PTO/AIA/15 (10-17)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	10018-01-0242-US-CON2
First Named Inventor	Jianquan JIA
Title	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
Priority Mail Express® Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✔] **Fee Transmittal Form** (PTO/SB/17 or equivalent)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [✔] **Specification** [*Total Pages* 14] Both the claims and abstract must start on a new page. *(See MPEP § 608.01(a) for information on the preferred arrangement)*
5. [✔] **Drawing(s)** (35 U.S.C. 113) [*Total Sheets* 4]
6. **Inventor's Oath or Declaration** [*Total Pages* 3] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. [ ] Newly executed (original or copy)
   b. [✔] A copy from a prior application (37 CFR 1.63(d))
7. [✔] **Application Data Sheet** ** See note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
8. **CD-ROM or CD-R** in duplicate, large table, or Computer Program (*Appendix*)
   [ ] Landscape Table on CD
9. **Nucleotide and/or Amino Acid Sequence Submission** (*if applicable, items a. – c. are required*)
   a. [ ] Computer Readable Form (CRF)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO:

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

ACCOMPANYING APPLICATION PAPERS

10. [✔] **Assignment Papers** (cover sheet & document(s))
    Name of Assignee: Yangtze Memory Technologies Co., Ltd.
11. [ ] **37 CFR 3.73(c) Statement** (*when there is an assignee*) [✔] **Power of Attorney**
12. [ ] **English Translation Document** (*if applicable*)
13. [✔] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
14. [ ] **Preliminary Amendment**
15. [ ] **Return Receipt Postcard** (*MPEP § 503*) (*Should be specifically itemized*)
16. [ ] **Certified Copy of Priority Document(s)** (*if foreign priority is claimed*)
17. [ ] **Nonpublication Request** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
18. [ ] **Other:**

***Note**: (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

19. CORRESPONDENCE ADDRESS

[✔] The address associated with Customer Number: 153988 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone	7039959887	Email	

Signature	/Zhiwei Zou/	Date	10/13/2022
Name (Print/Type)	Zhiwei Zou	Registration No. (Attorney/Agent)	66,041

This collection of information is required by 37 CFR 1.53(b). 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.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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FEE TRANSMITTAL

Complete if known	
Application Number	
Filing Date	Herewith
First Named Inventor	Jianquan JIA
Examiner Name	To Be Determined
Art Unit	To Be Determined
Practitioner Docket No.	10018-01-0242-US-CON2

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

TOTAL AMOUNT OF PAYMENT ($) 1820.00

METHOD OF PAYMENT (check all that apply)

☐ Check ■ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____

■ Deposit Account Deposit Account Number: 60-2227 Deposit Account Name: BAYES DEPOSIT ACCOUNT

For the above-identified deposit account, the Director is hereby authorized to (check all that apply):

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

■ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☐ Credit any overpayment of fee(s)

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.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

	FILING FEES			SEARCH FEES			EXAMINATION FEES			
Application Type	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**U ($)**	**S ($)**	**M ($)**	**Fees Paid ($)**
Utility	320	160*	80	700	350	175	800	400	200	1820
Design	220	110	55	160	80	40	640	320	160	
Plant	220	110	55	440	220	110	660	330	165	
Reissue	320	160	80	700	350	175	2,320	1,160	580	
Provisional	300	150	75	0	0	0		0	0	

* The $150 small entity status filing fee for a utility application is further reduced to $75 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	**Undiscounted Fee ($)**	**Small Entity Fee ($)**	**Micro Entity Fee ($)**
Each claim over 20 (including Reissues)	100	50	25
Each independent claim over 3 (including Reissues)	480	240	120
Multiple dependent claims	860	430	215

Total Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
20	-20 or HP =	0 x	0.00	=	

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims		**Extra Claims**	**Fee ($)**		**Fee Paid ($)**
2	-3 or HP =	0 x	0.00	=	

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims	**Fee ($)**	**Fee Paid ($)**

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $420 ($210 for small entity) ($105 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets		**Extra Sheets**		**Number of each additional 50 or fraction thereof**		**Fee ($)**		**Fee Paid ($)**
18	- 100 =		/ 50 =	(round **up** to a whole number)	x		=	

4. OTHER FEE(S) **Fees Paid ($)**

Non-English specification, $140 fee ($70 for small entity) ($35 for micro entity) _____

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, $400 fee ($200 small or micro entity) _____

Other (e.g., late filing surcharge): _____ _____

SUBMITTED BY

Signature	/Zhiwei Zou/	Registration No. (Attorney/Agent) 66,041	Telephone 7039959887
Name (Print/Type)	Zhiwei Zou		Date 10/13/2022

This collection of information is required by 37 CFR 1.136. 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 30 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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

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.
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.

Secrecy Order 37 CFR 5.2:

☐ 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:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Jianquan		Jia	

Residence Information (Select One) US Residency ● Non US Residency Active US Military Service

City	Wuhan	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	18 Gaoxin 4th Road
Address 2	East Lake High-Tech Development Zone

City	Wuhan	State/Province	
Postal Code	430074	Country [i]	CN

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Ying		Cui	

Residence Information (Select One) US Residency ◉ Non US Residency Active US Military Service

City	Wuhan	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	18 Gaoxin 4th Road
Address 2	East Lake High-Tech Development Zone

City	Wuhan	State/Province	
Postal Code	430074	Country [i]	CN

Inventor 3 Remove

Legal Name

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Kaikai		You	

Residence Information (Select One) US Residency ◉ Non US Residency Active US Military Service

City	Wuhan	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	18 Gaoxin 4th Road		
Address 2	East Lake High-Tech Development Zone		
City	Wuhan	**State/Province**	
Postal Code	430074	**Country** [i]	CN

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

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

Customer Number	153988		
Email Address	uspto@bayes.law	Add Email	Remove Email

Application Information:

Title of the Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD		
Attorney Docket Number	10018-01-0242-US-CON2	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	4	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country [i]

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

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:	● Customer Number	US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	153988		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim 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.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	17353727	2021-06-21
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
17353727	Continuation of	16709944	2019-12-11
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
16709944	Continuation of	PCT/CN2019/112409	2019-10-22

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. 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. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is 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 State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

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.

Applicant 1 Remove

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.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	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:

If the Applicant is an Organization check here. ☒

Organization Name	YANGTZE MEMORY TECHNOLOGIES CO., LTD.		
Mailing Address Information For Applicant:			
Address 1	18 Gaoxin 4th Road		
Address 2	East Lake High-Tech Development Zone		
City	Wuhan	**State/Province**	
Country	CN	Postal Code	430074
Phone Number		Fax Number	
Email Address			

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

Assignee Information including 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.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

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

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/Zhiwei Zou/			Date (YYYY-MM-DD)	2022-10-13
First Name	Zhiwei	Last Name	Zou	Registration Number	66,041

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	10018-01-0242-US-CON2
	Application Number	
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD	

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Micron Ex. 1016, p. 11
Micron v. YMTC
IPR2024-00795

NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U.S. Application No. 17/353,727, filed on June 21, 2021, which is a continuation of U.S. Application No. 16/709,944, filed on December 11, 2019, which is a continuation of International Application No. PCT/CN2019/112409, filed on October 22, 2019, all of which are incorporated herein by reference in their entireties.

BACKGROUND

[0002] The present disclosure is related to a non-volatile memory device and a control method, and more particularly to a non-volatile memory device and a control method capable of applying word line pre-pulse signals with different voltage levels and reducing programming disturb.

[0003] Non-volatile memory devices, such as flash memory, have become the storage of choice in various electrical products, such as personal computers, flash drives, digital cameras, and mobile phones. Flash memory devices have undergone rapid development. The flash memory can store data for a considerably long time without powering, and have advantages such as high integration level, fast access, easy erasing, and rewriting. To further improve the bit density and reduce cost of the flash memory device, a three-dimensional (3D) NAND flash memory has been developed. A 3D NAND memory architecture stacks memory cells vertically in multiple layers, achieving a higher density than traditional NAND memory. As more layers are added, the bit density increases, thus increasing more storage capacity. With the layer increases, the program disturb becomes worse. A pre-pulse signal may be applied to an unselected bit line connect to an unselected memory string so as to remove boosting charges (electrons) of the unselected memory string. However, as the layer increases, the channel length increases accordingly. The effect of bit line pre-charge for electrons remained in the bottom channel will be reduced because of the increased channel length. A traditional method for improving the bit line pre-charge effect is to extend the bit line pre-pulse time, but this would sacrifice and influence the data programming time. Another traditional method for improving the bit line pre-charge effect is to increase the voltage level of the bit line pre-pulse, but this would increase the risk of the breakdown phenomenon of the bit line transistor. Thus, there is a need for improvement.

Micron Ex. 1016, p. 12
Micron v. YMTC
IPR2024-00795

SUMMARY

[0004] It is therefore an objective of the present disclosure to provide a non-volatile memory device and a control method capable of applying word line pre-pulse signals with different voltage levels and reducing programming disturb.

[0005] An embodiment provides a non-volatile memory device. The non-volatile memory device includes a memory array including a plurality of memory strings, each memory string including a select gate transistor and a plurality of memory cells connected in series with the select gate transistor; a bit line connected to a first memory string of the plurality of memory strings; a select gate line connected to the select gate transistor of the first memory string of the plurality of memory strings; a plurality of word lines connected to the plurality of memory cells of the first memory string of the plurality of memory strings, each word line connected to a respective memory cell of the first memory string; a first control circuit configured to apply a bit line pre-pulse signal to the bit line during a pre-charge period; and a second control circuit configured to apply a word line signal to a selected word line of the plurality of word lines and apply a plurality of word line pre-pulse signals to word lines disposed between the select gate line and the selected word line during the pre-charge period, wherein voltage levels of the plurality of word line pre-pulse signals are incremental.

[0006] Another embodiment provides a control method of non-volatile memory device. The non-volatile memory device includes a memory array including a plurality of memory strings and each memory string includes a select gate transistor and a plurality of memory cells connected in series with the select gate transistor. The control method includes applying a bit line pre-pulse signal to a bit line connected to a first memory string of the plurality of memory strings during a pre-charge period; applying a word line signal to a selected word line connected to a selected memory cell of the plurality of memory cells of the first memory string during the pre-charge period; and applying a plurality of word line pre-pulse signals to a plurality of word lines connected to the plurality of memory cells of the first memory string and disposed between the select gate line and the selected word line during the pre-charge period, wherein voltage levels of the plurality of word line pre-pulse signals are different.

[0007] These and other objectives of the present disclosure will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the embodiments that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a schematic diagram of a non-volatile memory device according to an

Micron Ex. 1016, p. 13
Micron v. YMTC
IPR2024-00795

embodiment of the present disclosure.

[0009] FIG. 2 is a schematic diagram illustrating a memory string and related connection lines of the non-volatile memory device shown in FIG. 1 according to an embodiment of the present disclosure.

[0010] FIG. 3 is a schematic diagram illustrating an unselected memory string and related connection lines of the non-volatile memory device shown in FIG. 1 according to an embodiment of the present disclosure.

[0011] FIG. 4 and FIG. 5 are signal timing diagrams of the memory string shown in FIG. 3 according to embodiments of the present disclosure.

DETAILED DESCRIPTION

[0012] Please refer to FIG. 1, which is a schematic diagram of a non-volatile memory device 1 according to an embodiment of the present disclosure. The non-volatile memory device 1 may be a NAND flash memory. For example, the non-volatile memory device 1 may be a three-dimensional (3D) NAND flash memory. The non-volatile memory device 1 includes a memory array 10 and control circuits 20 and 30. The memory array 10 includes a plurality of memory strings. Each memory string includes a plurality of memory cells. The memory cells of each string are connected together in series. The intersection of a word line and a semiconductor channel forms a memory cell. Top select gate lines TSGs, word lines WLs, top dummy word lines TDMYs, bottom dummy word lines BDMYs and bottom gate lines BSGs are connected between the memory array 10 and the control circuit 20. Bit lines BLs are connected between the memory array 10 and the control circuit 30.

[0013] FIG. 2 is a schematic diagram illustrating a memory string and related connection lines of the non-volatile memory device 1 shown in FIG. 1 according to an embodiment of the present disclosure. The memory string of the memory array 10 includes, but not limited thereto, a top select gate transistor, at least one top dummy memory cell, a plurality of memory cells, at least one bottom dummy memory cell and a bottom select gate transistor. A bit line BL is coupled to the memory string. A top select gate line TSG is connected to the top select gate transistor of the memory string. The at least one top dummy memory cell is connected in series with the top select gate transistor. At least one top dummy word line TDMY is connected to the at least one top dummy memory cell of the memory string. Each top dummy word line is separately connected to a top dummy memory cell. The plurality of memory cells can be configured to store data. The plurality of memory cells can be connected in series with the at least one top dummy memory cell. Word lines WL are connected to the memory cells of the

Micron Ex. 1016, p. 14
Micron v. YMTC
IPR2024-00795

memory string. Each word line WL is separately connected to a memory cell. Further, the memory cells of the memory string of the memory array 10 are disposed sequentially along a first direction between the top dummy memory cell and the bottom dummy memory cell and accordingly the word lines WL are disposed sequentially along the first direction between the top dummy word line TDMY and the bottom dummy word line BDMY.

