... Asynchronously-accessible memory device with mode selection **circuitry** for burst or pipelined operation. ...

Cited by 74 Related articles All 2 versions Cite Save

### **Circuit** providing load **isolation** and memory domain translation for memory module

JR Bhakta, JC Solomon - US Patent 7,881,150, 2011 - Google Patents

... The method further comprises activating the **circuit** to selectively **isolate** at least one of the loads of ... used to reduce the current flow between the first **DQS** pin and the second **DQS** pin. ... As used herein, the term "**isolation**" is a broad term which includes, without limitation, electrical ...

Cited by 13 Related articles All 5 versions Cite Save

### Dynamic redundancy for random access memory assemblies

TJ Dell, MW Kellogg - US Patent 5,996,096, 1999 - Google Patents

... In order to **isolate** the ASIC and DRAM data drivers, some kind of switch is needed. However, because a ... re-mapping **circuitry** is implemented as an ASIC device and dotted directly to the RAM devices (all **DQs**) as well ... Signal sharing **circuit** with microelectric die **isolation** features. ...

Cited by 48 Related articles All 2 versions Cite Save

### **Circuit** and method for reading data transfers that are sent with a source synchronous clock signal

PW Coteus, FD Ferraolo, KC Gower - US Patent 6,807,125, 2004 - Google Patents

... The concepts of the present invention can also be further extended to provide a mode in which a greater range of possible arrivals of dq and **dqs** signals, (higher elasticity) are safely captured at the ... Memory module with a **circuit** providing load **isolation** and memory ...

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### **Circuit** providing load **isolation** and memory domain translation for memory module

JR Bhakta, JC Solomon - US Patent 7,916,574, 2011 - Google Patents

... **Circuit** providing load **isolation** and memory domain translation for memory module US 7916574 B1. ... The method further comprises activating the **circuit** to selectively **isolate** at least one of ... of example memory modules comprising a **circuit** which multiplexes the **DQS** data strobe ...

Cited by 5 Related articles All 5 versions Cite Save

### Memory system with switching for data **isolation**

MM Deneroff, KM Sarocky, DL McCall... - US Patent ..., 2001 - Google Patents

... said memory module not requiring switches disposed on said memory module for data **isolation** and not ... be placed in the memory system without affecting performance since the switches **isolate** unused DIMM ... of **DQS**, and output data is referenced to both edges of **DQS**, as well ...

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### High-speed data-rate converting and switching **circuit**

C Karabatsos - US Patent 6,854,042, 2005 - Google Patents

... DQSA1 are directed to memory Bank A. Similarly, strobes DQSB and DQSB1, generated by **DQS circuitry** 202, are ... SW 37, 38, 39 **isolate** the internals of the device from the BUS to which ... This low capacitance and the **isolation** feature allows the BUS to operate at high frequencies ...

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### Memory system with switching for data **isolation**

MM Deneroff, DL McCall, DE McCracken... - US Patent ..., 2000 - Google Patents

... Memory system with switching for data **isolation** US 6115278 A. Abstract. A memory system that ... be placed in the memory system without affecting performance since the switches **isolate** unused DIMM ... edges of **DQS**, and output data is referenced to both edges of **DQS**, as well as ...

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### Tri-directional, high-speed bus switch

C Karabatsos - US Patent 6,737,891, 2004 - Google Patents

... A port may be connected to the corresponding B port, with both A and B ports **isolated** from the ...  
Furthermore, strobe signals are generated which appear at **DQS** CA and **DQS** CB. ... Note that this **circuitry** provides for a high impedance of FET switch FS1, **isolating** port Cn from ports ...  
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Receipt date: 08/07/2014

13971231 - GAU: 2139

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012. OMB 0651-0031

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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | Application Number       | 13/971,231             |              |
|                                                                                                      |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                      |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                      |   |    | Art Unit                 | 2189                   |              |
|                                                                                                      |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 6011710                                  | 01-04-2000                       | Wiggers                                            |                                                                                 |
|                        | 2.                       | 20010008006                              | 07-12-2001                       | Klein                                              |                                                                                 |
|                        | 3.                       | 20050257109                              | 11-17-2005                       | Averbuj                                            |                                                                                 |
|                        | 4.                       | 20070070669                              | 03-29-2007                       | Tsern                                              |                                                                                 |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                                                                           |                |
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|                                 | 5.                       | Petition for Inter Partes Review filed on 6/24/2014 for U.S. Patent No. 8,516,185, IPR Case Number IPR2014-01029, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a>                                   |                |
|                                 | 6.                       | Petition for Inter Partes Review filed on 6/22/2014 for U.S. Patent No. 7,881,150, IPR Case Number IPR2014-00882 and IPR Case Number IPR2014-01011, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a> |                |
|                                 | 7.                       | Petition for Inter Partes Review filed on 6/24/2014 for U.S. Patent No. 8,081,536, IPR Case Number IPR2014-00883, and all associated documents including cited references and expert declarations, available at <a href="https://ptabtrials.uspto.gov">https://ptabtrials.uspto.gov</a>                                   |                |
|                                 | 8.                       | Altera, ACEX iK, Programmable Logic Device Family, Data Sheet, May 2003, Ver 3.4                                                                                                                                                                                                                                          |                |
|                                 | 9.                       | Horowitz, "The Art of Electronics," Cambridge Univ. Press, 1989, selected pages                                                                                                                                                                                                                                           |                |
|                                 | 10.                      | Jacob, Bruce L.; "Synchronous DRAM Architectures, Organizations, and Alternative Technologies". University of Maryland, Dec. 10, 2002.                                                                                                                                                                                    |                |
|                                 | 11.                      | JEDEC Standard No. 21-C Section 4.5.7, 168 Pin Registered SDRAM DIMM Family, Release 7                                                                                                                                                                                                                                    |                |
|                                 | 12.                      | JEDEC 21-C, Section 4.6.1, 278 Pin Buffered SDRAM DIMM Family                                                                                                                                                                                                                                                             |                |
|                                 | 13.                      | JEDEC Standard No. 21-C Section 4.1.2.5, Appendix E, "Specific PD's for Synchronous DRAM (SDRAM)," pp. 1-25,                                                                                                                                                                                                              |                |

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|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>SOLOMON ET AL. |
|                                                                                                              | <b>Examiner</b><br><br>GURTEJ BANSAL           | <b>Art Unit</b><br><br>2189                                          |

| CPC- SEARCHED |      |          |
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| CPC COMBINATION SETS - SEARCHED |      |          |
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| US CLASSIFICATION SEARCHED |          |            |          |
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| Class                      | Subclass | Date       | Examiner |
| 711                        | 5; 147   | 05/15/2014 | GB       |

| SEARCH NOTES                                        |            |          |
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| Search Notes                                        | Date       | Examiner |
| Text Search in EAST (See Attached)                  | 05/15/2014 | GB       |
| NPL Search in Google Scholar (See Attached)         | 05/15/2014 | GB       |
| Inventor Search in eDAN                             | 05/15/2014 | GB       |
| Consulted Alex Sofocleous (SPE)                     | 05/15/2014 | GB       |
| Updated Text Search in EAST (See Attached)          | 12/16/2014 | GB       |
| Updated Text Search in EAST (See Attached)          | 01/02/2015 | GB       |
| UPdated NPL Search in Google Scholar (See Attached) | 01/02/2015 | GB       |

| INTERFERENCE SEARCH     |                         |            |          |
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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
|                                                                                                                                          |   |    | Examiner Name            | BANSAL, GURTEJ         |              |
| Sheet                                                                                                                                    | 1 | of | 1                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS |                       |                                          |                               |                                                 |                                                                           |
|---------------------|-----------------------|------------------------------------------|-------------------------------|-------------------------------------------------|---------------------------------------------------------------------------|
| Examiner Initials * | Cite No. <sup>1</sup> | Document Number                          | Publication Date (MM-DD-YYYY) | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear |
|                     |                       | Number-Kind Code <sup>2</sup> (if known) |                               |                                                 |                                                                           |
|                     | 1.                    | 6747887                                  | 06-08-2004                    | Halbert et al.                                  |                                                                           |
|                     | 2.                    | 7093066                                  | 08-15-2006                    | Klein                                           |                                                                           |
|                     | 3.                    | 6832303                                  | 12/14/2004                    | Tanaka                                          |                                                                           |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                       |                |  |
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| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.       | T <sup>2</sup> |  |
|                                 | 4.                    | Inter Partes Review Case No. IPR2014-00882, Corrected Petition for Inter Partes Review of U.S. Patent No. 7,881,150, filed on July 8, 2014.                                                                                                                           |                |  |
|                                 | 5.                    | Inter Partes Review Case No. IPR2014-00882, Exhibit 1007 to Petition for Inter Partes Review, "Declaration of Dr. Srinivasan Jagannathan," filed on June 22, 2014.                                                                                                    |                |  |
|                                 | 6.                    | Inter Partes Review Case No. IPR2014-00883, Corrected Petition for Inter Partes Review of U.S. Patent No. 8,081,536, filed on July 8, 2014.                                                                                                                           |                |  |
|                                 | 7.                    | Inter Partes Review Case No. IPR2014-00883, Exhibit 1011 to Petition for Inter Partes Review, "Declaration of Dr. Srinivasan Jagannathan," filed on June 21, 2014.                                                                                                    |                |  |
|                                 | 8.                    | Inter Partes Review Case No. IPR2014-01011, Corrected Petition for Inter Partes Review of U.S. Patent No. 7,881,150, filed on July 8, 2014.                                                                                                                           |                |  |
|                                 | 9.                    | Inter Partes Review Case No. IPR2014-01011, Exhibit 1007 to Petition for Inter Partes Review, "Declaration of Dr. Srinivasan Jagannathan," filed on June 22, 2014.                                                                                                    |                |  |
|                                 | 10.                   | McCluskey, Edward J., <i>Logic Design Principles with Emphasis on Testable Semicustom Circuits</i> , Prentice Hall, 1986, pp. 104-107 and 119-120.                                                                                                                    |                |  |
|                                 | 11.                   | MICRON, DDR SDRAM DIMM Module: MT16VDDT3264A – 256 MB; MT16VDDT6464A – 512 MB, Data Sheet, 2002, Micron Technology, Inc.                                                                                                                                              |                |  |
|                                 | 12.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Smart Storage Systems, Inc.'s Invalidity Contentions, dated June 6, 2014                        |                |  |
|                                 | 13.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits F.1-F.5 to "Smart Storage Systems, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |  |
|                                 | 14.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits G.1-G.6 to "Smart Storage Systems, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |  |
|                                 | 15.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibit H to "Smart Storage Systems, Inc.'s Invalidity Contentions," dated June 6, 2014.        |                |  |

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|                                                                                                                                          |   |    | Art Unit                 | 2189                   |              |
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|                                 | 16.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Diablo Technologies, Inc.'s Invalidity Contentions, dated June 6, 2014.                          |                |
|                                 | 17.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits F-1 to F-5 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |
|                                 | 18.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibits G-1 to G-6 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014. |                |
|                                 | 19.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, <i>Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc.</i> , Exhibit H to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014.           |                |

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| L1    | 3613  | DQS and DQ                                                     | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:10 |
| L2    | 1574  | DQS and DQ with (coupl\$3 connect\$3 isolat\$3 select\$3)      | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:10 |
| L3    | 1309  | DQS and DQ with (connect\$3 isolat\$3 select\$3)               | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:11 |
| L4    | 1108  | DQS and DQ with (coupl\$3 isolat\$3 select\$3)                 | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:11 |
| L5    | 569   | DQS and DQ with (coupl\$3 isolat\$3)                           | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:12 |
| L6    | 149   | DQS and DQ with (decoupl\$3 isolat\$3)                         | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:15 |
| L7    | 149   | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3)               | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:17 |
| L8    | 167   | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3 disconnect\$3) | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:17 |
| L9    | 20    | DQS and DQ with (disconnect\$3)                                | US-PGPUB; USPAT | OR               | OFF     | 2015/01/01 23:18 |
| L10   | 3     | "20010008006".pn. "20050257109".pn. "20070070669".pn.          | US-PGPUB; USPAT | OR               | OFF     | 2015/01/02 00:02 |
| L11   | 3     | "6747887".pn. "7093066".pn. "6832303".pn.                      | US-PGPUB; USPAT | OR               | OFF     | 2015/01/02 00:03 |
| S1    | 4386  | 711/5.ccls. 711/147.ccls.                                      | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:37 |
| S2    | 4481  | DQS                                                            | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S3    | 88990 | DS                                                             | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S4    | 32759 | DQ                                                             | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S5    | 3171  | S2 and S4                                                      | US-PGPUB;       | OR               | OFF     | 2013/12/02 23:38 |

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| S6 | 134822 | rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-PGPUB;<br>USPAT           | OR | ON  | 2013/12/02<br>23:38 |
| S7 | 329    | S5 and S6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB;<br>USPAT           | OR | ON  | 2013/12/02<br>23:38 |
| S8 | 201    | US-4218740-\$.DID. OR US-4368515-\$.DID. OR US-4392212-\$.DID. OR US-4633429-\$.DID. OR US-4670748-\$.DID. OR US-4706214-\$.DID. OR US-4866603-\$.DID. OR US-4958322-\$.DID. OR US-4961172-\$.DID. OR US-4961204-\$.DID. OR US-4980850-\$.DID. OR US-5247643-\$.DID. OR US-5272664-\$.DID. OR US-5345412-\$.DID. OR US-5357478-\$.DID. OR US-5388072-\$.DID. OR US-5392252-\$.DID. OR US-5426753-\$.DID. OR US-5483497-\$.DID. OR US-5485589-\$.DID. OR US-5495435-\$.DID. OR US-5513135-\$.DID. OR US-5532954-\$.DID. OR US-5541448-\$.DID. OR US-5572691-\$.DID. OR US-5581498-\$.DID. OR US-5590071-\$.DID. OR US-5602999-\$.DID. OR US-5638534-\$.DID. OR US-5655153-\$.DID. OR US-5699542-\$.DID. OR US-5702984-\$.DID. OR US-5703826-\$.DID. OR US-5745914-\$.DID. OR US-5764590-\$.DID. OR US-5784705-\$.DID. OR US-5802395-\$.DID. OR US-5805520-\$.DID. OR US-5822251-\$.DID. OR US-5909388-\$.DID. OR US-5926827-\$.DID. OR US-5926839-\$.DID. OR US-5953215-\$.DID. OR US-5958025-\$.DID. OR US-5959930-\$.DID. OR US-5963464-\$.DID. OR US-5966736-\$.DID. OR US-5974493-\$.DID. OR US-6018787-\$.DID. OR US-6044032-\$.DID. OR US-6070217-\$.DID. OR US-6070227-\$.DID. OR US-6097652-\$.DID. OR US-6108745-\$.DID. OR US-6115278-\$.DID. OR US-6134638-\$.DID. OR US-6151271-\$.DID. OR US-6154418-\$.DID. OR US-6154419-\$.DID. OR US-6185654-\$.DID. OR US-6209074-\$.DID. OR US-6226709-\$.DID. OR US-6226736-\$.DID. OR US-6233650-\$.DID. OR US-6247088-\$.DID. OR US-6317352-\$.DID. OR US-6349051-\$.DID. OR US-6400637-\$.DID. OR US-6408356-\$.DID. OR US-6414868-\$.DID. OR US-6415374-\$.DID. OR US-6438062-\$.DID. OR US-6446158-\$.DID. OR US-6446184-\$.DID. OR US-6453381-\$.DID. OR US-6470417-\$.DID. OR US-6487102-\$.DID. OR US-6502161-\$.DID. OR US-6518794-\$.DID. OR US-6526473-\$.DID. OR US-6530007-\$.DID. OR US-6530033-\$.DID. OR US-6553450-\$.DID. OR US-6618320-\$.DID. OR US-6621496-\$.DID. OR US-6625081-\$.DID. OR US-6625687-\$.DID. OR US-6636935-\$.DID. OR US-6646949-\$.DID. OR US-6658509-\$.DID. OR US-6674684-\$.DID. OR US-6681301-\$.DID. OR US-6683372-\$.DID. OR US- | US-PGPUB;<br>USPAT;<br>USOCR | OR | OFF | 2013/12/03<br>00:02 |