[0014] Moreover, the at least one bottom dummy memory cell is connected in series with the plurality of memory cells. At least one bottom dummy word line BDMY is connected to the at least one bottom dummy memory cell of the memory string. Each bottom dummy word line BDMY is separately connected to a bottom dummy memory cell. The bottom select gate transistor is connected in series with the at least one bottom dummy memory cell. A bottom select gate line BSG is connected to the bottom select gate transistor of the memory string. Writing and erasing data in the memory cells can be controlled from the control circuits and external circuits trough the connection lines of the non-volatile memory device 1.

[0015] During a pre-charge period (before programming), the control circuit 30 is configured to apply a bit line pre-pulse signal to unselected bit lines BL of unselected memory strings of the memory array 10. For example, for each unselected memory string, the control circuit 30 is configured to apply a bit line pre-pulse signal to an unselected bit line BL of each unselected memory string during the pre-charge period. The control circuit 20 is configured to apply a top select gate pre-pulse signal to the top select gate line TSG and apply a bottom select gate pre-pulse signal to the bottom select gate line BSG. Moreover, the control circuit 20 is configured to apply a word line signal to a selected word line of the unselected memory string. The control circuit 20 is configured to apply a plurality of word line pre-pulse signals to word lines which are disposed between the selected word line and the top dummy word line TDMY (or the top select gate TSG). The control circuit 20 is also configured to apply a top dummy word line pre-pulse signal to the top dummy word lines TDMY disposed between the word lines and the top select gate TSG and apply a bottom dummy word line pre-pulse signal to the bottom dummy word lines BDMY disposed between the word lines and the bottom select gate BSG.

[0016] Moreover, voltage levels of the plurality of word line pre-pulse signals applied to the word lines disposed between the selected word line and the top dummy word line TDMY may be different. For example, the voltage levels of the plurality of word line pre-pulse signals applied to the word lines disposed between the selected word line and the top dummy word line TDMY may be incremental. For example, the voltage levels of the plurality of word line pre-pulse signals applied to the word lines disposed between the selected word line and the top

Micron Ex. 1016, p. 15
Micron v. YMTC
IPR2024-00795

dummy word line TDMY are incremental sequentially from a word line disposed adjacent to the selected word line. For example, a first word line pre-pulse signal of the plurality of word line pre-pulse signals can be applied to a first word line of the plurality of word lines, and the first word line is disposed adjacent to the selected word line and between the selected word line and the top dummy word line TDMY. A second word line pre-pulse signal of the plurality of word line pre-pulse signals can be applied to a second word line of the plurality of word lines, and the second word line is disposed adjacent to the first word line and between the first word line and the top dummy word line TDMY. In an embodiment, the voltage level of the second word line pre-pulse signal is greater than the voltage level of the first word line pre-pulse signal.

[0017] A third word line pre-pulse signal of the plurality of word line pre-pulse signals can be applied to a third word line of the plurality of word lines, and the third word line is disposed adjacent to the second word line and between the second word line and the top dummy word line TDMY. In an embodiment, the voltage level of the third word line pre-pulse signal is greater than the voltage level of the second word line pre-pulse signal. A fourth word line pre-pulse signal of the plurality of word line pre-pulse signals can be applied to a fourth word line, and the fourth word line is disposed adjacent to the third word line and between the third word line and the top dummy word line TDMY, and so on. In an embodiment, the voltage level of the fourth word line pre-pulse signal is greater than the voltage level of the third word line pre-pulse signal, and so on.

[0018] In other words, the farer away from the selected word line, the larger voltage level of the word line pre-pulse signal can be applied since the word line pre-pulse signals are applied to word lines disposed between the top select gate TSG and the selected word line. The voltage level of the word line pre-pulse signal applied to the word line located farthest from the selected word line may be the largest among the voltage levels of the plurality of word line pre-pulse signals applied to the word lines disposed between the selected word line and the top dummy word line TDMY. The voltage level of the word line pre-pulse signal applied to the word line located closet from the selected word line may be the smallest among the voltage levels of the plurality of word line pre-pulse signals applied to the word lines disposed between the selected word line and the top dummy word line TDMY. Since the word line pre-pulse signals with different voltage levels are applied to the word lines between the top select gate line and selected word line, the channel potential gradient is therefore enhanced, and thus enhancing the pre-charge effect of the unselected bit line and reducing programming disturb.

[0019] In addition, a voltage level of the top dummy word line pre-pulse signal applied to the top dummy word lines TDMY is greater than the voltage levels of the plurality of word line

Micron Ex. 1016, p. 16
Micron v. YMTC
IPR2024-00795

pre-pulse signals applied to the word lines disposed between the selected word line and the top dummy word line TDMY.

[0020] Moreover, the word lines disposed between the selected word line and the top select gate TSG can be divided into multiple groups of the word lines. Each divided group of word lines may include at least one word line. Note that, the amount of the word lines of each group of the word lines is not limited and may be varied and designed in accordance with practical system demands and requirements. Each group of the word lines may include at least one word line. For example, please refer to FIG. 3. FIG. 3 is a schematic diagram illustrating an unselected memory string and related connection lines of the non-volatile memory device 1 shown in FIG. 1 according to an embodiment of the present disclosure. A top select gate transistor TT, top dummy memory cells TDMY, memory cells MC0 to MCn, bottom dummy memory cells BDMC and a bottom select gate transistor BT are connected in series. FIG. 3 shows the unselected bit line BL, the top select gate line TSG, the top dummy word lines TDMY, the word lines WL0 to WLn, the bottom dummy word lines BDMY and the bottom select gate line BSG. As shown in FIG. 3, suppose the word line WL0 is the selected word line, the word lines WL1 to WLn are divided into a first group of word lines (Bottom WL), a second group of word lines (Middle WL) and a third group of word lines (Top WL). From the bottom to top, the first group of word lines (Bottom WL) includes the word lines WL1 to WLp. The first group of word lines (Bottom WL) is between the selected word line (word line WL0) and the second group of word lines (Middle WL). The second group of word lines (Middle WL) includes the word lines WL(p+1) to WLq. The second group of word lines (Middle WL) is between the first group of word lines (Bottom WL) and the third group of word lines (Top WL). The third group of word lines (Top WL) includes the word lines WL(q+1) to WLn. The third group of word lines (Top WL) is between the second group of word lines (Middle WL) and the top dummy word lines TDMY.

[0021] Please further refer to FIG. 3 and FIG. 4. FIG. 4 is a signal timing diagram of the memory string shown in FIG. 3 according to an embodiment of the present disclosure. Sequentially from the top of FIG. 4, the signal waveforms in a pre-charge period are: a bit line pre-pulse signal VP_BL, a top select gate pre-pulse signal VP_TSG, a top dummy word line pre-pulse signal VP_TDMY, word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL and a word line signal V_SELWL. During a pre-charge period, the bit line pre-pulse signal VP_BL is applied to the unselected bit line BL of the unselected memory string of the memory array 10. The top select gate pre-pulse signal VP_TSG is applied to the top select gate line TSG. The top dummy word line pre-pulse signal VP_TDMY is applied to the

Micron Ex. 1016, p. 17
Micron v. YMTC
IPR2024-00795

top dummy word lines TDMY. The word line pre-pulse signals VP_TOPWL is applied to the third group of word lines (Top WL). The word line pre-pulse signals VP_MIDDLEWL is applied to the second group of word lines (Middle WL). The word line pre-pulse signals VP_BOTTOMWL is applied to the first group of word lines (Bottom WL). The bit line pre-pulse signal VP_BL applied to the unselected bit line BL may be a first power supply voltage Vdd. The top select gate pre-pulse signal VP_TSG applied to the top select gate line TSG may be a second power supply voltage Vcc. The top dummy word line pre-pulse signal VP_TDMY applied to the top dummy word lines TDMY may also be the first power supply voltage Vdd. The word line signal V_SELWL applied to the selected word line (WL0) can be a programming voltage.

[0022] In an embodiment, as shown in FIG. 4, the voltage level (1.2 volts) of the word line pre-pulse signal VP_MIDDLEWL is greater than the voltage level (0.6 volts) of the word line pre-pulse signal VP_BOTTOMWL. The voltage level (1.8 volts) of the word line pre-pulse signal VP_ TOPWL is greater than the voltage level (1.2 volts) of the word line pre-pulse signal VP_MIDDLEWL. The voltage level (Vdd) of top dummy word line pre-pulse signal VP_TDMY is greater than the voltage levels of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL. In another embodiment, please further refer to FIG. 5. FIG. 5 is a signal timing diagram of the memory string shown in FIG. 3 according to an alternative embodiment of the present disclosure. Sequentially from the top of FIG. 5, the signal waveforms in a pre-charge period are: a bit line pre-pulse signal VP_BL, a top select gate pre-pulse signal VP_TSG, a top dummy word line pre-pulse signal VP_TDMY, word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL and a word line signal V_SELWL. The word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL and the word line signal V_SELWL are negative pulse signals. As shown in FIG. 5, the voltage level (-1.2 volts) of the word line pre-pulse signal VP_MIDDLEWL is greater than the voltage level (-1.8 volts) of the word line pre-pulse signal VP_ BOTTOMWL. The voltage level (-0.6 volts) of the word line pre-pulse signal VP_ TOPWL is greater than the voltage level (-1.2 volts) of the word line pre-pulse signal VP_ MIDDLEWL. The voltage level (Vdd) of top dummy word line pre-pulse signal VP_TDMY is greater than the voltage levels of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL.

[0023] In an embodiment, please further refer to FIGs. 3-5. During the pre-charge period, the ending of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL) occurs after the ending of the word line pre-pulse signal VP_BOTTOMWL applied to the first group of word lines (Bottom WL). The ending of the

Micron Ex. 1016, p. 18
Micron v. YMTC
IPR2024-00795

word line pre-pulse signal VP_TOPWL applied to the third group of word lines (Top WL) occurs after the ending of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL). The ending of the top dummy word line pre-pulse signal VP_TDMY applied to the top dummy word lines TDMY occurs after the endings of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL. As shown in FIG. 4 and FIG. 5, the end point of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL) is after the end point of the word line pre-pulse signal VP_ BOTTOMWL applied to the first group of word lines (Bottom WL) during the pre-charge period. The end point of the word line pre-pulse signal VP_TOPWL applied to the third group of word lines (Top WL) is after the end point of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL) during the pre-charge period. The end point of the top dummy word line pre-pulse signal VP_TDMY applied to the top dummy word lines TDMY is after the end points of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL. Since the word line pre-pulse signals with different ending timing are applied to the word lines between the top select gate line and selected word line, the whole programming speed can be improved effectively.

[0024] Moreover, as shown in FIG. 4, since the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL are positive pulse signals, the falling edge of the word line pre-pulse signal VP_MIDDLEWL is after the falling edge of the word line pre-pulse signal VP_ BOTTOMWL during the pre-charge period. The falling edge of the word line pre-pulse signal VP_TOPWL is after the falling edge of the word line pre-pulse signal VP_MIDDLEWL during the pre-charge period. The falling edge of the top dummy word line pre-pulse signal VP_TDMY applied to the top dummy word lines TDMY is after the falling edges of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL. As shown in FIG. 5, since the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL are negative pulse signals, the rising edge of the word line pre-pulse signal VP_MIDDLEWL is after the rising edge of the word line pre-pulse signal VP_ BOTTOMWL during the pre-charge period. The rising edge of the word line pre-pulse signal VP_TOPWL is after the rising edge of the word line pre-pulse signal VP_MIDDLEWL during the pre-charge period. The rising edge of the top dummy word line pre-pulse signal VP_TDMY is after the rising edges of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL.

[0025] In an embodiment, please further refer to FIGs. 4-5. During the pre-charge period, the pulse durations (signal lengths) of the word line pre-pulse signals VP_TOPWL,

Micron Ex. 1016, p. 19
Micron v. YMTC
IPR2024-00795

VP_MIDDLEWL and VP_BOTTOMWL are incremental. The pulse duration of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL) is greater than the pulse duration of the word line pre-pulse signal VP_ BOTTOMWL applied to the first group of word lines (Bottom WL). The pulse duration of the word line pre-pulse signal VP_TOPWL applied to the third group of word lines (Top WL) is greater than the ending of the word line pre-pulse signal VP_MIDDLEWL applied to the second group of word lines (Middle WL). The pulse duration of the top dummy word line pre-pulse signal VP_TDMY applied to the top dummy word lines TDMY is greater than the pulse durations of the word line pre-pulse signals VP_TOPWL, VP_MIDDLEWL and VP_BOTTOMWL.

[0026] In summary, the embodiments of the present disclosure provide word line pre-pulse signals with different to drive the word lines between the top select gate line and selected word line so as to enhance channel potential gradient, and thus enhancing the pre-charge effect of the unselected bit line and reducing programming disturb. Moreover, the embodiments of the present disclosure provide word line pre-pulse signals with different ending timing to the word lines between the top select gate line and selected word line, and thus improving the whole programming speed effectively.

[0027] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the present disclosure. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

Micron Ex. 1016, p. 20
Micron v. YMTC
IPR2024-00795

WHAT IS CLAIMED IS:

1. A non-volatile memory device, comprising:

a plurality of word lines; and

a control circuit configured to:

apply a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines;

apply a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period; and

apply a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period,

wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

2. The non-volatile memory device of claim 1, wherein the control circuit is further configured to:

apply a select pre-pulse signal of the plurality of word line pre-pulse signals to a selected word line of the plurality of word lines during the pre-charge period, wherein the select pre-pulse signal is different from the second word line pre-pulse signal.