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| S9  | 1184 | multiplex\$3 with (DQS and DQ)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:07 |
| S10 | 359  | multiplex\$3 with (DQS and DQ) with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:08 |
| S11 | 850  | multiplex\$3 with DQS and delay with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S12 | 562  | multiplex\$3 with DQS and DQ with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S13 | 401  | multiplex\$3 with DQS same DQ with delay\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S14 | 0    | 13/287042.app.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S15 | 0    | 13/287042.ap.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S16 | 0    | "13287042".ap.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S17 | 0    | "13287042".app.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S18 | 294  | multiplex\$3 with DQS same delay\$3 with data with signals                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S19 | 307  | multiplex\$3 with DQS same delay\$3 with data with (signals lines)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S20 | 9    | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same2 rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S21 | 26   | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:29 |
| S22 | 238  | multiplex\$3 with DQS same delay\$3 with                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-             | OR | ON | 2013/12/03       |

|     |      |                                                   |                        |    |    |                     |
|-----|------|---------------------------------------------------|------------------------|----|----|---------------------|
|     |      | data with (signals lines) same memory             | PGPUB;<br>USPAT        |    |    | 00:30               |
| S23 | 347  | isolat\$3 with DQ with DQS                        | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:47 |
| S24 | 21   | isolat\$3 with DQ with DQS same Rank              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:47 |
| S25 | 1353 | DQS with select\$3 with (memory rank)             | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>00:50 |
| S26 | 54   | chip\$1select with rank and DQ and DQS            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:25 |
| S27 | 56   | chip\$1select same rank and DQ and DQS            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:26 |
| S28 | 61   | chip\$1select and rank and DQ and DQS             | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:27 |
| S29 | 5    | rank with DQ with DQS with low                    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:39 |
| S30 | 300  | rank with DQ with DQS                             | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:40 |
| S31 | 82   | rank and (DQ with DQS) with off                   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:03 |
| S32 | 271  | rank and (DQ with DQS) with high                  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S33 | 29   | rank with (DQ with DQS) with high                 | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S34 | 1    | "6873533".pn.                                     | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S35 | 7    | rank with (DQ with DQS) with terminat\$3          | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:10 |
| S36 | 20   | rank with (DQ with DQS) with isolat\$3            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S37 | 21   | rank same (DQ with DQS) with isolat\$3            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S38 | 57   | rank same (DQ with DQS) with high                 | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S39 | 7    | rank same (DQ with DQS) with (mux<br>multiplexer) | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:15 |
| S40 | 37   | rank and (DQ with DQS) with (mux<br>multiplexer)  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:16 |
| S41 | 1040 | (DQ with DQS) with (mux multiplexer)              | US-                    | OR | ON | 2013/12/03          |

|     |      |                                                                                                                                                 |                    |    |     |                     |
|-----|------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----|-----|---------------------|
|     |      |                                                                                                                                                 | PGPUB;<br>USPAT    |    |     | 19:21               |
| S42 | 1024 | (DQ with DQS) with (mux multiplexer) and memory                                                                                                 | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S43 | 634  | (DQ with DQS) with (mux multiplexer) same memory                                                                                                | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S44 | 231  | (DQ with DQS) with (mux multiplexer) with memory                                                                                                | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:21 |
| S45 | 1    | "20040098428".pn.                                                                                                                               | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:40 |
| S46 | 1    | "20040098528".pn.                                                                                                                               | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:41 |
| S47 | 1    | "20030070052".pn.                                                                                                                               | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:42 |
| S48 | 1    | "20050047250".pn.                                                                                                                               | US-PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>20:07 |
| S49 | 1599 | G06F12/0607.cpc. G06F12/0813.cpc.                                                                                                               | US-PGPUB;<br>USPAT | OR | OFF | 2013/12/20<br>11:11 |
| S50 | 2437 | latency with memory adj controller with memory                                                                                                  | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:15 |
| S51 | 59   | latency with memory adj controller with (measur\$3 test\$3)                                                                                     | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:16 |
| S52 | 22   | rank same (DQ with DQS) with isolat\$3                                                                                                          | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:16 |
| S53 | 22   | isolat\$3 with DQ with DQS same Rank                                                                                                            | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S54 | 26   | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                     | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S55 | 1    | "6553450".pn.                                                                                                                                   | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:33 |
| S56 | 1    | "6742098".pn.                                                                                                                                   | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:48 |
| S60 | 644  | isolat\$3 with load with memory                                                                                                                 | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S61 | 46   | isolat\$3 with load with memory with controller                                                                                                 | US-PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S62 | 28   | US-5345412-\$.DID. OR US-5537584-\$.DID. OR US-5617559-\$.DID. OR US-5649159-\$.DID. OR US-5717851-\$.DID. OR US-5724604-\$.DID. OR US-5729716- | US-PGPUB;<br>USPAT | OR | ON  | 2014/05/05<br>00:39 |

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| S63 | 2355572 | read\$only with non\$1volatile with main memory                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S64 | 2126    | read\$only with non\$1volatile with main with memory                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S65 | 1       | "20080080261".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | OFF | 2014/05/11 20:14 |
| S66 | 4529    | 711/5.ccls. 711/147.ccls.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-PGPUB; USPAT | OR | OFF | 2014/05/15 16:09 |

**EAST Search History (Interference)**

| Ref # | Hits   | Search Query                 | DBs            | Default Operator | Plurals | Time Stamp       |
|-------|--------|------------------------------|----------------|------------------|---------|------------------|
| L12   | 3626   | 711/5.ccls.<br>711/147.ccls. | USPAT;<br>UPAD | OR               | OFF     | 2015/01/02 00:11 |
| L13   | 5815   | isolates.clm.                | USPAT;<br>UPAD | OR               | OFF     | 2015/01/02 00:12 |
| L14   | 0      | L12 and "L143"               | USPAT;<br>UPAD | OR               | OFF     | 2015/01/02 00:12 |
| L15   | 7      | L12 and L13                  | USPAT;<br>UPAD | OR               | OFF     | 2015/01/02 00:12 |
| L16   | 0      | L12 and L13 and DQS.clm.     | USPAT;<br>UPAD | OR               | OFF     | 2015/01/02 00:15 |
| S57   | 3448   | 711/5.ccls.<br>711/147.ccls. | USPAT;<br>UPAD | OR               | OFF     | 2014/04/04 15:50 |
| S58   | 171076 | isolat\$3.clm.               | USPAT;<br>UPAD | OR               | OFF     | 2014/04/04 15:52 |
| S59   | 45     | S57 and S58                  | USPAT;<br>UPAD | OR               | OFF     | 2014/04/04 15:52 |

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|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|--|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |  |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |  |

| CPC    |    |  |    |      |            |
|--------|----|--|----|------|------------|
| Symbol |    |  |    | Type | Version    |
| G06F   | 12 |  | 00 | F    | 2013-01-01 |
| G11C   | 5  |  | 04 | I    | 2013-01-01 |
| G06F   | 13 |  | 00 | I    | 2013-01-01 |
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| CPC Combination Sets |      |     |         |         |
|----------------------|------|-----|---------|---------|
| Symbol               | Type | Set | Ranking | Version |
|                      |      |     |         |         |
|                      |      |     |         |         |

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|----------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                               |            | <b>Total Claims Allowed:</b> |                   |
|                                                    |            | 20                           |                   |
| (Assistant Examiner)                               | (Date)     |                              |                   |
| /GURTEJ BANSAL/<br>Primary Examiner, Art Unit 2139 | 01/01/2015 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                 | (Date)     | 11                           | 1                 |



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|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |

| US ORIGINAL CLASSIFICATION |                                   |          |  |  |  | INTERNATIONAL CLASSIFICATION |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
|----------------------------|-----------------------------------|----------|--|--|--|------------------------------|---|---|---|----------------------|-------------|--|--|--|--|--|--|--|--|--|
| CLASS                      |                                   | SUBCLASS |  |  |  | CLAIMED                      |   |   |   |                      | NON-CLAIMED |  |  |  |  |  |  |  |  |  |
| 711                        |                                   | 5        |  |  |  | G                            | 0 | 6 | F | 12 / 00 (2006.01.01) |             |  |  |  |  |  |  |  |  |  |
| CROSS REFERENCE(S)         |                                   |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
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| CLASS                      | SUBCLASS (ONE SUBCLASS PER BLOCK) |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
| 711                        | 147                               |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
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|---------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                              |            | <b>Total Claims Allowed:</b> |                   |
|                                                   |            | 20                           |                   |
| (Assistant Examiner)                              | (Date)     |                              |                   |
| /GURTEJ BANSAL/<br>Primary Examiner.Art Unit 2139 | 01/01/2015 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                | (Date)     | 11                           | 1                 |

|                                                                                                                  |                                            |                                                                  |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |

| <input type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input checked="" type="checkbox"/> T.D. <input type="checkbox"/> R.1.47 |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
| Final                                                                                                                                                                                        | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|                                                                                                                                                                                              | 1        | 9     | 17       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                              | 2        | 3     | 18       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                              | 3        | 10    | 19       |       |          |       |          |       |          |       |          |       |          |       |          |
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|                                                                                                                                                                                              | 7        | 15    | 23       |       |          |       |          |       |          |       |          |       |          |       |          |
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| 2                                                                                                                                                                                            | 12       | 13    | 28       |       |          |       |          |       |          |       |          |       |          |       |          |
| 5                                                                                                                                                                                            | 13       | 20    | 29       |       |          |       |          |       |          |       |          |       |          |       |          |
| 6                                                                                                                                                                                            | 14       | 14    | 30       |       |          |       |          |       |          |       |          |       |          |       |          |
| 7                                                                                                                                                                                            | 15       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
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|---------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                              |            | <b>Total Claims Allowed:</b> |                   |
|                                                   |            | 20                           |                   |
| (Assistant Examiner)                              | (Date)     |                              |                   |
| /GURTEJ BANSAL/<br>Primary Examiner.Art Unit 2139 | 01/01/2015 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                | (Date)     | 11                           | 1                 |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO. | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|------------------|------------|------------|
| 13/971,231            | 08/20/2013               | 2139            | 800           | NETL.018P2C7     | 10         | 2          |

CONFIRMATION NO. 2072

CORRECTED FILING RECEIPT

79141

The Law Office of Jamie Zheng, Ph.D Esq.

P.O. Box 60573

Palo Alto, CA 94306



OC000000073472062

Date Mailed: 02/19/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

**Inventor(s)**

Jefferey C. Solomon, Irvine, CA;

Jayesh R. Bhakta, Cerritos, CA;

**Applicant(s)**

Netlist, Inc., Irvine, CA

**Assignment For Published Patent Application**

Netlist, Inc., Irvine, CA

**Power of Attorney:** The patent practitioners associated with Customer Number 79141

**Domestic Priority data as claimed by applicant**

This application is a CON of 13/287,081 11/01/2011 PAT 8516188

which is a CON of 13/032,470 02/22/2011 PAT 8081536

which is a CON of 12/955,711 11/29/2010 PAT 7916574

which is a CON of 12/629,827 12/02/2009 PAT 7881150

which is a CON of 12/408,652 03/20/2009 PAT 7636274

which is a CON of 11/335,875 01/19/2006 PAT 7532537

which claims benefit of 60/645,087 01/19/2005

and is a CIP of 11/173,175 07/01/2005 PAT 7289386

which claims benefit of 60/588,244 07/15/2004

and is a CIP of 11/075,395 03/07/2005 PAT 7286436

which claims benefit of 60/550,668 03/05/2004

and claims benefit of 60/575,595 05/28/2004

and claims benefit of 60/590,038 07/21/2004

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**If Required, Foreign Filing License Granted:** 09/11/2013

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/971,231**

**Projected Publication Date:** Not Applicable

**Non-Publication Request:** No

**Early Publication Request:** No

**\*\* SMALL ENTITY \*\***

**Title**

MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION

**Preliminary Class**

711

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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page 2 of 4

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Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0851-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

# **REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL** **(Submitted Only via EFS-Web)**

|                      |                     |             |            |                               |                |          |      |
|----------------------|---------------------|-------------|------------|-------------------------------|----------------|----------|------|
| Application Number   | 13/971,231          | Filing Date | 2013-08-20 | Docket Number (if applicable) | NETL.018P2C7   | Art Unit | 2139 |
| First Named Inventor | Jefferey C. Solomon |             |            | Examiner Name                 | Bansal, Gurtej |          |      |

**This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.**

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

## **SUBMISSION REQUIRED UNDER 37 CFR 1.114**

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on \_\_\_\_\_

☐ Other \_\_\_\_\_

☒ Enclosed

☒ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other \_\_\_\_\_

## **MISCELLANEOUS**

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months \_\_\_\_\_  
 (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other \_\_\_\_\_

## **FEES**

**The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 505963

## **SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**

☒ Patent Practitioner Signature

☐ Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)

Approved for use through 07/31/2012. OMB 0651-0031  
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| Signature of Registered U.S. Patent Practitioner |                  |                     |            |
|--------------------------------------------------|------------------|---------------------|------------|
| Signature                                        | /Jamie J. Zheng/ | Date (YYYY-MM-DD)   | 2015-03-23 |
| Name                                             | Jamie J. Zheng   | Registration Number | 51167      |

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*



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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronically filed \*\*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Netlist, Inc.  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : MEMORY MODULE WITH LOAD  
REDUCING CIRCUIT AND  
METHOD OF OPERATION  
Examiner : BANSAL, GURTEJ  
Art Unit : 2139  
Conf. No. : 2072  
Docket No. : NETL.018P2C7

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March 23, 2015

(Date)

/Jamie J. Zheng/

Jamie J. Zheng, Reg. No. 51167

AMENDMENT AND REQUEST FOR CONTINUED EXAMINATION

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

A Request for Continued Examination (RCE) is filed herewith for the above-identified patent application. Please amend the application as follows prior to continued examination.

The Commissioner is hereby authorized to charge any required fee(s) to Deposit Account No. 50-5963.

AMENDMENTS to the SPECIFICATION begin on Page 2 of this paper.

AMENDMENTS to the CLAIMS begin on Page 4 of this paper.

REMARKS begin on Page 11 of this paper.

## IN THE SPECIFICATION

Please amend paragraphs [0011]-[0013] under the Summary of the Invention as follows:

**[0011]** In certain embodiments, a memory module includes a plurality of memory devices and is operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system. The memory module being coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus. The memory module comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of output control/address signals are provided to the plurality of memory devices. The memory module further comprises a circuit coupled between the data bus and the plurality of memory devices, the circuit to selectively isolate one or more first memory devices among the plurality of memory devices from the data bus ~~memory controller~~ in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

**[0012]** In certain embodiments, the circuit further comprises DQ-DQS paths, and ~~the~~ logic that selectively isolates the one or more first memory devices by disabling at least one first group of DQ-DQS paths so as to isolate the one or more first memory devices. In certain embodiments, the logic is further configured to enable at least one second group of DQ-DQS paths in response to the respective memory command so as to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals. In certain embodiments, ~~the logic element circuit~~ includes a buffer circuit to electrically and selectively isolate the one or more first memory devices from the memory controller and to selectively allow one or more second memory devices to communicate data with the memory controller, the buffer circuit adding a time delay (e.g., one clock cycle) to a data signal from the one or more second memory devices to the memory controller. In certain embodiments, the logic provides functions of a data path

multiplexer/demultiplexer using the time delay. In certain embodiments, the logic is further configured to translate between a system memory domain and a physical memory device domain by generating a greater number of output control/address signals than the number of input control/address signals in response to the respective memory command. In certain embodiments, the logic receives one or more input chip select signals associated with the respective memory command, the one or more input chip select signals being less in number than chip-select signals in the output control/address signals.

**[0013]** In certain embodiments, a method of operating ~~a circuit in~~ a memory module comprises receiving a set of input control/address signals associated with a respective memory command from the memory controller, generating a set of output control/address signals in response to the set of input control/address signals, and providing the set of output control/address signals to a plurality of memory devices operable to perform memory operations in response to memory commands from a memory controller. The method further comprises monitoring the memory commands from the memory controller, and selectively isolating one or more first memory devices among the plurality of memory devices from the memory controller in response to the respective memory command so as to reduce a load of the memory module to the memory controller while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals. In certain embodiments, the method further comprises disabling at least one first group of DQ-DQS paths to isolate the one or more first memory devices and selectively enabling at least one second group of DQ-DQS paths to allow the one or more second memory devices to communicate data with the memory controller in response to the output control/address signals. In certain embodiments, the set of input control/address signals include at least one chip-select signal and the set of output control/address signals include a greater number of chip-select signals. \_\_\_\_\_

## AMENDMENTS TO THE CLAIMS

1-10. (Cancelled)

11. (Currently Amended) A memory module operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system, the memory module being coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus, the data bus including a set of data (DQ) and data strobe (DQS) signal lines, comprising:

a plurality of memory devices including a first set of memory devices and a second set of memory devices;

a register device to receive from the memory controller a first set of input C/A signals associated with a first memory command via the C/A bus and subsequently a second set of input C/A signals associated with a second memory command via the C/A bus, the first memory command to cause ~~make~~ the memory module receive or output a first data burst and the second memory command to cause ~~make~~ the memory module receive or output a second data burst, the register to generate a first set of output C/A signals in response to the first set of input C/A signals and a second set of output C/A signals in response to the second set of input C/A signals, the first set of output C/A signals causing the first set of memory devices to receive or output the first data burst, the second set of output C/A signals causing the second set of memory devices to receive or output the second data burst; and

a circuit coupled between the data bus and the plurality of memory devices, the circuit being coupled to the first set of memory devices via a first set of module DQ and DQS signal lines and to the second set of memory devices via a second set of module DQ and DQS signal lines, wherein the circuit in response to the first memory command couples the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and isolates the second set of module DQ and DQS signal lines from the data bus as the memory module is receiving or outputting the first data burst in response to the first memory command, and wherein the circuit in response to the second memory command couples the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and isolates the first set of module DQ and DQS signal lines from the data bus as the

memory module is receiving or outputting the second data burst in response to the second memory command.

12. (Previously Presented) The memory module of claim 11, wherein the circuit isolates both the first set of module DQ and DQS signal lines and the second set of module DQ and DQS signal lines from the data bus when the memory module is not being accessed by the memory system.

13. (Currently Amended) The memory module of claim 11, wherein the circuit further comprises multiple groups of DQ-DQS paths including a first group of DQ-DQS paths corresponding to the first set of module DQ and DQS signal lines and a second group of DQ-DQS paths corresponding to the second set of module DQ and DQS signal lines, wherein the circuit enables the first group of DQ-DQS paths and ~~as~~ disabling the second group of DQ-DQS paths in response to the first memory command, and wherein the circuit enables the second group of DQ-DQS paths and ~~as~~ disabling the first group of DQ-DQS paths in response to the second memory command.

14. (Previously Presented) The memory module of claim 13, wherein the register device is to translate between a system memory domain of the computer system and a physical memory device domain of the memory module, the system memory domain having a smaller number of ranks than the physical memory device domain, and wherein the first set of the plurality of memory devices and the second set of the plurality of memory devices belong to a same rank in the system memory domain and to different ranks in the physical memory device domain.

15. (Previously Presented) The memory module of claim 14, wherein the first set of input C/A signals include at least one chip-select signal and the register device outputs a greater number of chip-select signals than the at least one chip-select signal, the greater number of chip-select signals including a first chip select signal and a second chip select signal, the first chip-select signal being provided to the first set of memory devices and having an active value to select the first set of memory devices to receive or output the first data burst in response to the first memory command, the second chip-select signal being provided to the second set of memory devices and having a non-active value to keep the second set of memory devices from receiving or outputting data as the first set of memory devices are receiving or outputting the first data burst in response to the first memory command.

16. (Previously Presented) The memory module of claim 11, wherein the first memory command is a first read command and the second memory command is a second read command, wherein the first read command and the second read command are back to back adjacent read commands, and wherein the first set of memory devices output the first data burst together with a first burst of data strobes in response to the first read command, wherein the second set of memory devices output the second data burst together with a second burst of data strobes in response to the second read command, wherein the second data burst follows the first data burst on the data bus, and wherein the circuit prevents the first burst of data strobes and the second burst of data strobes from colliding with each other.

17. (Previously Presented) The memory module of claim 16, wherein each of the first burst of data strobes and the second burst of data strobes includes a pre-amble interval and a post-amble interval, and wherein the circuit combines the first burst of data strobes and the second burst of data strobes by skipping the post-amble interval of the first burst of data strobes and the pre-amble interval of the second burst of data strobes.

18. (Previously Presented) The memory module of claim 11, wherein the memory bus further includes an on-die termination (ODT) bus for conveying an ODT signal from the memory controller, each ODT signal corresponding to a respective memory command from the memory controller, wherein each memory device of the plurality of memory devices includes an ODT control input to allow a signal at the control input to enable or disable an ODT circuit in the memory device, and wherein the plurality of memory devices include at least one memory device having its respective control input configured to keep the ODT circuits in the at least one memory device disabled regardless of the ODT signal from the memory controller.

19. (Previously Presented) The memory module of claim 17, further comprising a termination assembly external to the plurality of memory devices and controlled in response to the ODT signal, wherein one or more DQ pins of the at least one memory device are coupled to the termination assembly so that one or more DQ signal paths between the at least one memory device and the memory controller can be terminated by the termination assembly.

20. (Previously Presented) The memory module of claim 11, wherein the circuit is to receive from the memory controller a third set of input C/A signals associated with a third

memory command via the C/A bus, the third memory command being one of a refresh or precharge command, wherein the register to generate a third set of output C/A signals in response to the third set of input C/A signals, the third set of output C/A signals causing both the first set of memory devices and the second set of memory devices to perform one of a refresh operation and a pre-charge operation, and wherein the circuit in response to the third memory command couples the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and couples the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus.

21. (Previously Presented) A method of operating a memory module in response to memory commands from a memory controller, the memory module having a plurality of memory devices including a first set of memory devices and a second set of memory devices, the memory module being coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus, the data bus including a set of data (DQ) and data strobe (DQS) signal lines, the first set of memory devices having a first set of DQ and DQS pins, the second set of memory devices having a second set of DQ and DQS pins, the method comprising:

- receiving from the memory controller a first set of input C/A signals associated with a first memory command via the C/A bus, the first memory command to cause the memory module to receive or output a first data burst;

- generating a first set of output C/A signals in response to the first set of input C/A signals, the first set of output C/A signals causing the first set of memory devices to receive or output the first data burst,;

- receiving from the memory controller a second set of input control/address signals associated with a second memory command via the C/A bus, the second memory command to cause the memory module to receive or output a second data burst

- generating a second set of output C/A signals in response to the second set of input C/A signals, the second set of output C/A signals causing the second set of memory devices to receive or output the second data burst;

- in response to the first memory command, coupling the first set DQ and DQS pins to respective DQ and DQS signal lines of the data bus and isolating the second set of module DQ and DQS pins from the data bus as the memory module is receiving or outputting the first data burst in response to the first memory command; and



in response to the second memory command, coupling the second set DQ and DQS pins to respective DQ and DQS signal lines of the data bus and isolating the first set of DQ and DQS pins from the data bus as the memory module is receiving or outputting the second data burst in response to the second memory command.

22. (Previously Presented) The method of claim 21, further comprising isolating both the first set of DQ and DQS pins and the second set of DQ and DQS pins from the data bus when the memory module is not being accessed by the memory system.

23. (Currently Amended) The method of claim 21, wherein the memory module further comprises multiple groups of DQ-DQS paths including a first group of DQ-DQS paths corresponding to the first set of DQ and DQS pins and a second group of DQ-DQS paths corresponding to the second set of DQ and DQS pins, the method further comprising enabling the first group of DQ-DQS paths and~~as~~ disabling the second group of DQ-DQS paths in response to the first memory command, and enabling the second group of DQ-DQS paths and~~as~~ disabling the first group of DQ-DQS paths in response to the second memory command.

24. (Previously Presented) The method of claim 23, further comprising translating between a system memory domain and a physical memory device domain, the system memory domain having a smaller number of ranks than the physical memory device domain, and wherein the first set of the plurality of memory devices and the second set of the plurality of memory devices belong to a same rank in the system memory domain and to different ranks in the physical memory device domain.

25. (Previously Presented) The method of claim 24, wherein the first set of input C/A signals include at least one chip-select signal and the register device outputs a greater number of chip-select signals than the at least one chip-select signal, the greater number of chip-select signals including a first chip select signal and a second chip select signal, the first chip-select signal being provided to the first set of memory devices and having an active value to select the first set of memory devices to receive or output the first data burst in response to the first memory command, the second chip-select signal being provided to the second set of memory devices and having a non-active value to keep the second set of memory devices from receiving or outputting data as the first set of memory devices are receiving or outputting the first data burst in response to the first memory command.

26. (Previously Presented) The method of claim 21, wherein the first memory command is a first read command and the second memory command is a second read command, wherein the first read command and the second read command are back to back adjacent read commands, and wherein the first set of memory devices output the first data burst together with a first burst of data strobes in response to the first read command, wherein the second set of memory devices output the second data burst together with a second burst of data strobes in response to the second read command, wherein the second data burst follows the first data burst on the data bus, the method further comprising combining the first burst of data strobes and the second burst of data strobes to form a third burst of data strobes on the data bus.

27. (Previously Presented) The method of claim 26, wherein each of the first burst of data strobes and the second burst of data strobes includes a pre-amble interval and a post-amble interval, and wherein combining the first burst of data strobes and the second burst of data strobes comprises skipping the post-amble interval of the first burst of data strobes and the pre-amble interval of the second burst of data strobes.

28. (Previously Presented) The method of claim 21, wherein the memory bus further includes an on-die termination (ODT) bus for conveying an ODT signal corresponding to each memory command from the memory controller, wherein each of the plurality of memory devices includes ODT circuits and an ODT control input to allow a signal at the control input to enable or disable the ODT circuits in the memory device, the method further comprising keeping the ODT circuits in at least one of the plurality of memory devices disabled regardless of the ODT signal from the memory controller.

29. (Previously Presented) The method of claim 27, further comprising controlling a termination assembly external to the plurality of memory devices according to the ODT signal, wherein one or more DQ pins of the at least one memory device are coupled to the termination assembly so that one or more DQ signal paths between the at least one memory device and the memory controller can be terminated by the termination assembly.

30. (Previously Presented) The method of claim 21, further comprising:  
receiving from the memory controller a third set of input C/A signals associated with a third memory command via the C/A bus, the third memory command being one of a refresh or precharge command;

generating a third set of output C/A signals in response to the third set of input C/A signals, the third set of output C/A signals causing both the first set of memory devices and the second set of memory devices to perform one of a refresh operation and a pre-charge operation; and

in response to the third memory command, coupling the first set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus and coupling the second set of module DQ and DQS signal lines to respective DQ and DQS signal lines of the data bus.

*REMARKS*

This amendment and request for continued examination is filed after the Notice of Allowance dated January 9, 2015.

Paragraphs [0011]-[0013] under the Summary of the Invention are amended to correspond with the allowed claims. Claims 11, 13 and 23 are amended for wording consistency and to correct typographical errors. No new matter is added.

In light of the above amendments and remarks, the Applicants respectfully request that the Examiner reconsider this application with a view towards allowance. The Examiner is invited to call the undersigned attorney at (650) 273-6008, if a telephone call could help resolve any remaining items.

|                             |                                         |            |
|-----------------------------|-----------------------------------------|------------|
| Date: <u>March 23, 2015</u> | Respectfully submitted,                 |            |
|                             | /Jamie J. Zheng/                        | 51167      |
|                             | Jamie J. Zheng<br>Customer Number 79141 | (Reg. No.) |

INFORMATION DISCLOSURE STATEMENT

|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : Netlist, Inc.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : BANSAL, GURTEJ                             |
| Art Unit  | : 2139                                       |
| Conf No.  | : 2072                                       |

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Mail Stop Amendment  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

Enclosed for filing in the above-identified application is a Form PTO/SB/08a/b Equivalent listing 54 references. Copies of foreign documents and/or their translation and non-patent literature are submitted herewith.

The applicants would appreciate the Examiner initialing and returning the Form PTO/SB/08a/b Equivalent indicating that the information has been considered and made of record herein.

The information contained in this Information Disclosure Statement is not to be construed as a representation that: (i) a complete search has been made; (ii) additional information material to this application does not exist; (iii) the information, protocols, results and the like reported by third parties are accurate or enabling; or (iv) the above information constitutes prior art to the subject invention.

This Information Disclosure Statement is being filed before the receipt of a first Office Action on the merits, and presumably no fee is required. If a first Office Action on the merits

Application No.: 13/971,231  
Filing Date: August 20, 2013

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was mailed before the mailing date of this Statement, the Commissioner is authorized to charge  
the fee set forth in 37 C.F.R. § 1.17(p) to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: March 23, 2015

/Jamie J. Zheng/

\_\_\_\_\_  
Jamie J. Zheng  
Customer No. 79141  
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51167  
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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2139                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 1 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 5388240                                  | 02-01-1995                       | IBM Corporation                                    |                                                                                 |
|                        | 2.                       | 5463590                                  | 10-31-1995                       | Watanabe                                           |                                                                                 |
|                        | 3.                       | 5953280                                  | 09-14-1999                       | Matsui                                             |                                                                                 |
|                        | 4.                       | 6188641                                  | 02-13-2001                       | Uchida                                             |                                                                                 |
|                        | 5.                       | 6205516                                  | 03-20-2001                       | Usami                                              |                                                                                 |
|                        | 6.                       | 6480439                                  | 11-12-2002                       | Tokutome et al.                                    |                                                                                 |
|                        | 7.                       | 7464225                                  | 12-09-2008                       | Tsern                                              |                                                                                 |
|                        | 8.                       | 7865674                                  | 01-04-2011                       | Gower et al.                                       |                                                                                 |
|                        | 9.                       | 8089795                                  | 01-03-2012                       | Rajan                                              |                                                                                 |
|                        | 10.                      | 8130560                                  | 03-06-2012                       | Rajan                                              |                                                                                 |
|                        | 11.                      | 8189328                                  | 05-29-2012                       | Kanapathippillai                                   |                                                                                 |
|                        | 12.                      | 8233303                                  | 07-31-2012                       | Best                                               |                                                                                 |
|                        | 13.                      | 8250295                                  | 08-21-2012                       | Amidi et al.                                       |                                                                                 |
|                        | 14.                      | 8417870                                  | 04-09-2013                       | Lee et al.                                         |                                                                                 |
|                        | 15.                      | 8516185                                  | 08-20-2013                       | Lee et al.                                         |                                                                                 |
|                        | 16.                      | 8516188                                  | 08-20-2013                       | Solomon et al.                                     |                                                                                 |
|                        | 17.                      | 8756364                                  | 06-17-2014                       | Bhakta et al.                                      |                                                                                 |
|                        | 18.                      | 20070058409                              | 03-15-2007                       | Ruckerbauer                                        |                                                                                 |
|                        | 19.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 20.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 21.                      | RE36229                                  | 06-15-1999                       | Cady                                               |                                                                                 |

| US PATENT APPLICATIONS |                          |                    |                             |                                                    |                                                                                 |
|------------------------|--------------------------|--------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Application Number | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          |                    |                             |                                                    |                                                                                 |
|                        | 22.                      | 13/411,344         | 3/2/2012                    | Lee                                                | Entire Prosecution History                                                      |
|                        | 23.                      | 13/970,606         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 24.                      | 13/971,231         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 25.                      | 14/229,844         | 3/29/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 26.                      | 14/324,990         | 7/7/2014                    | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 27.                      | 14/337,168         | 7/21/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |

### NON PATENT LITERATURE DOCUMENTS

EXAMINER

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|                                                                                                                                          |   |    | Application Number       | 13/971,231             |              |
|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2139                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 2 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| Examiner Initials* | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|--------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | 28.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-00882, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 29.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-00882, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 30.                   | Inter Partes Review of U.S. Patent No. 8,081,536, IPR Case No. IPR2014-00883, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 31.                   | Inter Partes Review of U.S. Patent No. 8,081,536, IPR Case No. IPR2014-00883, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 32.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 33.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 34.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3001 to Decision – Institution of Inter Partes Review, Excerpts from IEEE Dictionary, issued December 16, 2014                                                            |                |
|                    | 35.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3002 to Decision – Institution of Inter Partes Review, Excerpts from IEEE Dictionary, issued December 16, 2014                                                            |                |
|                    | 36.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3003 to Decision – Institution of Inter Partes Review, Excerpts from Oxford English Dictionary, issued December 16, 2014                                                  |                |
|                    | 37.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3004 to Decision – Institution of Inter Partes Review, Excerpts from Oxford English Dictionary, issued December 16, 2014                                                  |                |
|                    | 38.                   | McCluskey, Edward J., <i>Logic Design Principles with Emphasis on Testable Semicustom Circuits</i> , Prentice Hall, 1986, pp. 104-107 and 119-120.                                                                                                              |                |
|                    | 39.                   | Inter Partes Review Case No. IPR2014-01029, Petition for Inter Partes Review of U.S. Patent No. 8,516,185, filed on June 24, 2014.                                                                                                                              |                |
|                    | 40.                   | Inter Partes Review Case No. IPR2014-01029, Exhibit 1008 to Petition for Inter Partes Review, "Declaration of Charles J. Neuhauser, Ph.D. under 37 C.F.R. § 1.68," filed on June 24, 2014.                                                                      |                |
|                    | 41.                   | Inter Partes Review Case No. IPR2014-01029, Supplemental Petition for Inter Partes Review of U.S. Patent No. 8,516,185, filed on July 23, 2014.                                                                                                                 |                |
|                    | 42.                   | Inter Partes Review Case No. IPR2014-01029, Patent Owner's Preliminary Response pursuant to 37 C.F.R. § 42.107, filed on October 17, 2014.                                                                                                                      |                |
|                    | 43.                   | Inter Partes Review Case No. IPR2014-01029, Decision Denying Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014.                                                                                                                   |                |
|                    | 44.                   | Inter Partes Review Case No. IPR2014-01029, Petitioner's Request for Rehearing pursuant to 37 C.F.R. § 42.71, filed on January 15, 2015.                                                                                                                        |                |

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|                                                                                                                                          |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                                                          |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                                                          |   |    | Art Unit                 | 2139                   |              |
|                                                                                                                                          |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                                                    | 3 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |
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| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 45.                   | Inter Partes Review Case No. IPR2014-01029, Decision Denying Request for Rehearing, Issued on March 3, 2015.                                                                                                                                                    |                |
|                                 | 46.                   | Inter Partes Review Case No. IPR2014-01369, Corrected Petition for Inter Partes Review of Claims 1-19 of U.S. Patent No. 8,516,185, filed on September 22, 2014.                                                                                                |                |
|                                 | 47.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1008 to Corrected Petition for Inter Partes Review, "Declaration of Dr. Nader Bagherzadeh under 37 C.F.R. § 1.68," filed on September 22, 2014.                                                             |                |
|                                 | 48.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1013 to Corrected Petition for Inter Partes Review, "Webster's II New College Dictionary," filed on September 22, 2014.                                                                                     |                |
|                                 | 49.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1014 to Corrected Petition for Inter Partes Review, "Standard Dictionary of Electrical and Electronics Terms," IEEE 1988, filed on September 22, 2014.                                                      |                |
|                                 | 50.                   | Inter Partes Review Case No. IPR2014-01369, Decision Denying Institution of Inter Partes Review 37 C.F.R. § 42.108, issued March 9, 2014.                                                                                                                       |                |
|                                 | 51.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Smart Storage Systems, Inc.'s Invalidity Contentions, dated June 6, 2014                          |                |
|                                 | 52.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Exhibits E.1-E.7 to "Smart Storage Systems, Inc.'s Invalidity Contentions," dated June 6, 2014.   |                |
|                                 | 53.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Diablo Technologies, Inc.'s Invalidity Contentions, dated June 6, 2014.                           |                |
|                                 | 54.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Exhibits D-1 to D6 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014.   |                |

EXAMINER

DATE CONSIDERED

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.<sup>1</sup> Applicant's unique citation designation number (optional).<sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

| Electronic Patent Application Fee Transmittal         |                 |                                                                  |               |                             |
|-------------------------------------------------------|-----------------|------------------------------------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                            |                 | 13971231                                                         |               |                             |
| <b>Filing Date:</b>                                   |                 | 20-Aug-2013                                                      |               |                             |
| <b>Title of Invention:</b>                            |                 | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |               |                             |
| <b>First Named Inventor/Applicant Name:</b>           |                 | Jefferey C. Solomon                                              |               |                             |
| <b>Filer:</b>                                         |                 | Jamie Jie Zheng                                                  |               |                             |
| <b>Attorney Docket Number:</b>                        |                 | NETL.018P2C7                                                     |               |                             |
| Filed as Small Entity                                 |                 |                                                                  |               |                             |
| <b>Filing Fees for    Utility under 35 USC 111(a)</b> |                 |                                                                  |               |                             |
| <b>Description</b>                                    | <b>Fee Code</b> | <b>Quantity</b>                                                  | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                  |                 |                                                                  |               |                             |
| <b>Pages:</b>                                         |                 |                                                                  |               |                             |
| <b>Claims:</b>                                        |                 |                                                                  |               |                             |
| <b>Miscellaneous-Filing:</b>                          |                 |                                                                  |               |                             |
| <b>Petition:</b>                                      |                 |                                                                  |               |                             |
| <b>Patent-Appeals-and-Interference:</b>               |                 |                                                                  |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>              |                 |                                                                  |               |                             |
| <b>Extension-of-Time:</b>                             |                 |                                                                  |               |                             |

| Description                       | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------|----------|----------|--------|----------------------|
| <b>Miscellaneous:</b>             |          |          |        |                      |
| Request for Continued Examination | 2801     | 1        | 600    | 600                  |
| <b>Total in USD (\$)</b>          |          |          |        | <b>600</b>           |

| Electronic Acknowledgement Receipt          |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| <b>EFS ID:</b>                              | 21855848                                                         |
| <b>Application Number:</b>                  | 13971231                                                         |
| <b>International Application Number:</b>    |                                                                  |
| <b>Confirmation Number:</b>                 | 2072                                                             |
| <b>Title of Invention:</b>                  | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                                              |
| <b>Customer Number:</b>                     | 79141                                                            |
| <b>Filer:</b>                               | Jamie Jie Zheng                                                  |
| <b>Filer Authorized By:</b>                 |                                                                  |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                                                     |
| <b>Receipt Date:</b>                        | 23-MAR-2015                                                      |
| <b>Filing Date:</b>                         | 20-AUG-2013                                                      |
| <b>Time Stamp:</b>                          | 21:03:25                                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                                      |