3. The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are at a same side of the selected word line.

4. The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are disposed in an order of distance from the selected word line.

5. The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines are disposed adjacent to the selected word line, the second group of the plurality of word lines are disposed between the first group of the plurality of word lines and a top select gate line, and the third group of the plurality of word lines are disposed between the second group of the plurality of word lines and the top select gate line, wherein the selected word line

Micron Ex. 1016, p. 21
Micron v. YMTC
IPR2024-00795

are between the top select gate line and a bottom select gate line.

6. The non-volatile memory device of claim 1, wherein voltages of at least two group of the plurality of word lines change during a first period of the pre-charge period, wherein the first period of the pre-charge period is adjacent to a programming period in which a voltage Vpass is applied to the plurality of word lines.

7. The non-volatile memory device of claim 1, wherein voltages of at least two group of the plurality of word lines are zero volts during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line.

8. The non-volatile memory device of claim 1, wherein voltages of at least two group of the plurality of word lines decrease during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line.

9. The non-volatile memory device of claim 1, wherein voltage levels of the plurality of word line pre-pulse signals are positive, negative, or zero volts.

10. The non-volatile memory device of claim 5, wherein the control circuit is configured to apply a bit line pre-pulse signal to a bit line during the pre-charge period.

11. The non-volatile memory device of claim 10, further comprising: a first memory string connected to the top select gate line and being an unselected memory string, and the bit line is an unselected bit line.

12. The non-volatile memory device of claim 2, wherein the control circuit is configured to apply a top dummy word line pre-pulse signal to a top dummy word line of the plurality of word lines during the pre-charge period, wherein the selected word line is between the top dummy word line and a bottom select gate line.

13. The non-volatile memory device of claim 12, wherein a voltage level of the top dummy word line pre-pulse signal is greater than that of the third word line pre-pulse signal.

Micron Ex. 1016, p. 22
Micron v. YMTC
IPR2024-00795

14. The non-volatile memory device of claim 1, wherein a charge duration of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a charge duration of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

15. The non-volatile memory device of claim 1, wherein voltage levels of the first word line pre-pulse signal, the second word line pre-pulse signal, and the third word line pre-pulse signal are negative, wherein an absolute value of a voltage level of the first word line pre-pulse signal is greater than that of the second word line pre-pulse signal, and an absolute value of a voltage level of the second word line pre-pulse signal is greater than that of the third word line pre-pulse signal.

16. A control method of non-volatile memory device, wherein the non-volatile memory device comprises a plurality of word lines, the control method comprises:

applying a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines;

applying a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period; and

applying a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period,

wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

17. The control method of claim 16, further comprising:

applying a select pre-pulse signal of the plurality of word line pre-pulse signals to a selected word line of the plurality of word lines during the pre-charge period, wherein the select pre-pulse signal is different from the second word line pre-pulse signal.

18. The control method of claim 17, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are at a same side of the selected word line and are disposed in an order of distance from the selected word line.

Micron Ex. 1016, p. 23
Micron v. YMTC
IPR2024-00795

19. The control method of claim 16, wherein voltages of at least two group of the plurality of word lines change during a first period of the pre-charge period, wherein the first period of the pre-charge period is adjacent to a programming period in which a voltage Vpass is applied to the plurality of word lines.

20. The control method of claim 16, wherein voltages of at least two group of the plurality of word lines are zero volts during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line, or voltages of the at least two group of the plurality of word lines decrease during the period after the pre-charge period and before the voltage Vpass being applied to the word lines disposed between the selected word line and the top select gate line.

Micron Ex. 1016, p. 24
Micron v. YMTC
IPR2024-00795

ABSTRACT

A non-volatile memory device includes a plurality of word lines and a control circuit. The control circuit is configured to apply a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines, apply a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period, and apply a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period. A voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

Micron Ex. 1016, p. 25
Micron v. YMTC
IPR2024-00795

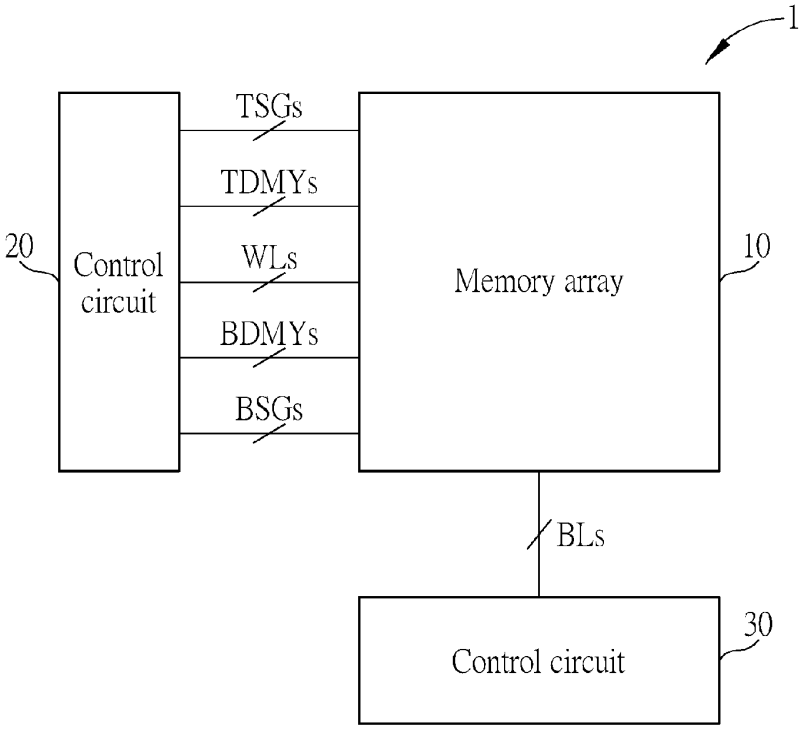

1
TSGs
TDMYs
WLs
BDMYs
BSGs
20
Control circuit
Memory array
10
BLs
Control circuit
30

FIG. 1

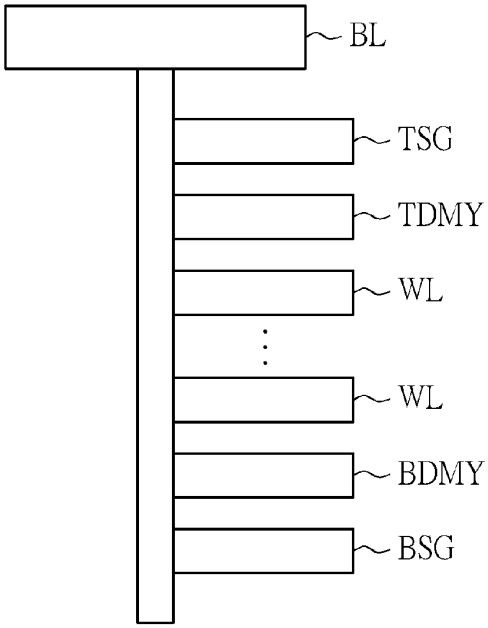

BL
TSG
TDMY
WL
WL
BDMY
BSG

FIG. 2

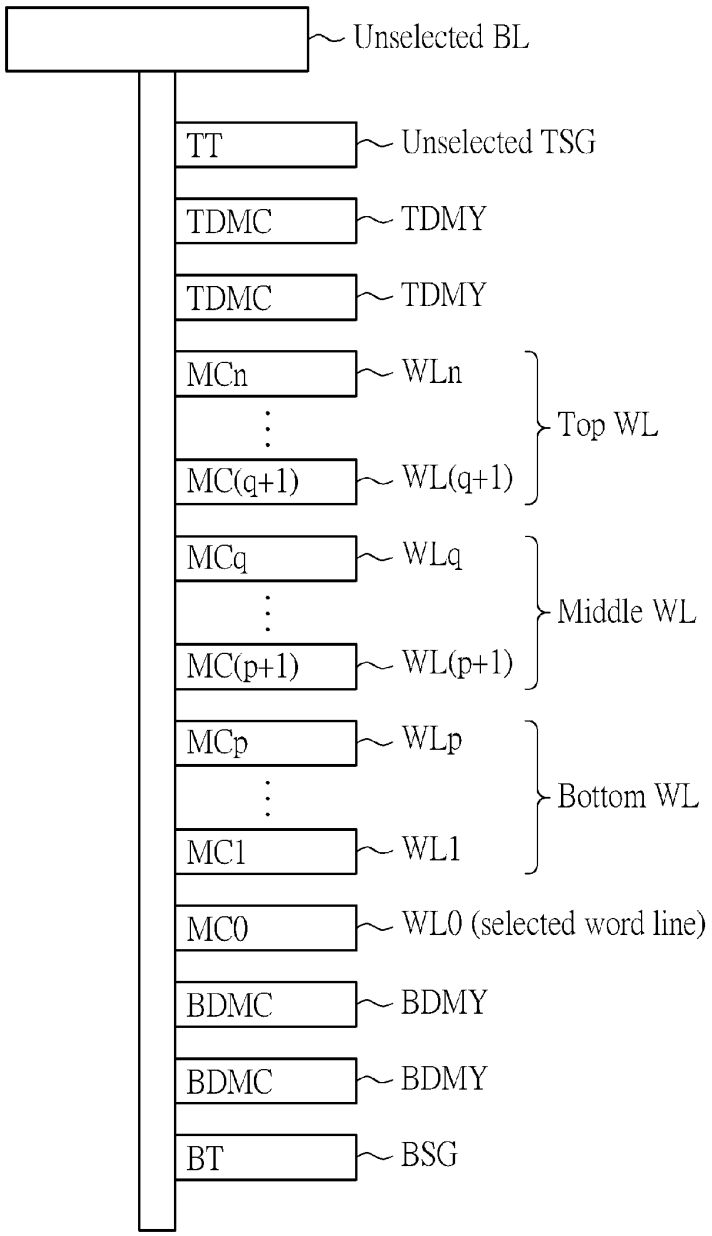

Unselected BL
TT
Unselected TSG
TDMC
TDMY
TDMC
TDMY
MCn
WLn
MC(q+1)
WL(q+1)
Top WL
MCq
WLq
MC(p+1)
WL(p+1)
Middle WL
MCp
WLp
MC1
WL1
Bottom WL
MC0
WL0 (selected word line)
BDMC
BDMY
BDMC
BDMY
BT
BSG

FIG. 3

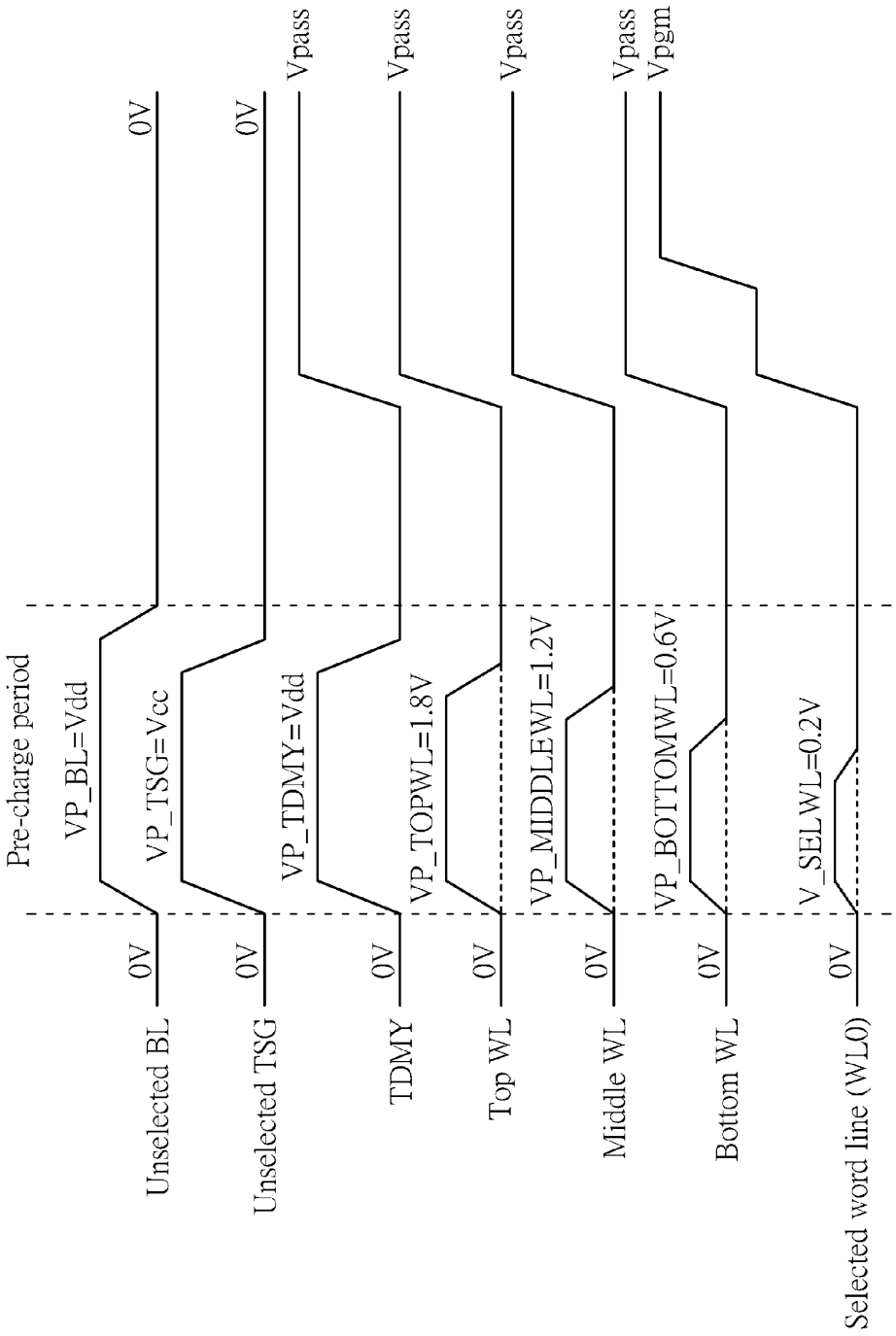

Pre-charge period
VP_BL=Vdd
VP_TSG=Vcc
VP_TDMY=Vdd
VP_TOPWL=1.8V
VP_MIDDLEWL=1.2V
VP_BOTTOMWL=0.6V
V_SELWL=0.2V
Vpass
Vpgm
0V
Unselected BL
Unselected TSG
TDMY
Top WL
Middle WL
Bottom WL
Selected word line (WL0)