**Payment information:**

|                                                                                                                |             |
|----------------------------------------------------------------------------------------------------------------|-------------|
| Submitted with Payment                                                                                         | yes         |
| Payment Type                                                                                                   | Credit Card |
| Payment was successfully received in RAM                                                                       | \$ 600      |
| RAM confirmation Number                                                                                        | 7971        |
| Deposit Account                                                                                                |             |
| Authorized User                                                                                                |             |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: |             |

|                                                 |                                                    |                                            |                                          |                  |                  |
|-------------------------------------------------|----------------------------------------------------|--------------------------------------------|------------------------------------------|------------------|------------------|
|                                                 |                                                    |                                            |                                          |                  |                  |
| File Listing:                                   |                                                    |                                            |                                          |                  |                  |
| Document Number                                 | Document Description                               | File Name                                  | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
| 1                                               | Request for Continued Examination (RCE)            | 2015-03-23_RCE_Transmittal_NETL018P2C7.pdf | 697426                                   | no               | 3                |
|                                                 |                                                    |                                            | 87ecfd2c1030c5e125d345e2670fe6eab087ea71 |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| 2                                               | Amendment Submitted/Entered with Filing of CPA/RCE | 2015-03-23_Amendment_RCE_NETL018P2C7.pdf   | 1920920                                  | no               | 11               |
|                                                 |                                                    |                                            | b9160d70ea1c1bbb73a476a7e8b3cd2b9305cb0  |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| 3                                               | Transmittal Letter                                 | 2015-03-23_IDS_Cover_NETL018P2C7.pdf       | 58297                                    | no               | 2                |
|                                                 |                                                    |                                            | 126a2293f9cf6c83deb44e9b6914b9435c762fc  |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| 4                                               | Information Disclosure Statement (IDS) Form (SB08) | 2015-03-23_IDS_NETL018P2C7.pdf             | 154492                                   | no               | 3                |
|                                                 |                                                    |                                            | 2fe4b9bd4d25775fa51eab82b33636a37896a60c |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| This is not an USPTO supplied IDS fillable form |                                                    |                                            |                                          |                  |                  |
| 5                                               | Non Patent Literature                              | preliminary_response_00882.pdf             | 2565336                                  | no               | 60               |
|                                                 |                                                    |                                            | 09849b7c0ebcd5bc8e16e07aa3c7f6bcc8622d43 |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| 6                                               | Non Patent Literature                              | institution_decision_00882.pdf             | 1039322                                  | no               | 34               |
|                                                 |                                                    |                                            | bb3172e918ca8d935eb711d76a14c9d1e8926b30 |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |
| 7                                               | Non Patent Literature                              | preliminary_response_00883.pdf             | 2381661                                  | no               | 56               |
|                                                 |                                                    |                                            | e987bf2019f017ddc8eedcc402681f32012a084e |                  |                  |
| Warnings:                                       |                                                    |                                            |                                          |                  |                  |
| Information:                                    |                                                    |                                            |                                          |                  |                  |

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| 8                   | Non Patent Literature | institution_decision_00883.pdf        | 916263<br>f37827a35a9c0307408f73270c78a89a47547468  | no | 27  |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 9                   | Non Patent Literature | preliminary_response_01011.pdf        | 2875716<br>9b7e44610d7ab045113fa8e8561b4513572d3c64 | no | 62  |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 10                  | Non Patent Literature | institution_decision_01011.pdf        | 903751<br>56c0309df8f7babblcc544ee91b4036b8b1ddb9e  | no | 31  |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 11                  | Non Patent Literature | Exhibit-3001.pdf                      | 902406<br>e357e8723caa0a5b86ae1bc9abc1a080ef5e7493  | no | 63  |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 12                  | Non Patent Literature | Exhibit-3002.pdf                      | 2525056<br>7db2e7e7374fa995780d3676ac75e787c35f802c | no | 133 |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 13                  | Non Patent Literature | Exhibit-3003.pdf                      | 283811<br>2fee627ab3350b948eff30ae20dc6c3ca5b05107  | no | 1   |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 14                  | Non Patent Literature | Exhibit-3004.pdf                      | 266334<br>3c5bba2f090727ef8b8212b3f715b448dad3c53a  | no | 1   |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 15                  | Non Patent Literature | 1986-McCluskey.pdf                    | 2063520<br>65a221b1bdf55ee1a8405d71c7abad8727c74168 | no | 9   |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
| <b>Information:</b> |                       |                                       |                                                     |    |     |
| 16                  | Non Patent Literature | 2014-06-24_Petition_IPR2014-01029.pdf | 995769<br>5f532e07581069892a1ca0f985e08ec811c3dade  | no | 64  |
| <b>Warnings:</b>    |                       |                                       |                                                     |    |     |
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|---------------------|-----------------------|-----------------------------------------------------|---------------------------------------------------------|----|-----|
| 17                  | Non Patent Literature | 2014-06-24_Neuhauser_Decl_I<br>PR2014-01029.pdf     | 3815549<br>306b26730565c7483c19319199c8b10dfee<br>e8b33 | no | 173 |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 18                  | Non Patent Literature | 2014-07-23_Supp_Petition_IPR<br>2014-01029.pdf      | 1058145<br>12b230bca6dbf7f1e89206150d7ba6fc10d<br>bf2be | no | 65  |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 19                  | Non Patent Literature | 2014-10-17_Prelim_Rsps_IPR20<br>14-01029.pdf        | 3272498<br>de4f42dccc84d138ce64e88f09df639d62db<br>5988 | no | 56  |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 20                  | Non Patent Literature | 2014-12-16_decision_denying_<br>Institution.pdf     | 672087<br>c4cf0575c18a15433ae803328bede744a08<br>e537   | no | 22  |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 21                  | Non Patent Literature | 2015-01-15_Rehearing_Reques<br>t_01029.pdf          | 562731<br>0550b2bfc97abde738165c0c16f6e9dca9c<br>7e0b   | no | 17  |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 22                  | Non Patent Literature | 2015-03-03_Rehearing_Decisio<br>n_01029.pdf         | 123320<br>0dd30f650e976ea8d1b3fb3080171b7f25af<br>65e7  | no | 7   |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 23                  | Non Patent Literature | 2014-09-22_Corrected_Petition<br>_IPR2014-01369.pdf | 912271<br>db81c4f9f7c8d687e8a242440bc7084a9a7c<br>5c8c  | no | 66  |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 24                  | Non Patent Literature | 2014-09-22_Bagherzadeh_Decl<br>_IPR2014-01369.pdf   | 9565317<br>7441d826caca8489a47bec3be76aa7cc703<br>e7204 | no | 396 |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |
| 25                  | Non Patent Literature | 2014-09-22_Exhibit-1013.pdf                         | 1716301<br>f98f2639ee453b16d439416ea5935d6c108<br>ad156 | no | 6   |
| <b>Warnings:</b>    |                       |                                                     |                                                         |    |     |
| <b>Information:</b> |                       |                                                     |                                                         |    |     |

|                                                                                                                                                                                                            |                       |                                                     |                                                      |    |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------|------------------------------------------------------|----|-----|
| 26                                                                                                                                                                                                         | Non Patent Literature | 2014-09-22_Exhibit-1014.pdf                         | 2001462<br>e75d557231316ea02a8d5912e06741f6351e938e  | no | 5   |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 27                                                                                                                                                                                                         | Non Patent Literature | 2015-03-09_Institution_Decision_01369.pdf           | 867692<br>0ac8262b507e89a629812f6a13849fa9c274d93a   | no | 27  |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 28                                                                                                                                                                                                         | Non Patent Literature | 2014-06-06_Smart_Storage_Invalidity_Contentions.pdf | 2718276<br>dcea87ec2ece9b8e701c8b6ab2647ff7c1ebce8   | no | 85  |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 29                                                                                                                                                                                                         | Non Patent Literature | SSS_Inv_Cont_Exh_E1-E4.pdf                          | 19588217<br>36ef069bffe590c8a2c24abf3992f2abb1b5bd1  | no | 122 |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 30                                                                                                                                                                                                         | Non Patent Literature | SSS_Inv_Cont_Exh_E5-E7.pdf                          | 14371632<br>9ca9401a280e47bc201747138cb24482a9f231ae | no | 82  |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 31                                                                                                                                                                                                         | Non Patent Literature | 20140606_DIABLO_Invalidity_Contentions.pdf          | 1703900<br>ed2e5f22373448111011661f8139988b2fca4464  | no | 41  |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 32                                                                                                                                                                                                         | Non Patent Literature | Diablo_EXHIBIT_D1-D6.pdf                            | 4503878<br>846616191878fef35456447c0ccb84fc865a3ddf  | no | 145 |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| 33                                                                                                                                                                                                         | Fee Worksheet (SB06)  | fee-info.pdf                                        | 30603<br>56b896e067a4117f2e01f5513d999f1f620efcecb   | no | 2   |
| <b>Warnings:</b>                                                                                                                                                                                           |                       |                                                     |                                                      |    |     |
| <b>Information:</b>                                                                                                                                                                                        |                       |                                                     |                                                      |    |     |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                        |                       |                                                     | 88033959                                             |    |     |



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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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|           |                                              |
|-----------|----------------------------------------------|
| Applicant | : Netlist, Inc.                              |
| App. No.  | : 13/971,231                                 |
| Filed     | : August 20, 2013                            |
| For       | : LOAD-REDUCING CIRCUIT FOR<br>MEMORY MODULE |
| Examiner  | : BANSAL, GURTEJ                             |
| Art Unit  | : 2139                                       |
| Conf No.  | : 2072                                       |

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## REQUEST AND AUTHORIZATION TO CHARGE DEPOSIT ACCOUNT

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

The Commissioner is hereby requested and authorized to charge all required fees, fees under § 1.17, or all required extension of time fees, for any concurrent or future submission made in the above-referenced patent application to Deposit Account No. 50-5963.

Respectfully submitted,

Dated: March 23, 2015

/Jamie J. Zheng/

Jamie J. Zheng  
Customer No. 79141  
(650) 273-6008

51167

(Reg. No.)

| Electronic Acknowledgement Receipt   |                                                                  |
|--------------------------------------|------------------------------------------------------------------|
| EFS ID:                              | 21856218                                                         |
| Application Number:                  | 13971231                                                         |
| International Application Number:    |                                                                  |
| Confirmation Number:                 | 2072                                                             |
| Title of Invention:                  | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |
| First Named Inventor/Applicant Name: | Jefferey C. Solomon                                              |
| Customer Number:                     | 79141                                                            |
| Filer:                               | Jamie Jie Zheng                                                  |
| Filer Authorized By:                 |                                                                  |
| Attorney Docket Number:              | NETL.018P2C7                                                     |
| Receipt Date:                        | 23-MAR-2015                                                      |
| Filing Date:                         | 20-AUG-2013                                                      |
| Time Stamp:                          | 22:49:23                                                         |
| Application Type:                    | Utility under 35 USC 111(a)                                      |

**Payment information:**

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

**File Listing:**

| Document Number | Document Description          | File Name                             | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|-------------------------------|---------------------------------------|---------------------------------------------------|------------------|------------------|
| 1               | Miscellaneous Incoming Letter | 2015-03-23_DA_Request_NETL018P2C7.pdf | 53215<br>1c236e37f901d9c79defd7b8b0adca02c4d3e04d | no               | 1                |

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**Information:**

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

|                                                                                   |  |  |  |                                                   |  |                                  |  |                                       |  |
|-----------------------------------------------------------------------------------|--|--|--|---------------------------------------------------|--|----------------------------------|--|---------------------------------------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875 |  |  |  | Application or Docket Number<br><b>13/971,231</b> |  | Filing Date<br><b>08/20/2013</b> |  | <input type="checkbox"/> To be Mailed |  |
|-----------------------------------------------------------------------------------|--|--|--|---------------------------------------------------|--|----------------------------------|--|---------------------------------------|--|

**ENTITY:**   ☐ LARGE   ☒ SMALL   ☐ MICRO

| APPLICATION AS FILED – PART I                                              |              |              |                                                                                                                                                                                                                               |  |           |          |  |  |  |
|----------------------------------------------------------------------------|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------|----------|--|--|--|
| (Column 1)                                                                 |              |              | (Column 2)                                                                                                                                                                                                                    |  |           |          |  |  |  |
| FOR                                                                        | NUMBER FILED | NUMBER EXTRA |                                                                                                                                                                                                                               |  | RATE (\$) | FEE (\$) |  |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))        | N/A          | N/A          |                                                                                                                                                                                                                               |  | N/A       |          |  |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (j), or (m))       | N/A          | N/A          |                                                                                                                                                                                                                               |  | N/A       |          |  |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))  | N/A          | N/A          |                                                                                                                                                                                                                               |  | N/A       |          |  |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                           | minus 20 =   | *            |                                                                                                                                                                                                                               |  | X \$      | =        |  |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                     | minus 3 =    | *            |                                                                                                                                                                                                                               |  | X \$      | =        |  |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE<br>(37 CFR 1.16(s))          |              |              | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |  |           |          |  |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j)) |              |              |                                                                                                                                                                                                                               |  |           |          |  |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.  |              |              |                                                                                                                                                                                                                               |  |           | TOTAL    |  |  |  |

| APPLICATION AS AMENDED – PART II |                                                                                          |                                  |            |                                    |               |                 |  |           |                     |
|----------------------------------|------------------------------------------------------------------------------------------|----------------------------------|------------|------------------------------------|---------------|-----------------|--|-----------|---------------------|
| (Column 1)                       |                                                                                          |                                  | (Column 2) |                                    |               | (Column 3)      |  |           |                     |
| AMENDMENT                        | 03/23/2015                                                                               | CLAIMS REMAINING AFTER AMENDMENT | MINUS      | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                 |  | RATE (\$) | ADDITIONAL FEE (\$) |
|                                  | Total (37 CFR 1.16(i))                                                                   | * 20                             | Minus      | ** 20                              | = 0           |                 |  | x \$40 =  | 0                   |
|                                  | Independent (37 CFR 1.16(h))                                                             | * 2                              | Minus      | *** 3                              | = 0           |                 |  | x \$210 = | 0                   |
|                                  | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |            |                                    |               |                 |  |           |                     |
|                                  | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |            |                                    |               |                 |  |           |                     |
|                                  |                                                                                          |                                  |            |                                    |               | TOTAL ADD'L FEE |  | 0         |                     |

| (Column 1) |                                                                                          |                                  | (Column 2) |                                    |               | (Column 3)      |  |           |                     |
|------------|------------------------------------------------------------------------------------------|----------------------------------|------------|------------------------------------|---------------|-----------------|--|-----------|---------------------|
| AMENDMENT  |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT | MINUS      | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                 |  | RATE (\$) | ADDITIONAL FEE (\$) |
|            | Total (37 CFR 1.16(i))                                                                   | *                                | Minus      | **                                 | =             |                 |  | X \$      | =                   |
|            | Independent (37 CFR 1.16(h))                                                             | *                                | Minus      | ***                                | =             |                 |  | X \$      | =                   |
|            | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                  |            |                                    |               |                 |  |           |                     |
|            | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |            |                                    |               |                 |  |           |                     |
|            |                                                                                          |                                  |            |                                    |               | TOTAL ADD'L FEE |  |           |                     |

\* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

\*\*\* If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

79141 7590 04/02/2015  
The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

EXAMINER

BANSAL, GURTEJ

ART UNIT

PAPER NUMBER

2139

DATE MAILED: 04/02/2015

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/971,231      | 08/20/2013  | Jefferey C. Solomon  | NEITL018P2C7        | 2072             |

TITLE OF INVENTION: MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$480         | \$0                 | \$0                  | \$480            | 07/02/2015 |

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

# PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**  
**Commissioner for Patents**  
**P.O. Box 1450**  
**Alexandria, Virginia 22313-1450**  
**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

79141 7590 04/02/2015  
The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13/971,231      | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7        | 2072             |

TITLE OF INVENTION: MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$480         | \$0                 | \$0                  | \$480            | 07/02/2015 |

| EXAMINER       | ART UNIT | CLASS-SUBCLASS |
|----------------|----------|----------------|
| BANSAL, GURTEJ | 2139     | 711-105000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) The names of up to 3 registered patent attorneys or agents OR, alternatively, 1 \_\_\_\_\_
- (2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 \_\_\_\_\_
- 3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

| APPLICATION NO.                                                                                            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.        | CONFIRMATION NO. |
|------------------------------------------------------------------------------------------------------------|-------------|----------------------|----------------------------|------------------|
| 13/971,231                                                                                                 | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7               | 2072             |
| 79141 7590 04/02/2015<br>The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306 |             |                      | EXAMINER<br>BANSAL, GURTEJ |                  |
|                                                                                                            |             |                      | ART UNIT<br>2139           | PAPER NUMBER     |

DATE MAILED: 04/02/2015

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.



## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

|                               |                                      |                                       |                                                  |
|-------------------------------|--------------------------------------|---------------------------------------|--------------------------------------------------|
| <b>Notice of Allowability</b> | <b>Application No.</b><br>13/971,231 | <b>Applicant(s)</b><br>SOLOMON ET AL. |                                                  |
|                               | <b>Examiner</b><br>GURTEJ BANSAL     | <b>Art Unit</b><br>2139               | <b>AIA (First Inventor to File) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to RCE dated 03/23/2015.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 11-30. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
**Certified copies:**  
 a) ☐ All    b) ☐ Some    \*c) ☐ None of the:  
     1. ☐ Certified copies of the priority documents have been received.  
     2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
     3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).  
     \* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.  
**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)<br>2. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date <u>03/23/2015</u><br>3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material<br>4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. | 5. <input type="checkbox"/> Examiner's Amendment/Comment<br>6. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance<br>7. <input type="checkbox"/> Other _____. |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                                    |  |
|----------------------------------------------------|--|
| /GURTEJ BANSAL/<br>Primary Examiner, Art Unit 2139 |  |
|----------------------------------------------------|--|

|                                                                                                                  |                                            |                                                                  |  |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|--|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |  |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |  |

| CPC    |    |  |    |      |            |
|--------|----|--|----|------|------------|
| Symbol |    |  |    | Type | Version    |
| G06F   | 12 |  | 00 | F    | 2013-01-01 |
| G11C   | 5  |  | 04 | I    | 2013-01-01 |
| G06F   | 13 |  | 00 | I    | 2013-01-01 |
|        |    |  |    |      |            |
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| CPC Combination Sets |      |     |         |         |
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| Symbol               | Type | Set | Ranking | Version |
|                      |      |     |         |         |
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|----------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                               |            | <b>Total Claims Allowed:</b> |                   |
|                                                    |            | 20                           |                   |
| (Assistant Examiner)                               | (Date)     |                              |                   |
| /GURTEJ BANSAL/<br>Primary Examiner, Art Unit 2139 | 03/30/2015 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                 | (Date)     | 11                           | 1                 |

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|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |

| US ORIGINAL CLASSIFICATION |                                   |          |  |  |  | INTERNATIONAL CLASSIFICATION |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
|----------------------------|-----------------------------------|----------|--|--|--|------------------------------|---|---|---|----------------------|-------------|--|--|--|--|--|--|--|--|--|
| CLASS                      |                                   | SUBCLASS |  |  |  | CLAIMED                      |   |   |   |                      | NON-CLAIMED |  |  |  |  |  |  |  |  |  |
| 711                        |                                   | 5        |  |  |  | G                            | 0 | 6 | F | 12 / 00 (2006.01.01) |             |  |  |  |  |  |  |  |  |  |
| CROSS REFERENCE(S)         |                                   |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
|                            |                                   |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
| CLASS                      | SUBCLASS (ONE SUBCLASS PER BLOCK) |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
| 711                        | 147                               |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
|                            |                                   |          |  |  |  |                              |   |   |   |                      |             |  |  |  |  |  |  |  |  |  |
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|---------------------------------------------------|------------|------------------------------|-------------------|
| NONE                                              |            | <b>Total Claims Allowed:</b> |                   |
|                                                   |            | 20                           |                   |
| (Assistant Examiner)                              | (Date)     |                              |                   |
| /GURTEJ BANSAL/<br>Primary Examiner.Art Unit 2139 | 03/30/2015 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                                | (Date)     | 11                           | 1                 |

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|------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br>SOLOMON ET AL. |
|                                                                                                                  | <b>Examiner</b><br>GURTEJ BANSAL           | <b>Art Unit</b><br>2139                                          |

| <input type="checkbox"/> <b>Claims renumbered in the same order as presented by applicant</b> <input type="checkbox"/> <b>CPA</b> <input checked="" type="checkbox"/> <b>T.D.</b> <input type="checkbox"/> <b>R.1.47</b> |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
| Final                                                                                                                                                                                                                    | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
|                                                                                                                                                                                                                          | 1        | 9     | 17       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 2        | 3     | 18       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 3        | 10    | 19       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 4        | 4     | 20       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 5        | 11    | 21       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 6        | 12    | 22       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 7        | 15    | 23       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 8        | 16    | 24       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 9        | 17    | 25       |       |          |       |          |       |          |       |          |       |          |       |          |
|                                                                                                                                                                                                                          | 10       | 18    | 26       |       |          |       |          |       |          |       |          |       |          |       |          |
| 1                                                                                                                                                                                                                        | 11       | 19    | 27       |       |          |       |          |       |          |       |          |       |          |       |          |
| 2                                                                                                                                                                                                                        | 12       | 13    | 28       |       |          |       |          |       |          |       |          |       |          |       |          |
| 5                                                                                                                                                                                                                        | 13       | 20    | 29       |       |          |       |          |       |          |       |          |       |          |       |          |
| 6                                                                                                                                                                                                                        | 14       | 14    | 30       |       |          |       |          |       |          |       |          |       |          |       |          |
| 7                                                                                                                                                                                                                        | 15       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
| 8                                                                                                                                                                                                                        | 16       |       |          |       |          |       |          |       |          |       |          |       |          |       |          |

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|------------------------------------------------------------------------------------------------|--|------------------------------------|------------------------|
| NONE<br><br>(Assistant Examiner) _____ (Date) _____                                            |  | <b>Total Claims Allowed:</b><br>20 |                        |
| /GURTEJ BANSAL/<br>Primary Examiner.Art Unit 2139<br><br>(Primary Examiner) _____ (Date) _____ |  | O.G. Print Claim(s)<br>11          | O.G. Print Figure<br>1 |

**EAST Search History****EAST Search History (Prior Art)**

| Ref # | Hits   | Search Query                                                                                                                                                                                                                                                                                         | DBs             | Default Operator | Plurals | Time Stamp       |
|-------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|---------|------------------|
| L1    | 25     | rank same (DQ with DQS) with isolat\$3                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:21 |
| L2    | 29     | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:23 |
| L3    | 1      | "5388240".pn.                                                                                                                                                                                                                                                                                        | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:24 |
| L4    | 18     | "5388240".pn. "5463590".pn. "5953280".pn. "6188641".pn. "6205516".pn. "64804393".pn. "7464225".pn. "7865674".pn. "8089795".pn. "8130560".pn. "8189328".pn. "8233303".pn. "8250295".pn. "8417870".pn. "8516185".pn. "8516188".pn. "8756364".pn. "20070058409".pn. "20080104352".pn. "20080104352".pn. | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:28 |
| L5    | 69     | chip\$1select same rank and DQ and DQS                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:31 |
| L6    | 10     | rank same (DQ with DQS) with (mux multiplexer)                                                                                                                                                                                                                                                       | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:32 |
| S1    | 4386   | 711/5.ccls. 711/147.ccls.                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:37 |
| S2    | 4481   | DQS                                                                                                                                                                                                                                                                                                  | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S3    | 88990  | DS                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S4    | 32759  | DQ                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S5    | 3171   | S2 and S4                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S6    | 134822 | rank                                                                                                                                                                                                                                                                                                 | US-PGPUB; USPAT | OR               | ON      | 2013/12/02 23:38 |
| S7    | 329    | S5 and S6                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | ON      | 2013/12/02 23:38 |
| S8    | 201    | US-4218740-\$.DID. OR US-4368515-\$.DID. OR US-4392212-\$.DID. OR US-                                                                                                                                                                                                                                | US-PGPUB;       | OR               | OFF     | 2013/12/03 00:02 |

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| S9  | 1184 | multiplex\$3 with (DQS and DQ)                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:07 |
| S10 | 359  | multiplex\$3 with (DQS and DQ) with delay\$3                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:08 |
| S11 | 850  | multiplex\$3 with DQS and delay with delay\$3                                                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S12 | 562  | multiplex\$3 with DQS and DQ with delay\$3                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S13 | 401  | multiplex\$3 with DQS same DQ with delay\$3                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S14 | 0    | 13/287042.app.                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S15 | 0    | 13/287042.ap.                                                                                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S16 | 0    | "13287042".ap.                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S17 | 0    | "13287042".app.                                                                                                                                                                                                                                                                                         | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S18 | 294  | multiplex\$3 with DQS same delay\$3 with data with signals                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S19 | 307  | multiplex\$3 with DQS same delay\$3 with data with (signals lines)                                                                                                                                                                                                                                      | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S20 | 9    | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same2 rank                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S21 | 26   | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:29 |
| S22 | 238  | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same memory                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:30 |
| S23 | 347  | isolat\$3 with DQ with DQS                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:47 |
| S24 | 21   | isolat\$3 with DQ with DQS same Rank                                                                                                                                                                                                                                                                    | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:47 |
| S25 | 1353 | DQS with select\$3 with (memory rank)                                                                                                                                                                                                                                                                   | US-             | OR | ON | 2013/12/03       |

|     |      |                                                     |                        |    |    |                     |
|-----|------|-----------------------------------------------------|------------------------|----|----|---------------------|
|     |      |                                                     | PGPUB;<br>USPAT        |    |    | 00:50               |
| S26 | 54   | chip\$1select with rank and DQ and DQS              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:25 |
| S27 | 56   | chip\$1select same rank and DQ and DQS              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:26 |
| S28 | 61   | chip\$1select and rank and DQ and DQS               | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:27 |
| S29 | 5    | rank with DQ with DQS with low                      | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:39 |
| S30 | 300  | rank with DQ with DQS                               | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:40 |
| S31 | 82   | rank and (DQ with DQS) with off                     | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:03 |
| S32 | 271  | rank and (DQ with DQS) with high                    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S33 | 29   | rank with (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S34 | 1    | "6873533".pn.                                       | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S35 | 7    | rank with (DQ with DQS) with terminat\$3            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:10 |
| S36 | 20   | rank with (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S37 | 21   | rank same (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S38 | 57   | rank same (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S39 | 7    | rank same (DQ with DQS) with (mux<br>multiplexer)   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:15 |
| S40 | 37   | rank and (DQ with DQS) with (mux<br>multiplexer)    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:16 |
| S41 | 1040 | (DQ with DQS) with (mux multiplexer)                | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S42 | 1024 | (DQ with DQS) with (mux multiplexer) and<br>memory  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S43 | 634  | (DQ with DQS) with (mux multiplexer)<br>same memory | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S44 | 231  | (DQ with DQS) with (mux multiplexer)                | US-                    | OR | ON | 2013/12/03          |

|     |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                        |    |     |                     |
|-----|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|---------------------|
|     |      | with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | PGPUB;<br>USPAT        |    |     | 19:21               |
| S45 | 1    | "20040098428".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:40 |
| S46 | 1    | "20040098528".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:41 |
| S47 | 1    | "20030070052".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:42 |
| S48 | 1    | "20050047250".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>20:07 |
| S49 | 1599 | G06F12/0607.cpc. G06F12/0813.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | OFF | 2013/12/20<br>11:11 |
| S50 | 2437 | latency with memory adj controller with<br>memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:15 |
| S51 | 59   | latency with memory adj controller with<br>(measur\$3 test\$3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:16 |
| S52 | 22   | rank same (DQ with DQS) with isolat\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:16 |
| S53 | 22   | isolat\$3 with DQ with DQS same Rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S54 | 26   | multiplex\$3 with DQS same delay\$3 with<br>data with (signals lines) and rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S55 | 1    | "6553450".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:33 |
| S56 | 1    | "6742098".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:48 |
| S60 | 644  | isolat\$3 with load with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S61 | 46   | isolat\$3 with load with memory with<br>controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S62 | 28   | US-5345412-\$.D.ID. OR US-5537584-<br>\$.D.ID. OR US-5617559-\$.D.ID. OR US-<br>5649159-\$.D.ID. OR US-5717851-\$.D.ID.<br>OR US-5724604-\$.D.ID. OR US-5729716-<br>\$.D.ID. OR US-5784705-\$.D.ID. OR US-<br>5802541-\$.D.ID. OR US-5973392-\$.D.ID.<br>OR US-6173357-\$.D.ID. OR US-6260127-<br>\$.D.ID. OR US-6446158-\$.D.ID. OR US-<br>6553449-\$.D.ID. OR US-6618791-\$.D.ID.<br>OR US-6717855-\$.D.ID. OR US-6788592-<br>\$.D.ID. OR US-6948084-\$.D.ID. OR US-<br>7130308-\$.D.ID. OR US-7133960-\$.D.ID.<br>OR US-7379361-\$.D.ID. OR US-<br>20050010737-\$.D.ID. OR US- | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/05/05<br>00:39 |

|     |         |                                                                                                                                   |                 |    |     |                  |
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|     |         | 20070293094-\$.DID. OR US-3412243-\$.DID. OR US-2201420-\$.DID. OR US-2761179-\$.DID. OR US-2201346-\$.DID. OR US-2504131-\$.DID. |                 |    |     |                  |
| S63 | 2355572 | read\$only with non\$1volatile with main memory                                                                                   | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S64 | 2126    | read\$only with non\$1volatile with main with memory                                                                              | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S65 | 1       | "20080080261".pn.                                                                                                                 | US-PGPUB; USPAT | OR | OFF | 2014/05/11 20:14 |
| S66 | 4529    | 711/5.ccls. 711/147.ccls.                                                                                                         | US-PGPUB; USPAT | OR | OFF | 2014/05/15 16:09 |
| S67 | 3613    | DQS and DQ                                                                                                                        | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:10 |
| S68 | 1574    | DQS and DQ with (coupl\$3 connect\$3 isolat\$3 select\$3)                                                                         | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:10 |
| S69 | 1309    | DQS and DQ with (connect\$3 isolat\$3 select\$3)                                                                                  | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:11 |
| S70 | 1108    | DQS and DQ with (coupl\$3 isolat\$3 select\$3)                                                                                    | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:11 |
| S71 | 569     | DQS and DQ with (coupl\$3 isolat\$3)                                                                                              | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:12 |
| S72 | 149     | DQS and DQ with (decoupl\$3 isolat\$3)                                                                                            | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:15 |
| S73 | 149     | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3)                                                                                  | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:17 |
| S74 | 167     | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3 disconnect\$3)                                                                    | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:17 |
| S75 | 20      | DQS and DQ with (disconnect\$3)                                                                                                   | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:18 |
| S76 | 3       | "20010008006".pn. "20050257109".pn. "20070070669".pn.                                                                             | US-PGPUB; USPAT | OR | OFF | 2015/01/02 00:02 |
| S77 | 3       | "6747887".pn. "7093066".pn. "6832303".pn.                                                                                         | US-PGPUB; USPAT | OR | OFF | 2015/01/02 00:03 |

**EAST Search History (Interference)**

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|-------|--------|--------------------------------------|----------------|------------------|---------|------------------|
| L7    | 1049   | G06F12/0607.cpc.<br>G06F12/0813.cpc. | USPAT;<br>UPAD | OR               | OFF     | 2015/03/30 14:34 |
| L8    | 181517 | isolat\$3.clm.                       | USPAT;         | OR               | OFF     | 2015/03/30       |

|     |        |                           |                |    |     |                     |
|-----|--------|---------------------------|----------------|----|-----|---------------------|
|     |        |                           | UPAD           |    |     | 14:34               |
| L9  | 5909   | isolates.clm.             | USPAT;<br>UPAD | OR | OFF | 2015/03/30<br>14:34 |
| L10 | 0      | L7 and L9                 | USPAT;<br>UPAD | OR | OFF | 2015/03/30<br>14:34 |
| S57 | 3448   | 711/5.ccls. 711/147.ccls. | USPAT;<br>UPAD | OR | OFF | 2014/04/04<br>15:50 |
| S58 | 171076 | isolat\$3.clm.            | USPAT;<br>UPAD | OR | OFF | 2014/04/04<br>15:52 |
| S59 | 45     | S57 and S58               | USPAT;<br>UPAD | OR | OFF | 2014/04/04<br>15:52 |
| S78 | 3626   | 711/5.ccls. 711/147.ccls. | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:11 |
| S79 | 5815   | isolates.clm.             | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S80 | 0      | S78 and "L143"            | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S81 | 7      | S78 and S79               | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S82 | 0      | S78 and S79 and DQS.clm.  | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:15 |

**3/30/2015 2:34:48 PM**

**C:\Users\gbansal\Documents\EAST\Workspaces\13971231.wsp**

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|--------------------------------------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------|
| <b>Search Notes</b><br><br> | <b>Application/Control No.</b><br><br>13971231 | <b>Applicant(s)/Patent Under Reexamination</b><br><br>SOLOMON ET AL. |
|                                                                                                              | <b>Examiner</b><br><br>GURTEJ BANSAL           | <b>Art Unit</b><br><br>2189                                          |

| CPC- SEARCHED |            |          |
|---------------|------------|----------|
| Symbol        | Date       | Examiner |
| G06F 12/0607  | 03/30/2015 | GB       |
| G06F 12/0813  | 03/30/2015 | GB       |

| CPC COMBINATION SETS - SEARCHED |      |          |
|---------------------------------|------|----------|
| Symbol                          | Date | Examiner |
|                                 |      |          |

| US CLASSIFICATION SEARCHED |          |            |          |
|----------------------------|----------|------------|----------|
| Class                      | Subclass | Date       | Examiner |
| 711                        | 5; 147   | 05/15/2014 | GB       |

| SEARCH NOTES                                        |            |          |
|-----------------------------------------------------|------------|----------|
| Search Notes                                        | Date       | Examiner |
| Text Search in EAST (See Attached)                  | 05/15/2014 | GB       |
| NPL Search in Google Scholar (See Attached)         | 05/15/2014 | GB       |
| Inventor Search in eDAN                             | 05/15/2014 | GB       |
| Consulted Alex Sofocleous (SPE)                     | 05/15/2014 | GB       |
| Updated Text Search in EAST (See Attached)          | 12/16/2014 | GB       |
| Updated Text Search in EAST (See Attached)          | 01/02/2015 | GB       |
| UPdated NPL Search in Google Scholar (See Attached) | 01/02/2015 | GB       |
| Updated Text Search in EAST (See Attached)          | 03/30/2015 | GB       |
| Updated NPL Search in Google Scholar (See Attached) | 03/30/2015 | GB       |

| INTERFERENCE SEARCH     |                         |            |          |
|-------------------------|-------------------------|------------|----------|
| US Class/<br>CPC Symbol | US Subclass / CPC Group | Date       | Examiner |
| 711                     | 5; 147                  | 01/02/2015 | GB       |
|                         | G06F 12/0813            |            |          |

|                                           |  |
|-------------------------------------------|--|
| /GURTEJ BANSAL/<br>Examiner.Art Unit 2189 |  |
|-------------------------------------------|--|