FIG. 4

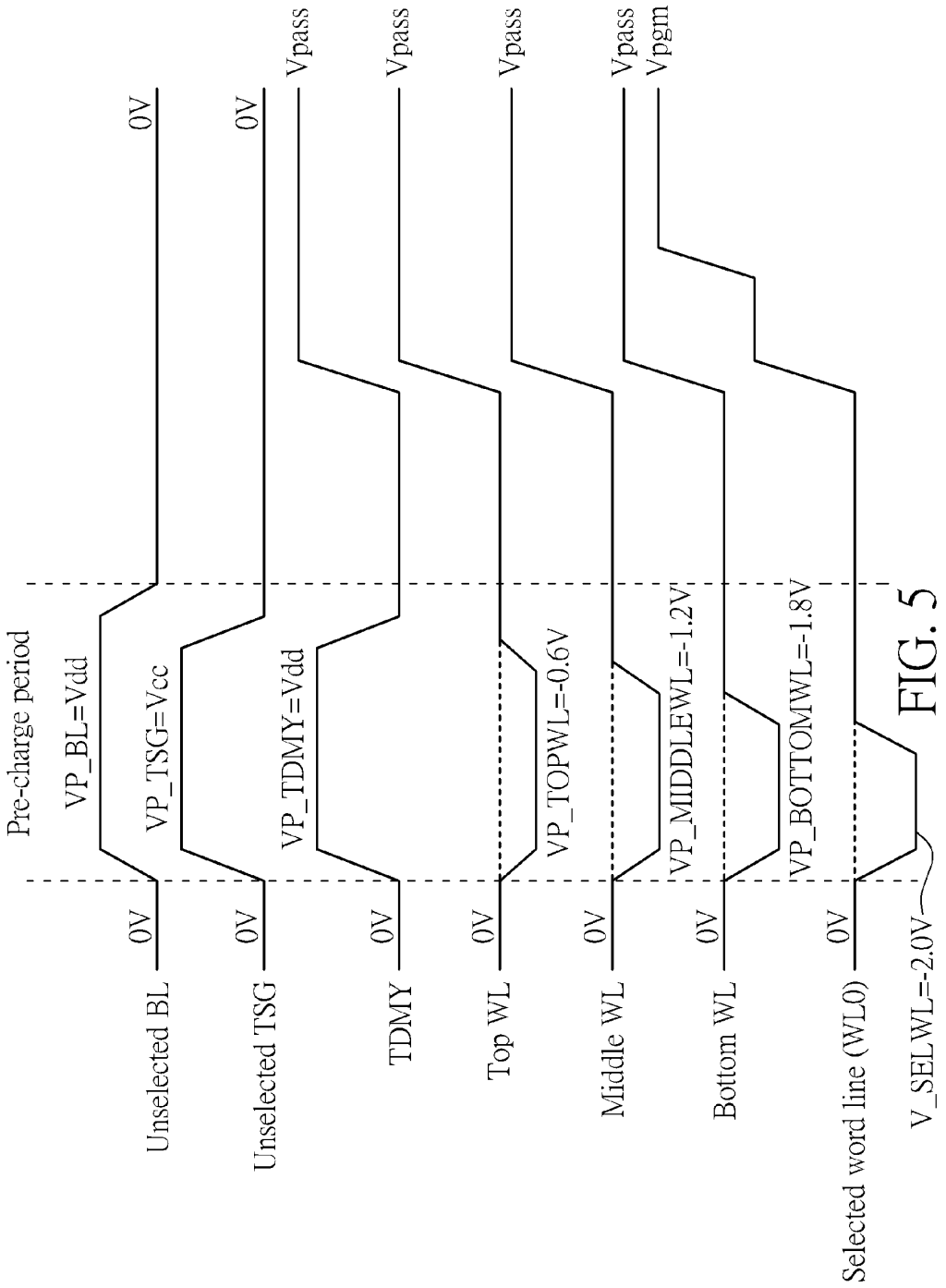

Pre-charge period
VP_BL=Vdd
VP_TSG=Vcc
VP_TDMY=Vdd
VP_TOPWL=-0.6V
VP_MIDDLEWL=-1.2V
VP_BOTTOMWL=-1.8V
V_SELWL=-2.0V
Unselected BL
Unselected TSG
TDMY
Top WL
Middle WL
Bottom WL
Selected word line (WL0)
0V
Vpass
Vpgm

FIG. 5

Atty. Docket No. YMTP0261USA3

COMBINED DECLARATION AND ASSIGNMENT

DECLARATION

As the below named inventors, I hereby declare that:

This declaration is directed to:

☒ The attached application, or

☐ United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. § 1001 by fine or imprisonment of not more than five (5) years, or both.

ASSIGNMENT

In consideration of the sum of One Dollar ($1.00) or equivalent and other good and valuable consideration paid to each of the below named inventors, each of the below named inventors, hereby sell and assign to **Yangtze Memory Technologies Co., Ltd.**, a corporation formed under the laws of China, whose mailing address is Room 7018, No.18, Huaguang Boulevard, Guandong Tech. Industrial Park, Donghu Development Area, Hongshan District, Wuhan City, Hubei Province 430074, P.R.C. (hereafter referred to as the Assignee), his/her entire right, title and interest, including the right to sue for past infringement and to collect for all past, present and future damages, for the United States of America (as defined in 35 U.S.C. § 100) and throughout the world,

(a) in the invention(s) known as **NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD** for which application(s) for patent in the United States of America is identified above, in any and all applications thereon, in any and all Letters Patent(s) therefor, and

(b) in any and all applications that claim the benefit of the patent application identified above in part (a), including non-provisional applications, continuing (continuation, divisional, or continuation-in-part) applications, reissues, extensions, renewals and reexaminations of the patent application or Letters Patent therefor listed above in part (a), to the full extent of the term or terms for which Letters Patents issue, and

(c) in any and all inventions described in the patent application identified above in part (a), and in any and all forms of intellectual and industrial property protection derivable from such patent application, and that are derivable from any and all continuing applications, reissues, extensions,

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Micron Ex. 1016, p. 30
Micron v. YMTC
IPR2024-00795

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The below named inventors agree to execute all papers necessary in connection with the application(s) and any non-provisional, continuing (continuation, divisional, or continuation-in-part), reissue, reexamination or corresponding application(s) thereof and also to execute separate assignments in connection with such application(s) as the Assignee may deem necessary or expedient.

The below named inventors agree to execute all papers necessary in connection with any patent enforcement action (judicial or otherwise) related to the application(s) or any non-provisional, continuing (continuation, divisional, or continuation-in-part), reissue or reexamination application(s) thereof and to cooperate with the Assignee in every way possible in obtaining evidence and going forward with such patent enforcement action.

The below named inventors hereby represent that he/she has full right to convey the entire interest herein assigned, and that he/she has not executed, and will not execute, any agreement in conflict therewith.

The below named inventors hereby represent that he/she understands that the patent practitioners associated with **CUSTOMER NUMBER 27765** are the legal representatives of, and attorneys for, the assignee, and are NOT the legal representatives of, and attorneys for, the inventors.

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Micron Ex. 1016, p. 31
Micron v. YMTC
IPR2024-00795

IN WITNESS WHEREOF, executed by the below named inventors on the date opposite his/her name.

LEGAL NAME OF INVENTOR

Inventor: Jianquan Jia Date: 2019.11.07

Signature of Inventor: Jianquan Jia

LEGAL NAME OF INVENTOR

Inventor: Ying Cui Date: 2019.11.07

Signature of Inventor: Ying Cui

LEGAL NAME OF INVENTOR

Inventor: Kaikai You Date: 2019.11.07

Signature of Inventor: Kaikai You

(9842265-000E74R2-16. 17-86. 195

Micron Ex. 1016, p. 32
Micron v. YMTC
IPR2024-00795

Doc Code: PA..
Document Description: Power of Attorney

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Application Number	
Filing Date	Herewith
First Named Inventor	Jianquan JIA
Title	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
Art Unit	To Be Determined
Examiner Name	To Be Determined
Attorney Docket Number	10018-01-0242-US-CON2

SIGNATURE of Applicant or Patent Practitioner

Signature	/Zhiwei Zou/	Date (Optional)	10/13/2022
Name	Zhiwei Zou	Registration Number	66,041
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	Yangtze Memory Technologies Co., Ltd.		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

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I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

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OR

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OR

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Address					
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Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Yangtze Memory Technologies Co., Ltd.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ 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) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	SIMON SHI-NING YANG		
Title	CEO		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

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(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	
First Named Inventor	Jianquan JIA
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	10018-01-0242-US-CON2

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9460805	B1	2016-10-04	Pang et al.	
	2	10283202	B1	2019-05-07	Chen et al.	
	3	10770157	B1	2020-09-08	Chen et al.	
	4	7577026	B2	2009-08-18	Dong et al.	
	5	9396800	B2	2016-07-19	Shim et al.	
	6	11081164	B2	2021-08-03	Jia et al.	
	7	11205471	B2	2021-12-21	Choi et al.	
	8	10998049	B1	2021-05-04	Wei et al.	

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	Application Number	
	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

	9	11024371	B2	2021-06-01	Cui et al.	
	10	10957408	B1	2021-03-23	Jia et al.	
	11	11017838	B2	2021-05-25	Kang et al.	
	12	10153029	B2	2018-12-11	Kwak et al.	
	13	10777254	B2	2020-09-15	Kwak et al.	
	14	9620232	B2	2017-04-11	Nam	
	15	9142313	B2	2015-09-22	Shim et al.	
	16	10157674	B2	2018-12-18	Kim et al.	
	17	9349471	B2	2016-05-24	Yun	
	18	9837164	B2	2017-12-05	Yun	

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	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20200353312	A1	2020-11-12	Smith	
	2	20110194351	A1	2011-08-11	KIM et al.	
	3	20190147955	A1	2019-05-16	Chen	
	4	20190108883	A1	2019-04-11	Yu	
	5	20190156901	A1	2019-05-23	Chen	
	6	20200006379	A1	2020-01-02	NISHIKAWA et al.	

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	1	110289034	CN	A	2019-09-27		Abstract	
	2	109935256	CN	A	2019-06-25	TOSHIBA MEMORY CORP		

Micron Ex. 1016, p. 37
Micron v. YMTC
IPR2024-00795

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	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
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	3	113053431	A	CN	2021-06-29	SAMSUNG ELECTRONICS CO LTD			

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Examiner Signature		Date Considered	

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Micron Ex. 1016, p. 38
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	Application Number	
	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2022-10-13
Name/Print	Zhiwei Zou	Registration Number	66,041

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Micron Ex. 1016, p. 39
Micron v. YMTC
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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 the Freedom of Information Act requires disclosure of these record s.

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.

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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.

Micron Ex. 1016, p. 40
Micron v. YMTC
IPR2024-00795

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan JIA
Filer:	Zhiwei Zou/Anna O'Connor
Attorney Docket Number:	10018-01-0242-US-CON2

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	320	320
UTILITY SEARCH FEE	1111	1	700	700
UTILITY EXAMINATION FEE	1311	1	800	800
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1820**

Electronic Acknowledgement Receipt	
EFS ID:	46814999
Application Number:	17965527
International Application Number:	
Confirmation Number:	7400
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan JIA
Customer Number:	153988
Filer:	Zhiwei Zou/Anna O'Connor
Filer Authorized By:	Zhiwei Zou
Attorney Docket Number:	10018-01-0242-US-CON2
Receipt Date:	13-OCT-2022
Filing Date:	
Time Stamp:	17:20:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1820
RAM confirmation Number	E20220CH21120433
Deposit Account	602227
Authorized User	Anna O'Connor
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	10018-01-0242-US-CON2_UtilityPatentAppTransmittal.pdf	270454 a1f4f29d6bbd1e272b38ee700e7241a61b210ece	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	10018-01-0242-US-CON2_UtilityFEETransmittal.pdf	200257 4286510a46da5cea54feb3e5f60340b2fd287c05	no	1
Warnings:					
Information:					
3	Application Data Sheet	10018-01-0242-US-CON2_ADS.pdf	1829548 031e15064d91c38f9907058e0022a01594c0dfab	no	9
Warnings:					
Information:					
4		10018-01-0242-US-CON2_FINALApplication.pdf	185699 eaff8a17e52df760ce76497be2ce36ad09757233	yes	14

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	9
Claims	10	13
Abstract	14	14

Warnings:					
Information:					
5	Drawings-only black and white line drawings	10018-01-0242-US-CON2_FINALFigures.pdf	137828 dde4d86cbb7582561c2983dac04bac1bf6cb213d	no	4

Warnings:					
Information:					
6	Oath or Declaration filed	10018-01-0242-US-CON1_CombinedDEC-ASSIGN_signed.pdf	376631 f47c5cb684aa48a72f1f7065f3c16da6252d5dbe	no	3
Warnings:					
Information:					
7	Power of Attorney	10018-01-0242-US-CON2_GeneralPOA.pdf	934856 ed3d49b87e74e585b905d02a9d5729d6e1af5de3	no	2
Warnings:					
Information:					
8	Information Disclosure Statement (IDS) Form (SB08)	10018-01-0242-US-CON2_IDS-SB08.pdf	612926 6e21cef062cdd0ddb45c3366b79b75dec46fea34	no	6
Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	43981 dd1206c4ddc1dec601f40f744ee56204df56688b	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	4592180	

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.

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.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT7590128

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
JIANQUAN JIA	11/07/2019
YING CUI	11/07/2019
KAIKAI YOU	11/07/2019

RECEIVING PARTY DATA

Name:	YANGTZE MEMORY TECHNOLOGIES CO., LTD.
Street Address:	18 GAOXIN 4TH ROAD
Internal Address:	EAST LAKE HIGH-TECH DEVELOPMENT ZONE
City:	WUHAN, HUBEI
State/Country:	CHINA

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	17965527

CORRESPONDENCE DATA

Fax Number: (703)821-8128

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

Phone: 7039959887
Email: uspto@bayes.law
Correspondent Name: BAYES PLLC
Address Line 1: 8260 GREENSBORO DRIVE
Address Line 2: SUITE 625
Address Line 4: MCLEAN, VIRGINIA 22102

ATTORNEY DOCKET NUMBER:	10018-01-0242-US-CON1
NAME OF SUBMITTER:	ZHIWEI ZOU
SIGNATURE:	/Zhiwei Zou/
DATE SIGNED:	10/13/2022
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 3
source=10018-01-0242-US-CON1_CombinedDEC-ASSIGN_signed#page1.tif
source=10018-01-0242-US-CON1_CombinedDEC-ASSIGN_signed#page2.tif

source=10018-01-0242-US-CON1_CombinedDEC-ASSIGN_signed#page3.tif

Atty. Docket No. YMTP0261USA3

COMBINED DECLARATION AND ASSIGNMENT

DECLARATION

As the below named inventors, I hereby declare that:

This declaration is directed to:

☒ The attached application, or

☐ United States application or PCT international application number _____ filed on _____

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. § 1001 by fine or imprisonment of not more than five (5) years, or both.

ASSIGNMENT

In consideration of the sum of One Dollar ($1.00) or equivalent and other good and valuable consideration paid to each of the below named inventors, each of the below named inventors, hereby sell and assign to **Yangtze Memory Technologies Co., Ltd.**, a corporation formed under the laws of China, whose mailing address is Room 7018, No.18, Huaguang Boulevard, Guandong Tech. Industrial Park, Donghu Development Area, Hongshan District, Wuhan City, Hubei Province 430074, P.R.C. (hereafter referred to as the Assignee), his/her entire right, title and interest, including the right to sue for past infringement and to collect for all past, present and future damages, for the United States of America (as defined in 35 U.S.C. § 100) and throughout the world,

(a) in the invention(s) known as **NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD** for which application(s) for patent in the United States of America is identified above, in any and all applications thereon, in any and all Letters Patent(s) therefor, and

(b) in any and all applications that claim the benefit of the patent application identified above in part (a), including non-provisional applications, continuing (continuation, divisional, or continuation-in-part) applications, reissues, extensions, renewals and reexaminations of the patent application or Letters Patent therefor listed above in part (a), to the full extent of the term or terms for which Letters Patents issue, and

(c) in any and all inventions described in the patent application identified above in part (a), and in any and all forms of intellectual and industrial property protection derivable from such patent application, and that are derivable from any and all continuing applications, reissues, extensions,

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Micron Ex. 1016, p. 48
Micron v. YMTC
IPR2024-00795

renewals and reexaminations of such patent application, including, without limitation, patents, applications, utility models, inventor's certificates, and designs together with the right to file applications therefor; and including the right to claim the same priority rights from any previously filed applications under the International Agreement for the Protection of Industrial Property, or any other international agreement, or the domestic laws of the country in which any such application is filed, as may be applicable;

all such rights, title and interest to be held and enjoyed by the above-named Assignee, its successors, legal representatives and assigns to the same extent as all such rights, title and interest would have been held and enjoyed by the Assignor had this assignment and sale not been made.

The below named inventors agree to execute all papers necessary in connection with the application(s) and any non-provisional, continuing (continuation, divisional, or continuation-in-part), reissue, reexamination or corresponding application(s) thereof and also to execute separate assignments in connection with such application(s) as the Assignee may deem necessary or expedient.

The below named inventors agree to execute all papers necessary in connection with any patent enforcement action (judicial or otherwise) related to the application(s) or any non-provisional, continuing (continuation, divisional, or continuation-in-part), reissue or reexamination application(s) thereof and to cooperate with the Assignee in every way possible in obtaining evidence and going forward with such patent enforcement action.

The below named inventors hereby represent that he/she has full right to convey the entire interest herein assigned, and that he/she has not executed, and will not execute, any agreement in conflict therewith.

The below named inventors hereby represent that he/she understands that the patent practitioners associated with **CUSTOMER NUMBER 27765** are the legal representatives of, and attorneys for, the assignee, and are NOT the legal representatives of, and attorneys for, the inventors.

19842265-906E74B>-19. 17. 86. 195

Micron Ex. 1016, p. 49
Micron v. YMTC
IPR2024-00795

IN WITNESS WHEREOF, executed by the below named inventors on the date opposite his/her name.

LEGAL NAME OF INVENTOR

Inventor: Jianquan Jia Date: 2019.11.07

Signature of Inventor: Jianquan Jia

LEGAL NAME OF INVENTOR

Inventor: Ying Cui Date: 2019.11.07

Signature of Inventor: Ying Cui

LEGAL NAME OF INVENTOR

Inventor: Kaikai You Date: 2019.11.07

Signature of Inventor: Kai Kai You

(9842285-00DE74R2-10. 17. 86. 195

Micron Ex. 1016, p. 50
Micron v. YMTC
IPR2024-00795

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
17/965,527	10/13/2022		1820	10018-01-0242-US-CON2	20	2

CONFIRMATION NO. 7400

FILING RECEIPT

153988
Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

OC000000050151385

Date Mailed: 10/27/2022

Receipt is acknowledged of this non-provisional utility 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 FIRST INVENTOR, 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 corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction 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 provided that the request is grantable.

Inventor(s)

Jianquan Jia, Wuhan, CHINA;
Ying Cui, Wuhan, CHINA;
Kaikai You, Wuhan, CHINA;

Applicant(s)

YANGTZE MEMORY TECHNOLOGIES CO., LTD., Wuhan, CHINA;

Power of Attorney: The patent practitioners associated with Customer Number 153988

Domestic Priority data as claimed by applicant

This application is a CON of 17/353,727 06/21/2021
which is a CON of 16/709,944 12/11/2019 PAT 11,081,164
which is a CON of PCT/CN2019/112409 10/22/2019

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.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

Micron Ex. 1016, p. 51
Micron v. YMTC
IPR2024-00795

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/25/2022
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/965,527**
Projected Publication Date: 02/02/2023
Non-Publication Request: No
Early Publication Request: No
Title

NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

Preliminary Class

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 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).

Micron Ex. 1016, p. 52
Micron v. YMTC
IPR2024-00795

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 AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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Micron Ex. 1016, p. 53
Micron v. YMTC
IPR2024-00795

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 17/965,527

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	320
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	700
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	800
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	* 0			OR	x =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	2 minus 3 =	*				x =	0
APPLICATION SIZE FEE (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
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1820

APPLICATION AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
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.
** 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 found in the appropriate box in column 1.

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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2

CONFIRMATION NO. 7400

NEW OR REVISED PPD NOTICE

153988
Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

OC000000136703751

NOTICE OF NEW OR REVISED PROJECTED PUBLICATION DATE

The above-identified application has a new or revised projected publication date. The current projected publication date for this application is 02/02/2023. If this is a new projected publication date (there was no previous projected publication date), the application has been cleared by Licensing & Review or a secrecy order has been rescinded and the application is now in the publication queue.

If this is a revised projected publication date (one that is different from a previously communicated projected publication date), the publication date has been revised due to processing delays in the USPTO or the abandonment and subsequent revival of an application. The application is anticipated to be published on a date that is more than six weeks different from the originally-projected publication date.

More detailed publication information is available through the private side of Patent Application Information Retrieval (PAIR) System. The direct link to access PAIR is currently http://pair.uspto.gov. Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Questions relating to this Notice should be directed to the Office of Data Management, Application Assistance Unit at (571) 272-4000, or (571) 272-4200, or 1-888-786-0101.

Micron Ex. 1016, p. 55
Micron v. YMTC
IPR2024-00795

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2

CONFIRMATION NO. 7400

153988
Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

PUBLICATION NOTICE

OC000000137320857

Title:NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

Publication No.US-2023-0030801-A1
Publication Date:02/02/2023

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.

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Micron Ex. 1016, p. 56
Micron v. YMTC
IPR2024-00795

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(Not for submission under 37 CFR 1.99)

Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	10018-01-0242-US-CON2

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	1	2015176620	JP	A	2015-10-05	TOSHIBA CORP		

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Micron Ex. 1016, p. 57
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

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Micron Ex. 1016, p. 58
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-13
Name/Print	Zhiwei Zou	Registration Number	66,041

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Micron Ex. 1016, p. 59
Micron v. YMTC
IPR2024-00795

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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 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.

Micron Ex. 1016, p. 60
Micron v. YMTC
IPR2024-00795

Espacenet

JP2015176620A SEMICONDUCTOR MEMORY DEVICE

Applicants: TOSHIBA CORP

Inventors: FUTAYAMA TAKUYA,SHIRAKAWA MASANOBU,ABE KENICHI

Classifications:
IPC ***G11C16/02; G11C16/06; H01L21/336; H01L21/8247; H01L27/115; H01L29/788; H01L29/792;***

CPC **G11C11/5628 (EP,US); G11C11/5671 (EP,US); G11C16/10 (EP,US); G11C16/3459 (EP,US);** G11C16/0483 (EP,US); H10B43/27 (EP,US);

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Application: JP2014051934A·2014-03-14

Publication: JP2015176620A·2015-10-05

Published as: **CN104916319A; CN104916319B; CN110085272A;** JP2015176620A;**TW201535387A; TW201631590A; TW201820342A; TW201923770A; TW202029203A; TWI527041B; TWI618073B; TWI652681B; TWI684181B; TWI719773B; US2015262682A1; US9214238B2**

SEMICONDUCTOR MEMORY DEVICE

Abstract

PROBLEM TO BE SOLVED: To provide a semiconductor memory device that can improve operation performance.SOLUTION: A semiconductor memory device of an embodiment includes: first to fourth memory cells which are laminated over a semiconductor substrate; first to fourth word lines which are respectively connected to gates of the first to fourth memory cells; and a row decoder 112 that applies voltage to the first to fourth word lines. The row decoder 112 applies a first program voltage to the first word line in write operation to the first memory cell; applies the first program voltage to the second word line in write operation to the second memory cell; applies a second program voltage to the third word line in write operation to the third memory cell; and applies the second program voltage to the fourth word line in write operation to the fourth memory cell. The second program voltage is higher than the first program voltage.