**EAST Search History****EAST Search History (Prior Art)**

| Ref # | Hits   | Search Query                                                                                                                                                                                                                                                                                         | DBs             | Default Operator | Plurals | Time Stamp       |
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| L1    | 25     | rank same (DQ with DQS) with isolat\$3                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:21 |
| L2    | 29     | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:23 |
| L3    | 1      | "5388240".pn.                                                                                                                                                                                                                                                                                        | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:24 |
| L4    | 18     | "5388240".pn. "5463590".pn. "5953280".pn. "6188641".pn. "6205516".pn. "64804393".pn. "7464225".pn. "7865674".pn. "8089795".pn. "8130560".pn. "8189328".pn. "8233303".pn. "8250295".pn. "8417870".pn. "8516185".pn. "8516188".pn. "8756364".pn. "20070058409".pn. "20080104352".pn. "20080104352".pn. | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:28 |
| L5    | 69     | chip\$1select same rank and DQ and DQS                                                                                                                                                                                                                                                               | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:31 |
| L6    | 10     | rank same (DQ with DQS) with (mux multiplexer)                                                                                                                                                                                                                                                       | US-PGPUB; USPAT | OR               | ON      | 2015/03/30 14:32 |
| S1    | 4386   | 711/5.ccls. 711/147.ccls.                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:37 |
| S2    | 4481   | DQS                                                                                                                                                                                                                                                                                                  | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S3    | 88990  | DS                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S4    | 32759  | DQ                                                                                                                                                                                                                                                                                                   | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S5    | 3171   | S2 and S4                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | OFF     | 2013/12/02 23:38 |
| S6    | 134822 | rank                                                                                                                                                                                                                                                                                                 | US-PGPUB; USPAT | OR               | ON      | 2013/12/02 23:38 |
| S7    | 329    | S5 and S6                                                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR               | ON      | 2013/12/02 23:38 |
| S8    | 201    | US-4218740-\$.DID. OR US-4368515-\$.DID. OR US-4392212-\$.DID. OR US-                                                                                                                                                                                                                                | US-PGPUB;       | OR               | OFF     | 2013/12/03 00:02 |

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20060179206-\$.DID. OR US-  
20060259711-\$.DID. OR US-  
20060262586-\$.DID. OR US-  
20060267172-\$.DID. OR US-  
20060277355-\$.DID. OR US-  
20080162790-\$.DID. OR US-  
20090103387-\$.DID. OR US-  
20100070690-\$.DID. OR US-  
20100091540-\$.DID. OR US-  
20100128507-\$.DID. OR US-  
20110016250-\$.DID. OR US-  
20110016269-\$.DID. OR US-  
20110090749-\$.DID. OR US-  
20110125966-\$.DID. OR WO-1992002879-

|     |      |                                                                                                                                                                                                                                                                                                         |                 |    |    |                  |
|-----|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----|----|------------------|
|     |      | \$.DID. OR WO-1994007242-\$.DID. OR WO-1995034030-\$.DID. OR WO-1999000734-\$.DID. OR WO-2002058069-\$.DID. OR WO-2002063804-\$.DID. OR WO-2003017283-\$.DID. OR WO-2003069484-\$.DID. OR WO-2006055497-\$.DID. OR US-2003254-\$.DID. OR US-1969279-\$.DID. OR US-2097152-\$.DID. OR US-4194204-\$.DID. |                 |    |    |                  |
| S9  | 1184 | multiplex\$3 with (DQS and DQ)                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:07 |
| S10 | 359  | multiplex\$3 with (DQS and DQ) with delay\$3                                                                                                                                                                                                                                                            | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:08 |
| S11 | 850  | multiplex\$3 with DQS and delay with delay\$3                                                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S12 | 562  | multiplex\$3 with DQS and DQ with delay\$3                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S13 | 401  | multiplex\$3 with DQS same DQ with delay\$3                                                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:12 |
| S14 | 0    | 13/287042.app.                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S15 | 0    | 13/287042.ap.                                                                                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S16 | 0    | "13287042".ap.                                                                                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S17 | 0    | "13287042".app.                                                                                                                                                                                                                                                                                         | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:25 |
| S18 | 294  | multiplex\$3 with DQS same delay\$3 with data with signals                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S19 | 307  | multiplex\$3 with DQS same delay\$3 with data with (signals lines)                                                                                                                                                                                                                                      | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S20 | 9    | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same2 rank                                                                                                                                                                                                                           | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:28 |
| S21 | 26   | multiplex\$3 with DQS same delay\$3 with data with (signals lines) and rank                                                                                                                                                                                                                             | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:29 |
| S22 | 238  | multiplex\$3 with DQS same delay\$3 with data with (signals lines) same memory                                                                                                                                                                                                                          | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:30 |
| S23 | 347  | isolat\$3 with DQ with DQS                                                                                                                                                                                                                                                                              | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:47 |
| S24 | 21   | isolat\$3 with DQ with DQS same Rank                                                                                                                                                                                                                                                                    | US-PGPUB; USPAT | OR | ON | 2013/12/03 00:47 |
| S25 | 1353 | DQS with select\$3 with (memory rank)                                                                                                                                                                                                                                                                   | US-             | OR | ON | 2013/12/03       |

|     |      |                                                     |                        |    |    |                     |
|-----|------|-----------------------------------------------------|------------------------|----|----|---------------------|
|     |      |                                                     | PGPUB;<br>USPAT        |    |    | 00:50               |
| S26 | 54   | chip\$1select with rank and DQ and DQS              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:25 |
| S27 | 56   | chip\$1select same rank and DQ and DQS              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:26 |
| S28 | 61   | chip\$1select and rank and DQ and DQS               | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:27 |
| S29 | 5    | rank with DQ with DQS with low                      | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:39 |
| S30 | 300  | rank with DQ with DQS                               | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>18:40 |
| S31 | 82   | rank and (DQ with DQS) with off                     | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:03 |
| S32 | 271  | rank and (DQ with DQS) with high                    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S33 | 29   | rank with (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S34 | 1    | "6873533".pn.                                       | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:07 |
| S35 | 7    | rank with (DQ with DQS) with terminat\$3            | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:10 |
| S36 | 20   | rank with (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S37 | 21   | rank same (DQ with DQS) with isolat\$3              | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S38 | 57   | rank same (DQ with DQS) with high                   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:11 |
| S39 | 7    | rank same (DQ with DQS) with (mux<br>multiplexer)   | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:15 |
| S40 | 37   | rank and (DQ with DQS) with (mux<br>multiplexer)    | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:16 |
| S41 | 1040 | (DQ with DQS) with (mux multiplexer)                | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S42 | 1024 | (DQ with DQS) with (mux multiplexer) and<br>memory  | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S43 | 634  | (DQ with DQS) with (mux multiplexer)<br>same memory | US-<br>PGPUB;<br>USPAT | OR | ON | 2013/12/03<br>19:21 |
| S44 | 231  | (DQ with DQS) with (mux multiplexer)                | US-                    | OR | ON | 2013/12/03          |

|     |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |    |     |                     |
|-----|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----|-----|---------------------|
|     |      | with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PGPUB;<br>USPAT        |    |     | 19:21               |
| S45 | 1    | "20040098428".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:40 |
| S46 | 1    | "20040098528".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:41 |
| S47 | 1    | "20030070052".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>19:42 |
| S48 | 1    | "20050047250".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | ON  | 2013/12/03<br>20:07 |
| S49 | 1599 | G06F12/0607.cpc. G06F12/0813.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | OFF | 2013/12/20<br>11:11 |
| S50 | 2437 | latency with memory adj controller with<br>memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:15 |
| S51 | 59   | latency with memory adj controller with<br>(measur\$3 test\$3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>14:16 |
| S52 | 22   | rank same (DQ with DQS) with isolat\$3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:16 |
| S53 | 22   | isolat\$3 with DQ with DQS same Rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S54 | 26   | multiplex\$3 with DQS same delay\$3 with<br>data with (signals lines) and rank                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:29 |
| S55 | 1    | "6553450".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:33 |
| S56 | 1    | "6742098".pn.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:48 |
| S60 | 644  | isolat\$3 with load with memory                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S61 | 46   | isolat\$3 with load with memory with<br>controller                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/04/04<br>15:58 |
| S62 | 28   | US-5345412-\$.DID. OR US-5537584-<br>\$.DID. OR US-5617559-\$.DID. OR US-<br>5649159-\$.DID. OR US-5717851-\$.DID.<br>OR US-5724604-\$.DID. OR US-5729716-<br>\$.DID. OR US-5784705-\$.DID. OR US-<br>5802541-\$.DID. OR US-5973392-\$.DID.<br>OR US-6173357-\$.DID. OR US-6260127-<br>\$.DID. OR US-6446158-\$.DID. OR US-<br>6553449-\$.DID. OR US-6618791-\$.DID.<br>OR US-6717855-\$.DID. OR US-6788592-<br>\$.DID. OR US-6948084-\$.DID. OR US-<br>7130308-\$.DID. OR US-7133960-\$.DID.<br>OR US-7379361-\$.DID. OR US-<br>20050010737-\$.DID. OR US- | US-<br>PGPUB;<br>USPAT | OR | ON  | 2014/05/05<br>00:39 |

|     |         |                                                                                                                                   |                 |    |     |                  |
|-----|---------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------|----|-----|------------------|
|     |         | 20070293094-\$.DID. OR US-3412243-\$.DID. OR US-2201420-\$.DID. OR US-2761179-\$.DID. OR US-2201346-\$.DID. OR US-2504131-\$.DID. |                 |    |     |                  |
| S63 | 2355572 | read\$only with non\$1volatile with main memory                                                                                   | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S64 | 2126    | read\$only with non\$1volatile with main with memory                                                                              | US-PGPUB; USPAT | OR | OFF | 2014/05/08 19:12 |
| S65 | 1       | "20080080261".pn.                                                                                                                 | US-PGPUB; USPAT | OR | OFF | 2014/05/11 20:14 |
| S66 | 4529    | 711/5.ccls. 711/147.ccls.                                                                                                         | US-PGPUB; USPAT | OR | OFF | 2014/05/15 16:09 |
| S67 | 3613    | DQS and DQ                                                                                                                        | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:10 |
| S68 | 1574    | DQS and DQ with (coupl\$3 connect\$3 isolat\$3 select\$3)                                                                         | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:10 |
| S69 | 1309    | DQS and DQ with (connect\$3 isolat\$3 select\$3)                                                                                  | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:11 |
| S70 | 1108    | DQS and DQ with (coupl\$3 isolat\$3 select\$3)                                                                                    | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:11 |
| S71 | 569     | DQS and DQ with (coupl\$3 isolat\$3)                                                                                              | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:12 |
| S72 | 149     | DQS and DQ with (decoupl\$3 isolat\$3)                                                                                            | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:15 |
| S73 | 149     | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3)                                                                                  | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:17 |
| S74 | 167     | DQS and DQ with (decoupl\$3 isolat\$3 detach\$3 disconnect\$3)                                                                    | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:17 |
| S75 | 20      | DQS and DQ with (disconnect\$3)                                                                                                   | US-PGPUB; USPAT | OR | OFF | 2015/01/01 23:18 |
| S76 | 3       | "20010008006".pn. "20050257109".pn. "20070070669".pn.                                                                             | US-PGPUB; USPAT | OR | OFF | 2015/01/02 00:02 |
| S77 | 3       | "6747887".pn. "7093066".pn. "6832303".pn.                                                                                         | US-PGPUB; USPAT | OR | OFF | 2015/01/02 00:03 |

**EAST Search History (Interference)**

| Ref # | Hits   | Search Query              | DBs         | Default Operator | Plurals | Time Stamp       |
|-------|--------|---------------------------|-------------|------------------|---------|------------------|
| S57   | 3448   | 711/5.ccls. 711/147.ccls. | USPAT; UPAD | OR               | OFF     | 2014/04/04 15:50 |
| S58   | 171076 | isolat\$3.clm.            | USPAT;      | OR               | OFF     | 2014/04/04       |

## EAST Search History

|     |      |                             |                |    |     |                     |
|-----|------|-----------------------------|----------------|----|-----|---------------------|
|     |      |                             | UPAD           |    |     | 15:52               |
| S59 | 45   | S57 and S58                 | USPAT;<br>UPAD | OR | OFF | 2014/04/04<br>15:52 |
| S78 | 3626 | 711/5.ccls. 711/147.ccls.   | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:11 |
| S79 | 5815 | isolates.clm.               | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S80 | 0    | S78 and "L143"              | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S81 | 7    | S78 and S79                 | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:12 |
| S82 | 0    | S78 and S79 and<br>DQS.clm. | USPAT;<br>UPAD | OR | OFF | 2015/01/02<br>00:15 |

**3/ 30/ 2015 2:33:35 PM****C:\Users\gbansal\Documents\EAST\Workspaces\13971231.wsp**

Receipt date: 03/23/2015

13971231 - GAU: 2139

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012. OMB 0651-0031

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|------------------------------------------------------------------------------------------------------------------------------------------|---|----|---|--------------------------|------------------|
| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    |   | <b>Complete if Known</b> |                  |
|                                                                                                                                          |   |    |   | Application Number       | 13/971,231       |
|                                                                                                                                          |   |    |   | Filing Date              | August 20, 2013  |
|                                                                                                                                          |   |    |   | First Named Inventor     | Jayesh R. Bhakta |
|                                                                                                                                          |   |    |   | Art Unit                 | 2139             |
|                                                                                                                                          |   |    |   | Examiner Name            | Unknown          |
| Sheet                                                                                                                                    | 1 | of | 3 | Attorney Docket Number   | NETL.018P2C7     |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 5388240                                  | 02-01-1995                       | IBM Corporation                                    |                                                                                 |
|                        | 2.                       | 5463590                                  | 10-31-1995                       | Watanabe                                           |                                                                                 |
|                        | 3.                       | 5953280                                  | 09-14-1999                       | Matsui                                             |                                                                                 |
|                        | 4.                       | 6188641                                  | 02-13-2001                       | Uchida                                             |                                                                                 |
|                        | 5.                       | 6205516                                  | 03-20-2001                       | Usami                                              |                                                                                 |
|                        | 6.                       | 6480439                                  | 11-12-2002                       | Tokutome et al.                                    |                                                                                 |
|                        | 7.                       | 7464225                                  | 12-09-2008                       | Tsern                                              |                                                                                 |
|                        | 8.                       | 7865674                                  | 01-04-2011                       | Gower et al.                                       |                                                                                 |
|                        | 9.                       | 8089795                                  | 01-03-2012                       | Rajan                                              |                                                                                 |
|                        | 10.                      | 8130560                                  | 03-06-2012                       | Rajan                                              |                                                                                 |
|                        | 11.                      | 8189328                                  | 05-29-2012                       | Kanapathippillai                                   |                                                                                 |
|                        | 12.                      | 8233303                                  | 07-31-2012                       | Best                                               |                                                                                 |
|                        | 13.                      | 8250295                                  | 08-21-2012                       | Amidi et al.                                       |                                                                                 |
|                        | 14.                      | 8417870                                  | 04-09-2013                       | Lee et al.                                         |                                                                                 |
|                        | 15.                      | 8516185                                  | 08-20-2013                       | Lee et al.                                         |                                                                                 |
|                        | 16.                      | 8516188                                  | 08-20-2013                       | Solomon et al.                                     |                                                                                 |
|                        | 17.                      | 8756364                                  | 06-17-2014                       | Bhakta et al.                                      |                                                                                 |
|                        | 18.                      | 20070058409                              | 03-15-2007                       | Ruckerbauer                                        |                                                                                 |
|                        | 19.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 20.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 21.                      | RE36229                                  | 06-15-1999                       | Cady                                               |                                                                                 |

| US PATENT APPLICATIONS |                          |                    |                             |                                                    |                                                                                 |
|------------------------|--------------------------|--------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Application Number | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          |                    |                             |                                                    |                                                                                 |
|                        | 22.                      | 13/411,344         | 3/2/2012                    | Lee                                                | Entire Prosecution History                                                      |
|                        | 23.                      | 13/970,606         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 24.                      | 13/971,231         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 25.                      | 14/229,844         | 3/29/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 26.                      | 14/324,990         | 7/7/2014                    | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 27.                      | 14/337,168         | 7/21/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |

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| <b>NON PATENT LITERATURE DOCUMENTS</b> |
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EXAMINER /Gurtej Bansal/ (03/30/2015)

DATE CONSIDERED 03/30/2015

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./

Receipt date: 03/23/2015

13971231 - GAU: 2139

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012. OMB 0651-0031

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| Substitute for form 1449/PTO<br><br><b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    |   | <b>Complete if Known</b> |                  |
|                                                                                                                                          |   |    |   | Application Number       | 13/971,231       |
|                                                                                                                                          |   |    |   | Filing Date              | August 20, 2013  |
|                                                                                                                                          |   |    |   | First Named Inventor     | Jayesh R. Bhakta |
|                                                                                                                                          |   |    |   | Art Unit                 | 2139             |
|                                                                                                                                          |   |    |   | Examiner Name            | Unknown          |
| Sheet                                                                                                                                    | 2 | of | 3 | Attorney Docket Number   | NETL.018P2C7     |

| Examiner Initials* | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|--------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | 28.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-00882, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 29.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-00882, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 30.                   | Inter Partes Review of U.S. Patent No. 8,081,536, IPR Case No. IPR2014-00883, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 31.                   | Inter Partes Review of U.S. Patent No. 8,081,536, IPR Case No. IPR2014-00883, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 32.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Patent Owner's Preliminary Response Pursuant to 37 C.F.R. § 42.107, filed October 7, 2014                                                                                         |                |
|                    | 33.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Decision – Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014                                                                                        |                |
|                    | 34.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3001 to Decision – Institution of Inter Partes Review, Excerpts from IEEE Dictionary, issued December 16, 2014                                                            |                |
|                    | 35.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3002 to Decision – Institution of Inter Partes Review, Excerpts from IEEE Dictionary, issued December 16, 2014                                                            |                |
|                    | 36.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3003 to Decision – Institution of Inter Partes Review, Excerpts from Oxford English Dictionary, issued December 16, 2014                                                  |                |
|                    | 37.                   | Inter Partes Review of U.S. Patent No. 7,881,150, IPR Case No. IPR2014-01011, Exhibit 3004 to Decision – Institution of Inter Partes Review, Excerpts from Oxford English Dictionary, issued December 16, 2014                                                  |                |
|                    | 38.                   | McCluskey, Edward J., <i>Logic Design Principles with Emphasis on Testable Semicustom Circuits</i> , Prentice Hall, 1986, pp. 104-107 and 119-120.                                                                                                              |                |
|                    | 39.                   | Inter Partes Review Case No. IPR2014-01029, Petition for Inter Partes Review of U.S. Patent No. 8,516,185, filed on June 24, 2014.                                                                                                                              |                |
|                    | 40.                   | Inter Partes Review Case No. IPR2014-01029, Exhibit 1008 to Petition for Inter Partes Review, "Declaration of Charles J. Neuhauser, Ph.D. under 37 C.F.R. § 1.68," filed on June 24, 2014.                                                                      |                |
|                    | 41.                   | Inter Partes Review Case No. IPR2014-01029, Supplemental Petition for Inter Partes Review of U.S. Patent No. 8,516,185, filed on July 23, 2014.                                                                                                                 |                |
|                    | 42.                   | Inter Partes Review Case No. IPR2014-01029, Patent Owner's Preliminary Response pursuant to 37 C.F.R. § 42.107, filed on October 17, 2014.                                                                                                                      |                |
|                    | 43.                   | Inter Partes Review Case No. IPR2014-01029, Decision Denying Institution of Inter Partes Review 37 C.F.R. § 42.108, issued December 16, 2014.                                                                                                                   |                |
|                    | 44.                   | Inter Partes Review Case No. IPR2014-01029, Petitioner's Request for Rehearing pursuant to 37 C.F.R. § 42.71, filed on January 15, 2015.                                                                                                                        |                |