Micron Ex. 1016, p. 61
Micron v. YMTC
IPR2024-00795

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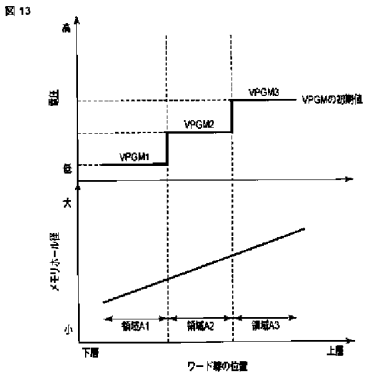
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最終頁に続く

(54)【発明の名称】半導体記憶装置

(57)【要約】
【課題】動作性能を向上できる半導体記憶装置を提供する。
【解決手段】実施形態の半導体記憶装置は、半導体基板の上方に積層された第１乃至第４メモリセルと、第１乃至第４メモリセルのゲートにそれぞれ接続された第１乃至第４ワード線と、第１乃至第４ワード線に電圧を印加するロウデコーダ１１２とを備える。ロウデコーダ１１２は、第１メモリセルへの書き込み動作時に、第１ワード線に第１プログラム電圧を印加し、第２メモリセルへの書き込み動作時に、第２ワード線に前記第１プログラム電圧を印加し、第３メモリセルへの書き込み動作時に、第３ワード線に第２プログラム電圧を印加し、第４メモリセルへの書き込み動作時に、第４ワード線に前記第２プログラム電圧を印加する。第２プログラム電圧は第１プログラム電圧より電圧が高い。
【選択図】図１３



Micron Ex. 1016, p. 62
Micron v. YMTC
IPR2024-00795

【特許請求の範囲】
【請求項１】
半導体基板の上方に積層された第１及び第２メモリセルと、
前記第１及び第２メモリセルの上方に積層された第３及び第４メモリセルと、
前記第１乃至第４メモリセルのゲートにそれぞれ電気的に接続された第１乃至第４ワード線と、
前記第１乃至第４ワード線に電圧を印加するロウデコーダと
を具備し、前記ロウデコーダは、前記第１メモリセルへの書き込み動作時に、前記第１ワード線に第１プログラム電圧を印加し、前記第２メモリセルへの書き込み動作時に、前記第２ワード線に前記第１プログラム電圧を印加し、
前記第３メモリセルへの書き込み動作時に、前記第３ワード線に第２プログラム電圧を印加し、前記第４メモリセルへの書き込み動作時に、前記第４ワード線に前記第２プログラム電圧を印加し、前記第２プログラム電圧は前記第１プログラム電圧より電圧が高い
ことを特徴とする半導体記憶装置。
【請求項２】
前記書き込み動作は、プログラム電圧で書き込みを行うプログラム動作と、前記プログラム動作を検証するベリファイ動作とを含む書き込みループの繰り返しを含み、
前記プログラム電圧は、前記書き込みループの度にステップアップされ、
前記第１、第２プログラム電圧はそれぞれ前記プログラム電圧の初期電圧である
ことを特徴とする請求項１に記載の半導体記憶装置。
【請求項３】
前記書き込み動作は、検知動作を更に含み、
前記第１及び第２メモリセルの少なくともいずれかに対する前記検知動作は、第１検知電圧を用いた読み出し動作を行うことにより閾値を判定し、
前記第３及び第４メモリセルの少なくともいずれかに対する前記検知動作は、第２検知電圧を用いた読み出し動作を行うことにより閾値を判定し、
前記第２検知電圧は前記第１検知電圧よりも電圧が高い
ことを特徴とする請求項２記載の半導体記憶装置。
【請求項４】
前記第１乃至第４メモリセルはそれぞれ２ビット以上のデータを保持可能であり、前記書き込み動作は、前記２ビット以上のデータの下位ビット書き込み動作と、前記下位ビット書き込み動作後の前記検知動作と、前記検知動作後の上位ビット書き込み動作とを含み、
前記下位ビット書き込み動作において、前記第１及び第２プログラム電圧が前記プログラム電圧の初期電圧として使用され、
前記上位ビット書き込み動作において使用されるプログラム電圧は、前記検知動作の結果に応じた値に設定される
ことを特徴とする請求項３記載の半導体記憶装置。
【請求項５】
前記第１乃至第４ワード線を貫通するメモリホールと、
前記メモリホール内を埋め込み、前記第１乃至第４メモリセルの電流経路が形成される導電層と
を更に備え、前記メモリホールの直径は、上層ほど大きく、下層ほど小さい
ことを特徴とする請求項１乃至４いずれか１項記載の半導体記憶装置。
【請求項６】
半導体基板の上方に設けられた第１メモリセルと、
前記第１メモリセルの上方に設けられた第２メモリセルと、
前記第１及び第２メモリセルのゲートにそれぞれ電気的に接続された第１及び第２ワード線と、
前記第１及び第２ワード線に電圧を印加するロウデコーダと

Micron Ex. 1016, p. 63
Micron v. YMTC
IPR2024-00795

を具備し、前記書き込み動作は、書き込みを行うプログラム動作と、前記プログラム動作を検証するベリファイ動作とを含む書き込みループと、メモリセルの書き込み特性を求める検知動作とを含み、
前記第１メモリセルに対する検知動作は、第１検知電圧を前記第１ワード線に印加することにより行われ、
前記第２メモリセルに対する検知動作は、第２検知電圧を前記第２ワード線に印加することにより行われ、
前記第２検知電圧は、前記第１検知電圧よりも電圧が高い
ことを特徴とする半導体記憶装置。
【請求項７】
前記第１メモリセルに対する前記検知動作は、前記書き込みループを第１の回数行った後に実行され、
前記第２メモリセルに対する前記検知動作は、前記書き込みループを、前記第１の回数よりも多い第２の回数行った後に実行される
ことを特徴とする請求項６記載の半導体記憶装置。
【請求項８】
前記第１、第２メモリセルはそれぞれ２ビット以上のデータを保持可能であり、前記書き込み動作は、前記２ビット以上のデータの下位ビット書き込み動作と、前記下位ビット書き込み動作後の前記検知動作と、前記検知動作後の上位ビット書き込み動作とを含み、
前記上位ビット書き込み動作において使用されるプログラム電圧は、前記検知動作の結果に応じた値に設定される
ことを特徴とする請求項７記載の半導体記憶装置。
【請求項９】
前記第１及び第２ワード線を貫通するメモリホールと、
前記メモリホール内を埋め込み、前記第１及び第２メモリセルの電流経路が形成される導電層と
を更に備え、前記メモリホールの直径は、上層ほど大きく、下層ほど小さい
ことを特徴とする請求項６乃至８いずれか１項記載の半導体記憶装置。
【請求項１０】
半導体基板の上方に積層された複数のメモリセルと、
前記複数のメモリセルのゲートにそれぞれ接続された複数のワード線と、
前記複数のワード線に電圧を印加するロウデコーダと
を具備し、前記ロウデコーダは、データのプログラム時において、選択ワード線にプログラム電圧を印加し、
前記選択ワード線よりも上層に位置する第１非選択ワード線に、前記プログラム電圧よりも小さい第１非選択電圧を印加し、
前記選択ワード線よりも下層に位置する第２非選択ワード線に、前記プログラム電圧及び前記第１電圧よりも小さい第２非選択電圧を印加する
ことを特徴とする半導体記憶装置。
【請求項１１】
前記ロウデコーダは、前記データのプログラム時において、上層に位置する非選択ワード線ほど高い非選択電圧を印加し、下層に位置する非選択ワード線ほど低い非選択電圧を印加する
ことを特徴とする請求項１０記載の半導体記憶装置。
【請求項１２】
前記ロウデコーダは、複数の非選択ワード線の組毎に、前記非選択電圧の値を変える
ことを特徴とする請求項１１記載の半導体記憶装置。
【請求項１３】
前記複数のワード線を貫通するメモリホールと、
前記メモリホール内を埋め込み、前記複数のメモリセルの電流経路が形成される導電層

Micron Ex. 1016, p. 64
Micron v. YMTC
IPR2024-00795

と
を更に備え、前記メモリホールの直径は、上層ほど大きく、下層ほど小さい
ことを特徴とする請求項１０乃至１２いずれか１項記載の半導体記憶装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明の実施形態は、半導体記憶装置に関する。
【背景技術】
【０００２】
メモリセルが三次元に配列されたＮＡＮＤ型フラッシュメモリが知られている。
【先行技術文献】
【特許文献】
【０００３】
【特許文献１】特開２０１１－２５８２８９号公報
【発明の概要】
【発明が解決しようとする課題】
【０００４】
動作性能を向上できる半導体記憶装置を提供する。
【課題を解決するための手段】
【０００５】
実施形態の半導体記憶装置は、半導体基板の上方に積層された第１及び第２メモリセルと、第１及び第２メモリセルの上方に積層された第３及び第４メモリセルと、第１乃至第４メモリセルのゲートにそれぞれ電気的に接続された第１乃至第４ワード線と、第１乃至第４ワード線に電圧を印加するロウデコーダとを具備する。ロウデコーダは、第１メモリセルへの書き込み動作時に、第１ワード線に第１プログラム電圧を印加し、第２メモリセルへの書き込み動作時に、第２ワード線に前記第１プログラム電圧を印加する。またロウデコーダは、第３メモリセルへの書き込み動作時に、第３ワード線に第２プログラム電圧を印加し、第４メモリセルへの書き込み動作時に、第４ワード線に第２プログラム電圧を印加する。そして、第２プログラム電圧は第１プログラム電圧より電圧が高い
【図面の簡単な説明】
【０００６】
【図１】図１は、第１実施形態に係るメモリシステムのブロック図である。
【図２】図２は、第１実施形態に係る半導体記憶装置のブロック図である。
【図３】図３は、第１実施形態に係るメモリセルアレイの回路図である。
【図４】図４は、第１実施形態に係るＮＡＮＤストリングの一例の断面図である。
【図５】図５は、第１実施形態に係るメモリセルの一例の閾値分布を示すグラフである。
【図６】図６は、第１実施形態に係るセンスアンプ及びソース線制御回路の回路図である。
【図７】図７は、第１実施形態に係る書き込み動作のフローチャートである。
【図８】図８は、第１実施形態に係るＮＡＮＤストリングの回路図である。
【図９】図９は、第１実施形態に係るＮＡＮＤストリングの回路図である。
【図１０】図１０は、第１実施形態に係る書き込み動作時におけるタイミングチャートである。
【図１１】図１１は、第１実施形態に係るワード線電圧のタイミングチャートである。
【図１２】図１２は、第１実施形態に係るＮＡＮＤストリングの一例の断面図である。
【図１３】図１３は、第１実施形態に係るワード線の位置に対する、メモリホール径とプログラム電圧の関係を示すグラフである。
【図１４】図１４は、第１実施形態に係るワード線の位置に対するプログラム電圧の関係を示すグラフである。
【図１５】図１５は、第２実施形態に係るメモリセルの一例の閾値分布を示すグラフであ

Micron Ex. 1016, p. 65
Micron v. YMTC
IPR2024-00795

る。
【図１６】図１６は、第２実施形態に係る書き込み時における閾値分布の変化を示すグラフである。
【図１７】図１７は、第２実施形態に係る書き込み動作のフローチャートである。
【図１８】図１８は、第２実施形態に係る書き込み動作時におけるタイミングチャートである。
【図１９】図１９は、第２実施形態に係る書き込み動作時におけるタイミングチャートである。
【図２０】図２０は、第２実施形態に係る検知動作の概念を示すダイアグラムである。
【図２１】図２１は、第２実施形態に係るワード線の位置に対する検知電圧の関係を示すグラフである。
【図２２】図２２は、第２実施形態の変形例に係る書き込み動作時におけるタイミングチャートである。
【図２３】図２３は、第２実施形態の変形例に係る書き込み動作時におけるタイミングチャートである。
【図２４】図２４は、第３実施形態に係るワード線の位置に対する、メモリホール径とプログラム電圧の関係を示すグラフである。
【図２５】図２５は、第３実施形態に係るワード線の位置に対する、ＶＰＡＳＳ及びＶＰＧＭとの関係を示すグラフである。
【図２６】図２６は、第３実施形態に係るワード線の位置に対する、ＶＰＡＳＳ及びＶＰＧＭとの関係を示すグラフである。
【図２７】図２７は、第３実施形態に係るワード線の位置に対する、ＶＰＡＳＳ及びＶＰＧＭとの関係を示すグラフである。
【図２８】図２８は、第４実施形態に係るＮＡＮＤストリングの断面図である。
【図２９】図２９は、第４実施形態に係るワード線の位置に対する、メモリホール径とプログラム電圧の関係を示すグラフである。
【図３０】図３０は、第４実施形態に係るワード線の位置に対する、メモリホール径とＶＰＡＳＳの関係を示すグラフである。
【図３１】図３１は、第４実施形態の変形例に係るワード線の位置に対する、メモリホール径とＶＰＡＳＳの関係を示すグラフである。
【図３２】図３２は、第４実施形態の変形例に係るＮＡＮＤストリングの断面図である。
【図３３】図３３は、第５実施形態の第１の例に係るＮＡＮＤストリングの断面図である。
【図３４】図３４は、第５実施形態の第２の例に係るＮＡＮＤストリングの断面図である。
【図３５】図３５は、第５実施形態の第３の例に係るＮＡＮＤストリングの断面図である。
【図３６】図３６は、第５実施形態の第４の例に係るＮＡＮＤストリングの断面図である。
【図３７】図３７は、第６実施形態の第１の例に係るメモリセルアレイの回路図である。
【図３８】図３８は、第６実施形態の第１の例に係るメモリセルアレイの斜視図である。
【図３９】図３９は、第６実施形態の第１の例に係るメモリセルアレイの平面図である。
【図４０】図４０は、図３９における４０－４０線に沿った断面図である。
【図４１】図４１は、図３９における４１－４１線に沿った断面図である。
【図４２】図４２は、図３９における４２－４２線に沿った断面図である。
【図４３】図４３は、第６実施形態に係る読み出し動作のフローチャートである。
【図４４】図４４は、第６実施形態に係る書き込み動作のタイミングチャートである。
【図４５】図４５は、第６実施形態の第２の例に係るメモリセルアレイの斜視図である。
【図４６】図４６は、第６実施形態の第２の例に係るメモリセルアレイの平面図である。
【図４７】図４７は、図４６における４７－４７線に沿った断面図である。