EXAMINER /Gurtej Bansal/ (03/30/2015)

DATE CONSIDERED 03/30/2015

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./



Receipt date: 03/23/2015

13971231 - GAU: 2139

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012. OMB 0651-0031

US Patent &amp; Trademark Office; U.S. DEPARTMENT OF COMMERCE

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|-----------------------------------------------------------------------------------------------|---|--------------------------|------------------|------------------------|--------------|
| Substitute for form 1449/PTO                                                                  |   | <b>Complete if Known</b> |                  |                        |              |
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br>(Use as many sheets as necessary) |   | Application Number       | 13/971,231       |                        |              |
|                                                                                               |   | Filing Date              | August 20, 2013  |                        |              |
|                                                                                               |   | First Named Inventor     | Jayesh R. Bhakta |                        |              |
|                                                                                               |   | Art Unit                 | 2139             |                        |              |
|                                                                                               |   | Examiner Name            | Unknown          |                        |              |
| Sheet                                                                                         | 3 | of                       | 3                | Attorney Docket Number | NETL.018P2C7 |

| NON PATENT LITERATURE DOCUMENTS |                       |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner Initials*              | Cite No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 45.                   | Inter Partes Review Case No. IPR2014-01029, Decision Denying Request for Rehearing, Issued on March 3, 2015.                                                                                                                                                    |                |
|                                 | 46.                   | Inter Partes Review Case No. IPR2014-01369, Corrected Petition for Inter Partes Review of Claims 1-19 of U.S. Patent No. 8,516,185, filed on September 22, 2014.                                                                                                |                |
|                                 | 47.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1008 to Corrected Petition for Inter Partes Review, "Declaration of Dr. Nader Bagherzadeh under 37 C.F.R. § 1.68," filed on September 22, 2014.                                                             |                |
|                                 | 48.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1013 to Corrected Petition for Inter Partes Review, "Webster's II New College Dictionary," filed on September 22, 2014.                                                                                     |                |
|                                 | 49.                   | Inter Partes Review Case No. IPR2014-01369, Exhibit 1014 to Corrected Petition for Inter Partes Review, "Standard Dictionary of Electrical and Electronics Terms," IEEE 1988, filed on September 22, 2014.                                                      |                |
|                                 | 50.                   | Inter Partes Review Case No. IPR2014-01369, Decision Denying Institution of Inter Partes Review 37 C.F.R. § 42.108, issued March 9, 2014.                                                                                                                       |                |
|                                 | 51.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Smart Storage Systems, Inc.'s Invalidity Contentions, dated June 6, 2014                          |                |
|                                 | 52.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Exhibits E.1-E.7 to "Smart Storage Systems, Inc.'s Invalidity Contentions," dated June 6, 2014.   |                |
|                                 | 53.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Diablo Technologies, Inc.'s Invalidity Contentions, dated June 6, 2014.                           |                |
|                                 | 54.                   | U.S. District Court Northern District of California, Case No. 4:13-CV-05889-YGR, Netlist, Inc. v. Smart Storage Systems, Inc., and Diablo Technologies, Inc., Exhibits D-1 to D6 to "Diablo Technologies, Inc.'s Invalidity Contentions," dated June 6, 2014.   |                |

EXAMINER

/Gurtej Bansal/ (03/30/2015)

DATE CONSIDERED

03/30/2015

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./



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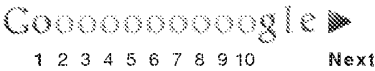
High performance high capacity memory systems

JJ Shau - US Patent App. 11/933,556, 2007 - Google Patents

... signals that are allowed to communicate with the system level signal, and **isolate** the loadings ... is turned off, the loadings on the chip level signal (Dc) are **isolated** from the ... The major function of the bidirectional multiplexer (BM1) used by the present invention is **loading isolation**. ...

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# PART B - FEE(S) TRANSMITTAL

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**Commissioner for Patents**  
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**or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Customer No. 79141

The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

|                    |
|--------------------|
| (Depositor's name) |
| (Signature)        |
| (Date)             |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 13971231        | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7        | 2072             |

TITLE OF INVENTION:

| APPLN. TYPE    | SMALL ENTITY | ISSUE FEE DUE  | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|--------------|----------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL        | \$480          | \$0                 | \$0                  | \$480            | 07/02/2015 |
| EXAMINER       | ART UNIT     | CLASS-SUBCLASS |                     |                      |                  |            |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev. 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 JAMIE J. ZHENG, Ph.D, Esq.  
2  
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Netlist, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Irvine, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

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- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

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- ☐ A check is enclosed.
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5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

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Authorized Signature /Jamie J. Zheng/

Date April 2, 2015

Typed or printed name Jamie J. Zheng

Registration No. 51,167

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
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| Electronic Patent Application Fee Transmittal      |                 |                                                                  |               |                             |
|----------------------------------------------------|-----------------|------------------------------------------------------------------|---------------|-----------------------------|
| <b>Application Number:</b>                         |                 | 13971231                                                         |               |                             |
| <b>Filing Date:</b>                                |                 | 20-Aug-2013                                                      |               |                             |
| <b>Title of Invention:</b>                         |                 | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        |                 | Jefferey C. Solomon                                              |               |                             |
| <b>Filer:</b>                                      |                 | Jamie Jie Zheng                                                  |               |                             |
| <b>Attorney Docket Number:</b>                     |                 | NETL.018P2C7                                                     |               |                             |
| Filed as Small Entity                              |                 |                                                                  |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                 |                                                                  |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b> | <b>Quantity</b>                                                  | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                 |                                                                  |               |                             |
| <b>Pages:</b>                                      |                 |                                                                  |               |                             |
| <b>Claims:</b>                                     |                 |                                                                  |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                 |                                                                  |               |                             |
| <b>Petition:</b>                                   |                 |                                                                  |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                 |                                                                  |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                 |                                                                  |               |                             |
| Utility Appl Issue Fee                             | 2501            | 1                                                                | 480           | 480                         |

| Description               | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|---------------------------|----------|----------|--------|----------------------|
| <b>Extension-of-Time:</b> |          |          |        |                      |
| <b>Miscellaneous:</b>     |          |          |        |                      |
| <b>Total in USD (\$)</b>  |          |          |        | <b>480</b>           |

| Electronic Acknowledgement Receipt          |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| <b>EFS ID:</b>                              | 21961160                                                         |
| <b>Application Number:</b>                  | 13971231                                                         |
| <b>International Application Number:</b>    |                                                                  |
| <b>Confirmation Number:</b>                 | 2072                                                             |
| <b>Title of Invention:</b>                  | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                                              |
| <b>Customer Number:</b>                     | 79141                                                            |
| <b>Filer:</b>                               | Jamie Jie Zheng                                                  |
| <b>Filer Authorized By:</b>                 |                                                                  |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                                                     |
| <b>Receipt Date:</b>                        | 02-APR-2015                                                      |
| <b>Filing Date:</b>                         | 20-AUG-2013                                                      |
| <b>Time Stamp:</b>                          | 20:54:00                                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                                      |

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| Payment Type                                                                                                   | Credit Card |
| Payment was successfully received in RAM                                                                       | \$ 480      |
| RAM confirmation Number                                                                                        | 7004        |
| Deposit Account                                                                                                |             |
| Authorized User                                                                                                |             |
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| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                             |                                                   |                                                   |                  |                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------|---------------------------------------------------|------------------|------------------|
| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Document Description        | File Name                                         | File Size(Bytes)/ Message Digest                  | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Issue Fee Payment (PTO-85B) | 2015-04-02_Issue_Fee_Transmission_NETL018P2C7.pdf | 74229<br>e8ef5fe764f568389c565bfb79e2c9e743d4c193 | no               | 2                |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             |                                                   |                                                   |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                                                   |                                                   |                  |                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Fee Worksheet (SB06)        | fee-info.pdf                                      | 30652<br>46706b2b29fe24af4b45c994c62cfb8e2d57e6c9 | no               | 2                |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             |                                                   |                                                   |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                                                   |                                                   |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                                                   | 104881                                            |                  |                  |
| <p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/>         If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/>         If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/>         If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                             |                                                   |                                                   |                  |                  |

Electronically filed \*\*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Netlist, Inc.  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : MEMORY MODULE WITH LOAD  
REDUCING CIRCUIT AND  
METHOD OF OPERATION  
Examiner : BANSAL, GURTEJ  
Art Unit : 2139  
Conf. No. : 2072  
Docket No. : NETL.018P2C7

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April 2, 2015

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/Jamie J. Zheng/

Jamie J. Zheng, Reg. No. 51167

AMENDMENT UNDER 37 C.F.R. 1.312

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

Applicant hereby submits the following amendment under 37 C.F.R. 1.312.

The Commissioner is hereby authorized to charge any required fee(s) to Deposit  
Account No. 50-5963.

AMENDMENTS to the SPECIFICATION begin on Page 2 of this paper.

REMARKS begin on Page 3 of this paper.

**IN THE SPECIFICATION**

Please amend paragraph [0011] under the Summary of the Invention as follows:

**[0011]** In certain embodiments, a memory module includes a plurality of memory devices and is operable in a computer system to perform memory operations in response to memory commands from a memory controller of the computer system. The memory module is to be ~~being~~ coupled to the memory controller via a memory bus, the memory bus including a control/address (C/A) bus and a data bus. The memory module comprises a register device configured to receive a set of input control/address signals associated with a respective memory command (e.g., a read command or a write command) from the memory controller and to generate a set of output control/address signals in response to the set of input control/address signals. The set of output control/address signals are provided to the plurality of memory devices. The memory module further comprises a circuit coupled between the data bus and the plurality of memory devices, the circuit to selectively isolate one or more first memory devices among the plurality of memory devices from the data bus in response to the respective memory command so as to reduce a load of the memory module to the computer system while one or more second memory devices among the plurality of memory devices are communicating with the memory controller in response to the set of output control/address signals.

---

*REMARKS*

This amendment under 37 C.F.R. 1.312 is filed after the Notice of Allowance dated April 2, 2015.

Paragraph [0011] under the Summary of the Invention are amended to correct a grammatical/typographical error. No new matter is added.

The undersigned attorney can be reached at (650) 273-6008, if a telephone call could help resolve any remaining items.

Respectfully submitted,

Date: April 2, 2015

/Jamie J. Zheng/

Jamie J. Zheng  
Customer Number 79141

51167  
(Reg. No.)

| Electronic Acknowledgement Receipt          |                                                                  |
|---------------------------------------------|------------------------------------------------------------------|
| <b>EFS ID:</b>                              | 21961235                                                         |
| <b>Application Number:</b>                  | 13971231                                                         |
| <b>International Application Number:</b>    |                                                                  |
| <b>Confirmation Number:</b>                 | 2072                                                             |
| <b>Title of Invention:</b>                  | MEMORY MODULE WITH LOAD REDUCING CIRCUIT AND METHOD OF OPERATION |
| <b>First Named Inventor/Applicant Name:</b> | Jefferey C. Solomon                                              |
| <b>Customer Number:</b>                     | 79141                                                            |
| <b>Filer:</b>                               | Jamie Jie Zheng                                                  |
| <b>Filer Authorized By:</b>                 |                                                                  |
| <b>Attorney Docket Number:</b>              | NETL.018P2C7                                                     |
| <b>Receipt Date:</b>                        | 02-APR-2015                                                      |
| <b>Filing Date:</b>                         | 20-AUG-2013                                                      |
| <b>Time Stamp:</b>                          | 21:13:55                                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                                      |

**Payment information:**

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| Submitted with Payment | no |
|------------------------|----|

**File Listing:**

| Document Number | Document Description                           | File Name                                 | File Size(Bytes)/<br>Message Digest                | Multi Part /.zip | Pages (if appl.) |
|-----------------|------------------------------------------------|-------------------------------------------|----------------------------------------------------|------------------|------------------|
| 1               | Amendment after Notice of Allowance (Rule 312) | 2015-04-02_312_Amendment_ NETL018P2C7.pdf | 580403<br>efa07f26f0dd2c2937ed2170b7653d78fdd26090 | no               | 3                |

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**New Applications Under 35 U.S.C. 111**

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Electronically filed \*\*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Netlist, Inc.  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : MEMORY MODULE WITH LOAD  
REDUCING CIRCUIT AND  
METHOD OF OPERATION  
Examiner : BANSAL, GURTEJ  
Art Unit : 2139  
Conf. No. : 2072  
Docket No. : NETL.018P2C7

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April 2, 2015

(Date)

/Jamie J. Zheng/

Jamie J. Zheng, Reg. No. 51167

AMENDMENT UNDER 37 C.F.R. 1.312

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

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The Commissioner is hereby authorized to charge any required fee(s) to Deposit

Account No. 50-5963.

AMENDMENTS to the SPECIFICATION begin on Page 2 of this paper.

REMARKS begin on Page 3 of this paper.



# UNITED STATES PATENT AND TRADEMARK OFFICE

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| APPLICATION NO.                                                                   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------------------------------------------------------------------------|-------------|----------------------|---------------------|------------------|
| 13/971,231                                                                        | 08/20/2013  | Jefferey C. Solomon  | NETL.018P2C7        | 2072             |
| 79141                                                                             | 7590        | 04/20/2015           | EXAMINER            |                  |
| The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306 |             |                      | BANSAL, GURTEJ      |                  |
|                                                                                   |             |                      | ART UNIT            | PAPER NUMBER     |
|                                                                                   |             |                      | 2139                |                  |
|                                                                                   |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                                                                                   |             |                      | 04/20/2015          | ELECTRONIC       |

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The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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| APPLICATION NO./<br>CONTROL NO. | FILING DATE     | FIRST NAMED INVENTOR /<br>PATENT IN REEXAMINATION | ATTORNEY DOCKET NO. |
|---------------------------------|-----------------|---------------------------------------------------|---------------------|
| 13/971,231                      | 20 August, 2013 | SOLOMON ET AL.                                    | NETL.018P2C7        |

|                                                                                   |  |                 |              |
|-----------------------------------------------------------------------------------|--|-----------------|--------------|
| The Law Office of Jamie Zheng, Ph.D Esq.<br>P.O. Box 60573<br>Palo Alto, CA 94306 |  | <b>EXAMINER</b> |              |
|                                                                                   |  | GURTEJ BANSAL   |              |
|                                                                                   |  | <b>ART UNIT</b> | <b>PAPER</b> |
|                                                                                   |  | 2139            | 20150415     |

DATE MAILED:

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Commissioner for Patents

|                                                     |                                                    |
|-----------------------------------------------------|----------------------------------------------------|
| The amendment dated April 2, 2015 has been entered. |                                                    |
|                                                     | /GURTEJ BANSAL/<br>Primary Examiner, Art Unit 2139 |

PTO-90C (Rev.04-03)

Receipt date: 04/07/2014

13971231 - GAU: 2189

PTO/SB/08a/b(07-09)

Approved for use through 7/31/2012, OMB 0651-0031

US Patent &amp; Trademark Office; U.S. DEPARTMENT OF COMMERCE

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|                                                                                                                                          |   |    |   | Application Number       | 13/971,231       |
|                                                                                                                                          |   |    |   | Filing Date              | August 20, 2013  |
|                                                                                                                                          |   |    |   | First Named Inventor     | Jayesh R. Bhakta |
|                                                                                                                                          |   |    |   | Art Unit                 | 2189             |
|                                                                                                                                          |   |    |   | Examiner Name            | Unknown          |
| Sheet                                                                                                                                    | 1 | of | 1 | Attorney Docket Number   | NETL.018P2C7     |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 20080025137                              | 01-31-2008                       | <del>Natarajan et al.</del>                        | Rajan; Suresh Natarajan; et al.                                                 |
|                        | 2                        | 2006233012                               | 10-19-2006                       | <del>Tomonori et al.</del>                         | Sekiguchi; Tomonori; et al.                                                     |

Change(s) applied

to document,

/S.X.S./

2/25/2015

| FOREIGN PATENT DOCUMENTS |                          |                         |                                     |                                                       |                                                                                    |                |
|--------------------------|--------------------------|-------------------------|-------------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials *   | Cite<br>No. <sup>1</sup> | Foreign Patent Document | Publication<br>Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited<br>Document | Pages, Columns, Lines,<br>Where Relevant<br>Passages or Relevant<br>Figures Appear | T <sup>6</sup> |
|                          | 3                        | EP 1 816 570 A2         | 08-08-2007                          | Rambus, Inc.                                          |                                                                                    |                |

| NON PATENT LITERATURE DOCUMENTS |                          |                                                                                                                                                                                                                                                                 |                |
|---------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Examiner<br>Initials*           | Cite<br>No. <sup>1</sup> | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>2</sup> |
|                                 | 4                        | International Search Report and Written Opinion, PCT/US2011/059209, January 31, 2013                                                                                                                                                                            |                |

EXAMINER

/Gurtej Bansal/ (05/11/2014)

DATE CONSIDERED

05/11/2014

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./

Receipt date: 04/07/2014

13971231 - GAU: 2189

PTO/SB/08a/b(07-09)