Micron Ex. 1016, p. 66
Micron v. YMTC
IPR2024-00795

【図４８】図４８は、図４６における４８－４８線に沿った断面図である。
【発明を実施するための形態】
【０００７】
以下、図面を参照して実施形態について説明する。なお、以下の説明において、同一の機能及び構成を有する構成要素については、共通する参照符号を付す。
【０００８】
１．第１実施形態
第１実施形態に係る半導体記憶装置について説明する。以下では半導体記憶装置として、メモリセルが半導体基板の上方に積層された三次元積層型ＮＡＮＤ型フラッシュメモリを例に挙げて説明する。
【０００９】
１．１　構成
１．１．１　メモリシステムの構成
まず、本実施形態に係る半導体記憶装置を含むメモリシステムの構成について、図１を用いて説明する。図１は、本実施形態に係るメモリシステムのブロック図である。
【００１０】
図示するようにメモリシステム１は、ＮＡＮＤ型フラッシュメモリ１００及びコントローラ２００を備えている。コントローラ２００とＮＡＮＤ型フラッシュメモリ１００は、例えばそれらの組み合わせにより一つの半導体装置を構成しても良く、その例としてはＳＤ™カードのようなメモリカードや、ＳＳＤ（solid state drive）等が挙げられる。
【００１１】
ＮＡＮＤ型フラッシュメモリ１００は、複数のメモリセルを備え、データを不揮発に記憶する。ＮＡＮＤ型フラッシュメモリ１００の構成の詳細は後述する。
【００１２】
コントローラ２００は、外部のホスト機器からの命令に応答して、ＮＡＮＤ型フラッシュメモリ１００に対して読み出し、書き込み、及び消去等を命令する。また、ＮＡＮＤ型フラッシュメモリ１００におけるメモリ空間を管理する。
【００１３】
コントローラ２００は、ホストインターフェイス回路２１０、内蔵メモリ（ＲＡＭ）２２０、プロセッサ（ＣＰＵ）２３０、バッファメモリ２４０、ＮＡＮＤインターフェイス回路２５０、及びＥＣＣ回路２６０を備えている。
【００１４】
ホストインターフェイス回路２１０は、コントローラバスを介してホスト機器と接続され、ホスト機器との通信を司る。そして、ホスト機器から受信した命令及びデータを、それぞれＣＰＵ２３０及びバッファメモリ２４０に転送する。またＣＰＵ２３０の命令に応答して、バッファメモリ２４０内のデータをホスト機器へ転送する。
【００１５】
ＮＡＮＤインターフェイス回路２５０は、ＮＡＮＤバスを介してＮＡＮＤ型フラッシュメモリ１００と接続され、ＮＡＮＤ型フラッシュメモリ１００との通信を司る。そして、ＣＰＵ２３０から受信した命令をＮＡＮＤ型フラッシュメモリ１００に転送し、また書き込み時にはバッファメモリ２４０内の書き込みデータをＮＡＮＤ型フラッシュメモリ１００へ転送する。更に読み出し時には、ＮＡＮＤ型フラッシュメモリ１００から読み出されたデータをバッファメモリ２４０へ転送する。
【００１６】
ＣＰＵ２３０は、コントローラ２００全体の動作を制御する。例えば、ＣＰＵ２３０は、ホスト機器から書き込み命令を受信した際には、それに応答して、ＮＡＮＤインターフェイスに基づく書き込み命令を発行する。読み出し及び消去の際も同様である。またＣＰＵ２３０は、ウェアレベリング等、ＮＡＮＤ型フラッシュメモリ１００を管理するための様々な処理を実行する。更にＣＰＵ２３０は、各種の演算を実行する。例えば、データの暗号化処理やランダマイズ処理等を実行する。

Micron Ex. 1016, p. 67
Micron v. YMTC
IPR2024-00795

【００１７】
ＥＣＣ回路２６０は、データの誤り訂正（ＥＣＣ：Error Checking and Correcting）処理を実行する。すなわちＥＣＣ回路２６０は、データの書き込み時には書き込みデータに基づいてパリティを生成し、読み出し時にはパリティからシンドロームを生成して誤りを検出し、この誤りを訂正する。なお、ＣＰＵ２３０がＥＣＣ回路２６０の機能を有していても良い。
【００１８】
内蔵メモリ２２０は、例えばＤＲＡＭ等の半導体メモリであり、ＣＰＵ２３０の作業領域として使用される。そして内蔵メモリ２２０は、ＮＡＮＤ型フラッシュメモリ１００を管理するためのファームウェアや、各種の管理テーブル等を保持する。
【００１９】
１．１．２　半導体記憶装置の構成
次に、ＮＡＮＤ型フラッシュメモリ１００の構成について説明する。
【００２０】
１．１．２．１　半導体記憶装置の全体構成
図２は、本実施形態に係るＮＡＮＤ型フラッシュメモリ１００のブロック図である。図示するようにＮＡＮＤ型フラッシュメモリ１００は、大まかにはコア部１１０及び周辺回路１２０を備えている。
【００２１】
コア部１１０は、メモリセルアレイ１１１、ロウデコーダ１１２、センスアンプ１１３、及びソース線制御回路１１４を備えている。
【００２２】
メモリセルアレイ１１１は、それぞれがワード線及びビット線に関連付けられた複数の不揮発性メモリセルの集合である複数のブロックＢＬＫ（ＢＬＫ０、ＢＬＫ１、ＢＬＫ２、…）を備えている。ブロックＢＬＫはデータの消去単位となり、同一ブロックＢＬＫ内のデータは一括して消去される。ブロックＢＬＫの各々は、メモリセルが直列接続されたＮＡＮＤストリング１１５の集合である複数のストリングユニットＳＵ（ＳＵ０、ＳＵ１、ＳＵ２、…）を備えている。もちろん、メモリセルアレイ１１１内のブロック数や、１ブロックＢＬＫ内のストリングユニット数は任意である。
【００２３】
ロウデコーダ１１２は、ブロックアドレスやページアドレスをデコードして、対応するブロックのいずれかのワード線を選択する。そしてロウデコーダ１１２は、選択ワード線及び非選択ワード線に、適切な電圧を印加する。
【００２４】
センスアンプ１１３は、データの読み出し時には、メモリセルからビット線に読み出されたデータをセンス・増幅する。またデータの書き込み時には、書き込みデータをメモリセルに転送する。メモリセルアレイ１１１へのデータの読み出し及び書き込みは、複数のメモリセル単位で行われ、この単位がページとなる。
【００２５】
ソース線制御回路１１４は、データの読み出し時や消去時等に、ソース線に印加する。
【００２６】
周辺回路１２０は、シーケンサ１２１、チャージポンプ１２２、レジスタ１２３、及びドライバ１２４を備える。
【００２７】
ドライバ１２４は、データの書き込み、読み出し、及び消去に必要な電圧を、ロウデコーダ１１２、センスアンプ１１３、及びソース線制御回路１１４に供給する。これらの電圧が、ロウデコーダ１１２、センスアンプ１１３、及びソース線制御回路１１４によってメモリセル（後述するワード線、セレクトゲート線、バックゲート線、ビット線、及びソース線）に印加される。
【００２８】

Micron Ex. 1016, p. 68
Micron v. YMTC
IPR2024-00795

チャージポンプ１２２は、外部から与えられる電源電圧を昇圧して、必要な電圧をドライバ１２４に供給する。

【００２９】

レジスタ１２３は、種々の信号を保持する。例えば、データの書き込みや消去動作のステータスを保持し、これによってコントローラに動作が正常に完了したか否かを通知する。あるいは、レジスタ１２３は、種々のテーブルを保持することも可能である。

【００３０】

シーケンサ１２１は、ＮＡＮＤ型フラッシュメモリ１００全体の動作を制御する。例えば、シーケンサ１２１は、書き込み時においてワード線に与えるプログラム電圧を制御する。すなわち、シーケンサ１２１は、コントローラ２００からアドレス信号を受け取ると、アドレス信号に基づいて複数のプログラム電圧の中からいずれの電圧を供給するかを選択し、その選択信号をチャージポンプ１２２に出力する。チャージポンプ１２２は、複数のプログラム電圧の中から前記選択信号に応じたプログラム電圧をドライバ１２４に供給する。ドライバ１２４は、受け取ったプログラム電圧をロウデコーダ１１２に出力する。

【００３１】

１．１．２．２　メモリセルアレイ１１１

次に、上記メモリセルアレイ１１１の構成の詳細について説明する。図３はいずれかのブロックＢＬＫの回路図であり、他のブロックＢＬＫも同様の構成を有している。

【００３２】

図示するように、ブロックＢＬＫは例えば４つのストリングユニットＳＵ（ＳＵ０～ＳＵ３）を含む。また各々のストリングユニットＳＵは、複数のＮＡＮＤストリング１１５を含む。

【００３３】

ＮＡＮＤストリング１１５の各々は、例えば８個のメモリセルトランジスタＭＴ（ＭＴ０～ＭＴ７）と、選択トランジスタＳＴ１、ＳＴ２と、バックゲートトランジスタＢＴとを含んでいる。メモリセルトランジスタＭＴは、制御ゲートと電荷蓄積層とを含む積層ゲートを備え、データを不揮発に保持する。なお、メモリセルトランジスタＭＴの個数は８個に限られず、１６個や３２個、６４個、１２８個等であってもよく、その数は限定されるものではない。バックゲートトランジスタＢＴもメモリセルトランジスタＭＴと同様に、制御ゲートと電荷蓄積層とを含む積層ゲートを備える。但し、バックゲートトランジスタＢＴはデータを保持するためのものでは無く、データの書き込み、読み出し、及び消去時には単なる電流経路として機能する。メモリセルトランジスタＭＴ及びバックゲートトランジスタＢＴは、選択トランジスタＳＴ１、ＳＴ２間に、その電流経路が直列接続されるようにして配置されている。なおバックゲートトランジスタＢＴは、メモリセルトランジスタＭＴ３とＭＴ４との間に設けられる。この直列接続の一端側のメモリセルトランジスタＭＴ７の電流経路は選択トランジスタＳＴ１の電流経路の一端に接続され、他端側のメモリセルトランジスタＭＴ０の電流経路は選択トランジスタＳＴ２の電流経路の一端に接続されている。

【００３４】

ストリングユニットＳＵ０～ＳＵ３の各々の選択トランジスタＳＴ１のゲートは、それぞれセレクトゲート線ＳＧＤ０～ＳＧＤ３に共通接続され、選択トランジスタＳＴ２のゲートは、それぞれセレクトゲート線ＳＧＳ０～ＳＧＳ３に共通接続される。これに対して、同一のブロックＢＬＫ０内にあるメモリセルトランジスタＭＴ０～ＭＴ７の制御ゲートはそれぞれワード線ＷＬ０～ＷＬ７に共通接続され、バックゲートトランジスタＢＴの制御ゲートはバックゲート線ＢＧ（ブロックＢＬＫ０～ＢＬＫ２では、それぞれＢＧ０～ＢＧ２）に共通接続される。

【００３５】

すなわち、ワード線ＷＬ０～ＷＬ７及びバックゲート線ＢＧは同一ブロックＢＬＫ０内の複数のストリングユニットＳＵ０～ＳＵ３間で共通に接続されているのに対し、セレクトゲート線ＳＧＤ、ＳＧＳは、同一ブロックＢＬＫ０内であってもストリングユニットＳ

Micron Ex. 1016, p. 69
Micron v. YMTC
IPR2024-00795

ＵＯ～ＳＵ３毎に独立している。

【００３６】

また、メモリセルアレイ１１１内でマトリクス状に配置されたＮＡＮＤストリング１１５のうち、同一行にあるＮＡＮＤストリング１１５の選択トランジスタＳＴ１の電流経路の他端は、いずれかのビット線ＢＬ（ＢＬ０～ＢＬ（Ｌ－１）、（Ｌ－１）は１以上の自然数）に共通接続される。すなわちビット線ＢＬは、複数のブロックＢＬＫ間でＮＡＮＤストリング１１５を共通に接続する。また、選択トランジスタＳＴ２の電流経路の他端はソース線ＳＬに共通に接続されている。ソース線ＳＬは、例えば複数のブロック間でＮＡＮＤストリング１１５を共通に接続する。

【００３７】

前述の通り、同一のブロックＢＬＫ内にあるメモリセルトランジスタＭＴのデータは、一括して消去される。これに対してデータの読み出し及び書き込みは、いずれかのブロックＢＬＫのいずれかのストリングユニットＳＵにおける、いずれかのワード線ＷＬに共通に接続された複数のメモリセルトランジスタＭＴにつき、一括して行われる。この単位を「ページ」と呼ぶ。

【００３８】

メモリセルアレイ１１１の構成については、例えば、“三次元積層不揮発性半導体メモリ”という２００９年３月１９日に出願された米国特許出願１２／４０７，４０３号に記載されている。また、“三次元積層不揮発性半導体メモリ”という２００９年３月１８日に出願された米国特許出願１２／４０６，５２４号、“不揮発性半導体記憶装置及びその製造方法”という２０１０年３月２５日に出願された米国特許出願１２／６７９，９９１号“半導体メモリ及びその製造方法”という２００９年３月２３日に出願された米国特許出願１２／５３２，０３０号に記載されている。これらの特許出願は、その全体が本願明細書において参照により援用されている。

【００３９】

図４は、ＮＡＮＤストリング１１５の一構成例の断面図である。図４に示す構成は一例に過ぎず、その他の構成であっても良く、いくつかのバリエーションについては後述する実施形態で述べる。メモリセルアレイ１１１内では、図４に示す構造が、図４を記載した紙面の奥行き方向に複数配列され、且つそれらがワード線ＷＬ０～ＷＬ７、セレクトゲート線ＳＧＤ及びＳＧＳ、並びにバックゲート線ＢＧを共有して、１つのストリングユニットＳＵを形成する。