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|                                                                                                                                          |         |    |   | Application Number       | 13/971,231       |
|                                                                                                                                          |         |    |   | Filing Date              | August 20, 2013  |
|                                                                                                                                          |         |    |   | First Named Inventor     | Jayesh R. Bhakta |
|                                                                                                                                          |         |    |   | Art Unit                 | 2189             |
| Examiner Name                                                                                                                            | Unknown |    |   |                          |                  |
| Sheet                                                                                                                                    | 1       | of | 3 | Attorney Docket Number   | NETL018P2C7      |

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1                        | 5345412                                  | 09-06-1994                       | Shiratsuchi                                        |                                                                                 |
|                        | 2                        | 5537584                                  | 07-16-1996                       | Miyai et al.                                       |                                                                                 |
|                        | 3                        | 5617559                                  | 04-01-1997                       | Le et al.                                          |                                                                                 |
|                        | 4                        | 5649159                                  | 07-15-1997                       | Le et al.                                          |                                                                                 |
|                        | 5                        | 5717851                                  | 02-10-1998                       | Yishay et al.                                      |                                                                                 |
|                        | 6                        | 5724604                                  | 03-03-1998                       | Moyer                                              |                                                                                 |
|                        | 7                        | 5729716                                  | <del>05-17-1998</del>            | Lee et al. 3/1998                                  |                                                                                 |
|                        | 8                        | 5784705                                  | 07-21-1998                       | Leung, Wingyu                                      |                                                                                 |
|                        | 9                        | 5802541                                  | 09-01-1998                       | Reed                                               |                                                                                 |
|                        | 10                       | 5973392                                  | 10-26-1999                       | Senba et al.                                       |                                                                                 |
|                        | 11                       | 6173357                                  | <del>01-09-2011</del>            | Ju 1/2001                                          |                                                                                 |
|                        | 12                       | 6260127                                  | 07-10-2001                       | Olari et al.                                       |                                                                                 |
|                        | 13                       | 6446158                                  | 09-03-2002                       | Karabatsos                                         |                                                                                 |
|                        | 14                       | 6553449                                  | 04-22-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 15                       | 6618791                                  | 09-09-2003                       | Dodd et al.                                        |                                                                                 |
|                        | 16                       | 6717855                                  | 04-06-2004                       | Underwood                                          |                                                                                 |
|                        | 17                       | 6788592                                  | 09-07-2004                       | Nakata et al.                                      |                                                                                 |
|                        | 18                       | 6948084                                  | 09-20-2005                       | Manapat et al                                      |                                                                                 |
|                        | 19                       | 7130308                                  | 10-31-2006                       | Haddock et al.                                     |                                                                                 |
|                        | 20                       | 7133960                                  | 11-07-2006                       | Thompson et al.                                    |                                                                                 |
|                        | 21                       | 7379361                                  | 05-27-2008                       | Co et al.                                          |                                                                                 |
|                        | 22                       | 20050010737                              | 01-01-2005                       | Ware et al.                                        |                                                                                 |
|                        | 23                       | 20070293094                              | 12-01-2007                       | Aekins, Robert A.                                  |                                                                                 |

Change(s) applied  
to document,  
/S.X.S./  
Change(s) applied  
to document,  
/S.X.S./  
2/25/2015

| US PATENT APPLICATIONS |                          |                                          |                             |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                             |                                                    |                                                                                 |
|                        | 24                       | 95/001,758                               | 09-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 25                       | 13/154,172                               | 06-06-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 26                       | 13/287,042                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 27                       | 13/473,413                               | 05-16-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 28                       | 13/032,470                               | 02-22-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 29                       | 13/287,081                               | 11-01-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 30                       | 13/971,231                               | 08-20-2013                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 31                       | 13/412,243                               | 03-05-2012                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 32                       | 13/183,253                               | 07-14-2011                  | Owned by Netlist, Inc.                             |                                                                                 |
|                        | 33                       | 13/745,790                               | 01-19-2013                  | Owned by Netlist, Inc.                             |                                                                                 |

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| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br><i>(Use as many sheets as necessary)</i> |   |    | Application Number       | 13/971,231             |              |
|                                                                                                      |   |    | Filing Date              | August 20, 2013        |              |
|                                                                                                      |   |    | First Named Inventor     | Jayesh R. Bhakta       |              |
|                                                                                                      |   |    | Art Unit                 | 2139                   |              |
|                                                                                                      |   |    | Examiner Name            | Unknown                |              |
| Sheet                                                                                                | 1 | of | 3                        | Attorney Docket Number | NETL.018P2C7 |

Change(s) applied  
to document,  
/J.H./  
4/23/2015

| US PATENT DOCUMENTS    |                          |                                          |                                  |                                                    |                                                                                 |
|------------------------|--------------------------|------------------------------------------|----------------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Document Number                          | Publication Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        |                          | Number-Kind Code <sup>2</sup> (if known) |                                  |                                                    |                                                                                 |
|                        | 1.                       | 5388240                                  | 02-01-1995                       | IBM Corporation                                    | Olderdissen et al.                                                              |
|                        | 2.                       | 5463590                                  | 10-31-1995                       | Watanabe                                           |                                                                                 |
|                        | 3.                       | 5953280                                  | 09-14-1999                       | Matsui                                             |                                                                                 |
|                        | 4.                       | 6188641                                  | 02-13-2001                       | Uchida                                             |                                                                                 |
|                        | 5.                       | 6205516                                  | 03-20-2001                       | Usami                                              |                                                                                 |
|                        | 6.                       | 6480439                                  | 11-12-2002                       | Tokutome et al.                                    |                                                                                 |
|                        | 7.                       | 7464225                                  | 12-09-2008                       | Tsern                                              |                                                                                 |
|                        | 8.                       | 7865674                                  | 01-04-2011                       | Gower et al.                                       |                                                                                 |
|                        | 9.                       | 8089795                                  | 01-03-2012                       | Rajan                                              |                                                                                 |
|                        | 10.                      | 8130560                                  | 03-06-2012                       | Rajan                                              |                                                                                 |
|                        | 11.                      | 8189328                                  | 05-29-2012                       | Kanapathippillai                                   |                                                                                 |
|                        | 12.                      | 8233303                                  | 07-31-2012                       | Best                                               |                                                                                 |
|                        | 13.                      | 8250295                                  | 08-21-2012                       | Amidi et al.                                       |                                                                                 |
|                        | 14.                      | 8417870                                  | 04-09-2013                       | Lee et al.                                         |                                                                                 |
|                        | 15.                      | 8516185                                  | 08-20-2013                       | Lee et al.                                         |                                                                                 |
|                        | 16.                      | 8516188                                  | 08-20-2013                       | Solomon et al.                                     |                                                                                 |
|                        | 17.                      | 8756364                                  | 06-17-2014                       | Bhakta et al.                                      |                                                                                 |
|                        | 18.                      | 20070058409                              | 03-15-2007                       | Ruckerbauer                                        |                                                                                 |
|                        | 19.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 20.                      | 20080104352                              | 05-01-2008                       | Talbot                                             |                                                                                 |
|                        | 21.                      | RE36229                                  | 06-15-1999                       | Cady                                               |                                                                                 |

| US PATENT APPLICATIONS |                          |                    |                             |                                                    |                                                                                 |
|------------------------|--------------------------|--------------------|-----------------------------|----------------------------------------------------|---------------------------------------------------------------------------------|
| Examiner<br>Initials * | Cite<br>No. <sup>1</sup> | Application Number | Filing Date<br>(MM-DD-YYYY) | Name of Patentee or<br>Applicant of cited Document | Pages, Columns, Lines, Where<br>Relevant Passages or Relevant<br>Figures Appear |
|                        | 22.                      | 13/411,344         | 3/2/2012                    | Lee                                                | Entire Prosecution History                                                      |
|                        | 23.                      | 13/970,606         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 24.                      | 13/971,231         | 8/20/2013                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 25.                      | 14/229,844         | 3/29/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 26.                      | 14/324,990         | 7/7/2014                    | Netlist, Inc.                                      | Entire Prosecution History                                                      |
|                        | 27.                      | 14/337,168         | 7/21/2014                   | Netlist, Inc.                                      | Entire Prosecution History                                                      |

### NON PATENT LITERATURE DOCUMENTS

EXAMINER /Gurtej Bansal/ (03/30/2015)

DATE CONSIDERED 03/30/2015

\* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. <sup>1</sup> Applicant's unique citation designation number (optional). <sup>2</sup> See Kinds Codes of USPTO Patents Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. <sup>3</sup> Enter Office that issued the document, by the two-letter code (WIPO Standard ST. 3). <sup>4</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>5</sup> Kind of document by the appropriate symbols as indicated on the document and WIPO Standard ST. 16 if possible. <sup>6</sup> Applicant is to place a check mark here if English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.B./



## UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
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[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 13/971,231      | 05/19/2015 | 9037774    | NETL.018P2C7        | 2072             |

79141 7590 04/29/2015  
The Law Office of Jamie Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

### ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

#### **Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)** (application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Netlist, Inc., Irvine, CA, Assignee (with 37 CFR 1.172 Interest);  
Jefferey C. Solomon, Irvine, CA;  
Jayesh R. Bhakta, Cerritos, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

PATENT

*Cope*



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No. : 9,037,774  
Issued : May 19, 2015  
Assignee : Netlist, Inc.  
App. No. : 13/971,231  
Filed : August 20, 2013  
For : MEMORY MODULE WITH LOAD  
REDUCING CIRCUIT AND  
METHOD OF OPERATION  
Examiner : BANSAL, GURTEJ  
Art Unit : 2139  
Conf. No. : 2072  
Docket No. : NETL.018P2C7

**REQUEST FOR CERTIFICATE OF CORRECTION**

**Certificate of Correction Branch**

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir or Madam:

Applicant hereby requests that the enclosed Certificate of Correction be issued in the above-referenced patent.

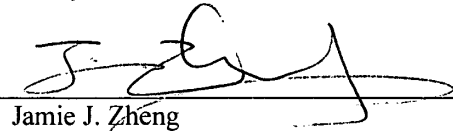
The Commissioner is hereby authorized to charge any required fee(s) to Deposit Account No. 50-5963.

The undersigned attorney can be reached at (650) 273-6008, if a telephone call could help resolve any issues.

Respectfully submitted,

Date: August 10, 2015

By:

  
Jamie J. Zheng  
Registration No. 51,167  
Customer No. 79,141

**UNITED STATES PATENT AND TRADEMARK OFFICE  
CERTIFICATE OF CORRECTION**

Page 1 of 1

PATENT NO. : 9,037,774

APPLICATION NO.: 13/971,231

ISSUE DATE : May 19, 2015

INVENTOR(S) : Jeffrey C. Solomon and Jayesh R. Bhakta

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the front page, Inventor Jefferey C. Solomon should be Jeffrey C. Solomon

Column 41, lines 52 and 54, insert --to-- between "memory module" and "receive."

Column 42, lines 54 and 57, "disabling" should be changed to -disables--.

Column 42, line 59, the claim reference numeral '5' should read -1-.

Column 43, line 39, the claim reference numeral '9' should read -1-.

Column 43, line 41, change "the" before "ODT" to -an-- and insert the following text after "ODT signal"  
from the memory controller

Column 44, line 11, delete the word "module" before "DQ and DQS pins."

Column 44, lines 45 and 47, cancel the text "module DQ and DQS signal lines" and insert the following text  
after "set of"

DQ and DQS pins

Column 45, line 3, cancel the text "register device outputs" and insert the following text before "a greater  
number of"

method further comprises outputting

Column 46, line 15, the claim reference numeral '19' should read -11-.

Column 46, line 17, change "the" before "ODT" to -an-- and insert the following text after "ODT signal"  
from the memory controller

MAILING ADDRESS OF SENDER (Please do not use customer number below):  
Jamie Zheng, PO Box 60573, Palo Alto, CA 94306

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*



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79141 e 2015-12-14

Jamie J. Zheng, Ph.D Esq.  
P.O. Box 60573  
Palo Alto, CA 94306

**Paper No.**

|                              |                                                                                   |                     |                   |
|------------------------------|-----------------------------------------------------------------------------------|---------------------|-------------------|
| <b>Application No.:</b>      | <b>13/971,231</b>                                                                 | <b>Date Mailed:</b> | <b>2015-12-14</b> |
|                              |  |                     | <b>ELECTRONIC</b> |
| <b>First Named Inventor:</b> | Jefferey C. Solomon                                                               | <b>Examiner:</b>    | BANSAL, GURTEJ    |
| <b>Attorney Docket No.:</b>  | NETL.018P2C7                                                                      | <b>Art Unit:</b>    | 2139              |
| <b>Confirmation No.:</b>     | 2072                                                                              | <b>Filing Date:</b> | 08/20/2013        |

Please find attached an Office communication concerning this application or proceeding.

Commissioner for Patents

PTO-90c (Rev.08-06)



|                                                                                            |                                   |                                       |
|--------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------------|
| <p align="center"><b>Response to the<br/>Request for<br/>Certificate of Correction</b></p> | <b>Patent No.</b><br>9037774      | <b>Applicant(s)</b><br>SOLOMON ET AL. |
|                                                                                            | <b>Issue Date</b><br>19 May, 2015 | <b>Docket No.</b><br>NETL.018P2C7     |

This is in response to the request for a Certificate of Correction filed 13 August, 2015

☒ **Request Approval- In- Part** – Consideration has been given to your request for the issuance of a Certificate of Correction under the provisions of 37 CFR 1.322 and/or 37 CFR 1.323. The Request is improper and approved in part for the reason(s) below:

☐ **Supersede/Vacate** – The Certificate of Correction issued in error, in that error(s) was made in identifying the patent number and/or keying text/corrections. See 'Other Comments' below:

1. ☐ Assignees' names and addresses (assignment data) printed in a patent, are based solely on information supplied in the appropriate space for identifying the assignment data on the Issue Fee Transmittal Form (PTOL-85b). Any request for a patent to be corrected to state the name of the assignee, must state that the assignment was submitted for recordation as set forth in 37 CFR 3.11 before issuance of the patent. The petition fee set forth in 37 CFR 1.17(i)(1) (currently \$140, \$70, \$35 for large, small and micro entities, respectively).
2. ☐ The alleged error in \_\_\_\_\_, is in fact an Amendment and/or Change made by the examiner and considered to be in accordance with the permissible amendments enumerated in the Manual of Patent Examining Procedure (MPEP) Section 1302.04. Applicant did not file objection or amendment under 37 CFR 1.312 prior to payment of the issue fee.
3. ☒ A petition under CFR 1.182 is required to correct the alleged errors in spelling or order of inventor's names, since inventor's names are printed solely in accordance with the type-written names, and in the order of the type-written names on the Application Data Sheet (ADS).
4. ☐ With respect to the alleged error in changing the inventor name on the patent due to clerical error in ADS/OATH of related patents. The inventor's name is printed in accordance with the OATH/ADS submitted at the time of filing the application. However, your attention is directed to C.F.R. 1.324, wherein a request is being made to change, add or delete inventor(s), after issuance of the patent.
5. ☐ With respect to the alleged error in \_\_\_\_\_, comparison of the printed patent with the corresponding location in the application file reveals that there is no discrepancy.
6. ☐ With respect to 37 CFR 1.72, the title should be brief but technically accurate and descriptive and should contain fewer than 500 characters. Inasmuch as the words "new," "improved," "improvement of," and "improvement in" are not considered as part of the title of an invention, these words should not be included at the beginning of the title of the invention and will be deleted when the Office enters the title into the Office's computer records, and when any patent issues.
7. ☐ The fee for correction under 37 CFR 1.323 is set forth in 37 CFR 1.20(a). ☐ Partial fee ☐ No fee was received with your request. Full fee payment is required before further action is taken on this request.
8. ☐ With respect to the request for corrected Letters Patent (Grant), corrections to the original Letters Patent are made under the provisions of Rule 1.322(b), not Rule 1.323, unless a petition is granted.
9. ☐ Other Comments:

*Further correspondence concerning this matter should be filed and directed to the Certificates of Correction Branch.*

Legal Instrument Examiner: /EVA E. JAMES/

Phone: (571)272-3422

Certificates of Correction Branch email: CustomerServiceCoC@uspto.gov

CoC Central Phone Number: (703) 756-1814

*If applicable, information regarding a petition under 37 CFR 1.183 should be directed to the attention of the Commissioner for Patents using the FAX number (571) 273-8300*

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 9,037,774 B2  
APPLICATION NO. : 13/971231  
DATED : May 19, 2015  
INVENTOR(S) : Jeffrey C. Solomon and Jayesh R. Bhakta

Page 1 of 2

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the claims

Column 41, lines 52 and 54, insert --to-- between “memory module” and “receive.”.

Column 42, lines 54 and 57, “disabling” should be changed to --disables--.

Column 42, line 59, the claim reference numeral ‘5’ should read -1-.

Column 43, line 39, the claim reference numeral ‘9’ should read -1-.

Column 43, line 41, change “the” before “ODT” to --an-- and insert the following text after “ODT signal”

--from the memory controller--

Column 44, line 11, delete the word “module” before “DQ and DQS pins.”

Column 44, lines 45 and 47, cancel the text “module DQ and DQS signal lines” and insert the following text after “set of”

--DQ and DQS pins--

Column 45, line 3, cancel the text “register device outputs” and insert the following text before “a greater number of”

--method further comprises outputting--

Column 46, line 15, the claim reference numeral ‘19’ should read -11-.

Signed and Sealed this  
Twenty-ninth Day of December, 2015



Michelle K. Lee  
*Director of the United States Patent and Trademark Office*

**CERTIFICATE OF CORRECTION (continued)**  
**U.S. Pat. No. 9,037,774 B2**

Page 2 of 2

Column 46, line 17, change “the” before “ODT” to --an-- and insert the following text after “ODT signal”

--from the memory controller--



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE | REQUEST ID |
|--------------------|-----------------------|-----------------------|------------------------|------------|
| 13/971,231         | 08/20/2013            | Jefferey C. Solomon   | 129980-5021US          | 67119      |

## Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 07/06/2018 has been accepted.

### CERTIFICATIONS:

#### Change of Entity Status:

☒ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

|                      |                  |
|----------------------|------------------|
| Signature:           | /Jamie J. Zheng/ |
| Name:                | Jamie J. Zheng   |
| Registration Number: | 51167            |