【００４０】

半導体基板上には、例えばロウデコーダ１１２やセンスアンプ１１３等の周辺回路部が形成される。また半導体基板上には、この周辺回路部を被覆するようにして層間絶縁膜が形成され、この層間絶縁膜上にメモリセルアレイ１１１が形成される。すなわち、図４に示すように、半導体基板上方に、バックゲート線ＢＧとして機能する導電層（例えば多結晶シリコン層）が形成される。さらに、バックゲート線ＢＧ上には、ワード線ＷＬ０～ＷＬ７として機能する複数の導電層（例えば多結晶シリコン層）が形成される。ワード線ＷＬ０上には、セレクトゲート線ＳＧＳとして機能する導電層（例えば多結晶シリコン層）が形成される。さらに、ワード線ＷＬ７上には、セレクトゲート線ＳＧＤとして機能する導電層（例えば多結晶シリコン層）が形成される。

【００４１】

本例では、ワード線ＷＬ０とＷＬ７とが同一のレイヤに形成され、ワード線ＷＬ１とＷＬ６とが同一のレイヤに形成され、ワード線ＷＬ２とＷＬ５とが同一のレイヤに形成され、ワード線ＷＬ３とＷＬ４とが同一のレイヤに形成される。

【００４２】

そして、セレクトゲート線ＳＧＳ及びワード線ＷＬ０～ＷＬ３を貫通するようにメモリホールＭＨが形成され、またセレクトゲート線ＳＧＤ及びワード線ＷＬ４～ＷＬ７を貫通するように別のメモリホールＭＨが形成される。これらのメモリホールＭＨ内には半導体層ＡＡが埋め込まれ、２つのメモリホールＭＨ内に埋め込まれた半導体層ＡＡは、バック

Micron Ex. 1016, p. 70
Micron v. YMTC
IPR2024-00795

ゲート線ＢＧ内に形成された半導体層によって接続される。この半導体層ＡＡはＮＡＮＤストリング１１５の電流経路として機能し、メモリセルトランジスタＭＴの動作時にチャネルが形成される領域である。さらに、半導体層ＡＡ上にはソース線ＳＬ及びビット線ＢＬが形成される。

【００４３】

メモリホールＭＨの直径D_{MH}は、バックゲート線ＢＧ上方において上層側から下層側に向かって徐々に小さくなっている。すなわち、ワード線ＷＬ７からＷＬ４へ、及びワード線ＷＬ０からＷＬ３へ向かって直径D_{MH}が小さくなっている。このため、メモリホールＭＨ内の半導体層ＡＡは、上層側から下層側に向かって徐々に直径が小さくなるテーパー形状を有している。

【００４４】

図５は、本実施形態に係るメモリセルトランジスタＭＴの取りうる閾値分布を示す。図示するように、本例に係るメモリセルトランジスタＭＴは、その閾値に応じて１ビットのデータを保持可能である（ＳＬＣ(Single-Level Cell)）。１ビットデータは、閾値の低いものから順番に、例えば“Ｅ”レベル、“Ｐ”レベルである。“Ｅ”レベルは、データが消去された状態における閾値であり、例えば負の値を有し（正の値を有していても良い）、ベリファイ電圧ＥＶよりも低い。“Ｐ”レベルは、電荷蓄積層内に電荷が注入された状態の閾値であり、“Ｐ”レベルは読み出しレベル“ＰＲ”よりも高い閾値を有する（ＰＲ＞ＥＶ）。

【００４５】

１．１．２．３　センスアンプ１１３の構成について

次に、センスアンプ１１３の構成につき、図６を参照して説明する。図６は、いずれか１つのＮＡＮＤストリング１１５（１本のビット線ＢＬ）に対応したセンスアンプ１１３及びソース線制御回路１１４の回路図である。センスアンプ１１３はビット線毎に図６に示す構成を有し、ソース線制御回路１１４は複数のソース線ＳＬにつき図６に示す構成を有する。

【００４６】

図示するようにセンスアンプ１１３は、センスアンプユニット１３０、レギュレータ１３１、及びｎチャネルＭＯＳトランジスタ１３２～１３４を備えている。

【００４７】

トランジスタ１３２は、ゲートに信号ＢＬＳが与えられ、電流経路の一端がビット線ＢＬに接続され、他端がトランジスタ１３３の電流経路の一端に接続される。トランジスタ１３２は、トランジスタ１３３を介してビット線ＢＬをセンスアンプユニット１３０に接続するスイッチとして機能する。従って、消去動作時以外であって、対応するビット線ＢＬが選択される場合、信号ＢＬＳの電圧は例えば７～８Ｖ程度（トランジスタ１３２を十分にオン状態と出来る電圧）に設定される。

【００４８】

トランジスタ１３４は、ゲートに信号ＢＬＰが印加され、ドレインにプリチャージ電圧ＶＰＲＥが印加される。そしてトランジスタ１３４はデータの読み出し時において、センスアンプユニット１３０並びにトランジスタ１３２及び１３３を介して、ビット線ＢＬをプリチャージする。

【００４９】

レギュレータ１３１は、たとえば電源電圧をレギュレートして、所定の値の電圧を有する信号ＢＬＣを生成する。信号ＢＬＣの電圧値は、たとえばシーケンサ１２１の命令によって決定される。

【００５０】

トランジスタ１３３は、ゲートに信号ＢＬＣが与えられ、電流経路の一端がトランジスタ１３２を介してビット線ＢＬに接続され、他端がセンスアンプユニット１３０を介してトランジスタ１３４のソースに接続される。トランジスタ１３３は、たとえば読み出し時において、ビット線ＢＬの電圧を、信号ＢＬＣに応じた所望の値に設定する。

Micron Ex. 1016, p. 71
Micron v. YMTC
IPR2024-00795

【００５１】
センスアンプユニット１３０は、データの読み出し時には、ビット線ＢＬに流れる電流またはビット線ＢＬの電圧変化を検知して、ビット線ＢＬに読み出されたデータをセンスし、増幅する。増幅されたデータは、センスアンプユニット１３０内のラッチ回路に一時的に保持され、その後、図示せぬ入出力回路によって外部（メモリコントローラ２００）へ出力される。またデータの書き込み時には、メモリコントローラ２００から与えられた書き込みデータを一時的に保持し、書き込みデータに応じた電圧を、トランジスタ１３２及び１３３を介してビット線ＢＬに印加する。
【００５２】
１．１．２．４　ソース線制御回路１１４の構成について
次にソース線制御回路１１４の構成につき、引き続き図６を参照して説明する。図示するようにソース線制御回路１１４は、レギュレータ１４０、及びｎチャネルＭＯＳトランジスタ１４１～１４３を備えている。
【００５３】
トランジスタ１４１は、ゲートに信号ＧＳＲＣが与えられ、電流経路の一端がソース線ＳＬに接続され、他端がトランジスタ１４２及び１４３の電流経路の一端に接続される。トランジスタ１４１は、ソース線ＳＬをトランジスタ１４２及び１４３に接続するスイッチとして機能する。従って、ソース線ＳＬが選択される場合、信号ＧＳＲＣの電圧は例えば７～８Ｖ程度（トランジスタ１４１を十分にオン状態と出来る電圧）に設定される。
【００５４】
トランジスタ１４３は、ゲートに信号ＳＬＰが印加され、電流経路の他端（ドレイン）に例えば電源電圧Ｖdd（例えば３Ｖ）が印加される。そしてトランジスタ１４３はデータの読み出し時や消去時等において、トランジスタ１４１を介してソース線ＳＬに電圧を転送する。
【００５５】
レギュレータ１４０は、例えば電源電圧をレギュレートして、所定の値の電圧を有する信号ＳＬＧを生成する。信号ＳＬＧの電圧値は、例えばシーケンサ１２１の命令によって決定される。
【００５６】
トランジスタ１４２は、ゲートに信号ＳＬＧが与えられ、電流経路の他端が接地（０Ｖ）される。トランジスタ１４２は、例えば読み出し時において、ソース線ＳＬを接地する。この際、トランジスタ１４２が電流駆動力は信号ＳＬＧによって決定される。従ってソース線ＳＬの電位は、トランジスタ１４３がオンされる場合には、トランジスタ１４３によって転送される電源電圧Ｖddと、信号ＳＬＧに応じてソース線ＳＬが接地される強さとの兼ね合いによって決まる。またトランジスタ１４３がオフされる場合には、トランジスタ１４２によってソース線ＳＬには０Ｖが与えられる。
【００５７】
１．１．３　データの書き込み動作について
次に、本実施形態に係る書き込み動作について説明する。図７は、本実施形態に係る書き込み動作の流れを示すフローチャートである。
【００５８】
書き込み動作は、大まかには電荷を電荷蓄積層に注入して閾値を上昇させるプログラム動作と、プログラム動作の結果としての変化した閾値電圧を確認するプログラムベリファイ動作とを含む。そして、これらの動作の組（書き込みシーケンスと呼ぶ）を繰り返すことによって、データを書き込む。なお図７に示す処理は、主にシーケンサ１２１の制御によって実行される。
【００５９】
図示するように、まずＮＡＮＤ型フラッシュメモリ１００は、コントローラ２００からデータとアドレス信号をロードする。データはセンスアンプ１１３に保持され、アドレス信号はシーケンサ１２１に入力される（ステップＳ１０）。

Micron Ex. 1016, p. 72
Micron v. YMTC
IPR2024-00795

【００６０】
次に、シーケンサ１２１は、アドレス信号に基づいて適切なプログラム電圧ＶＰＧＭを選択して、その選択結果をチャージポンプ１２２に命令する。チャージポンプ１２２は、シーケンサ１２１の命令に応答して、適切なプログラム電圧ＶＰＧＭを生成し、これをドライバ１２４に供給する（ステップＳ１１）。
【００６１】
次に、シーケンサ１２１の命令に応答して、ロウデコーダ１１２はワード線ＷＬを選択し、選択ワード線ＷＬにプログラム電圧ＶＰＧＭを印加する。さらに、センスアンプ１１３がビット線ＢＬに電圧を印加する。これにより、ステップＳ１０でロードしたデータをメモリセルトランジスタにページ単位でプログラムする（ステップＳ１２）。ステップＳ１２の様子を図８に示す。図８はＮＡＮＤストリング１１５の回路図である。図示するように、非選択ワード線には電圧ＶＰＡＳＳが印加され、選択ワード線にはＶＰＧＭが印加される。電圧ＶＰＡＳＳは、保持データに関わらずメモリセルトランジスタＭＴをオンさせる電圧であり、電圧ＶＰＧＭは、ＦＮトンネリングにより電荷を電荷蓄積層に注入するための高電圧である（ＶＰＧＭ＞ＶＰＡＳＳ）。バックゲート線ＢＧには、トランジスタＢＴをオンさせる電圧ＶＢＧが印加される。更にセレクトゲート線ＳＧＤ及びＳＧＳにはそれぞれ電圧ＶＳＧＤ及び０Ｖが印加される。電圧ＶＳＧＤは、選択ビット線（０Ｖ）に対応する選択トランジスタＳＴ１をオンさせ、非選択ビット線（Ｖ１＞０Ｖ）に対応する選択トランジスタＳＴ１をカットオフさせる電圧である。
【００６２】
次に、シーケンサ１２１の命令に応答して、チャージポンプ１２２がベリファイ電圧を発生する。そしてロウデコーダ１１２は、ベリファイ電圧を選択ワード線ＷＬに印加して、プログラムベリファイ動作を実行する（ステップＳ１３）。すなわち、例えばシーケンサ１２１の命令に従って、センスアンプ１１３が選択ページからデータを読み出す。そしてシーケンサ１２１は、メモリセルトランジスタＭＴの閾値が所望の値まで上昇しているか否かを、読み出しデータに基づいて確認する。以下、メモリセルトランジスタＭＴの閾値が所望の値まで上昇していた場合をベリファイに「パスした」、と呼び、上昇していなかった場合を「フェイルした」、と呼ぶ。ステップＳ１３の様子を図９に示す。図９はＮＡＮＤストリング１１５の回路図である。図示するように、非選択ワード線には電圧ＶＲＥＡＤが印加され、選択ワード線にはプログラムベリファイ電圧Ｖpvが印加される。電圧ＶＲＥＡＤは、保持データに関わらずメモリセルトランジスタＭＴをオンさせる電圧であり、電圧Ｖpvは、プログラムすべきデータに応じた電圧である（ＶＲＥＡＤ＞Ｖpv）。バックゲート線ＢＧには電圧ＶＢＧが印加される。更にセレクトゲート線ＳＧＤ及びＳＧＳには、それぞれ電圧ＶＳＧが印加される。電圧ＶＳＧは、選択トランジスタＳＴ１及びＳＴ２をオンさせる電圧である。
【００６３】
ページ内の規定数以上のメモリセルがベリファイにパスすれば（ステップＳ１４、ＹＥＳ）、当該ページに対する書き込み動作は終了する。一方、パスしたメモリセルが規定数未満であれば、つまりフェイルしたメモリセル数が多ければ（ステップＳ１４、ＮＯ）、シーケンサ１２１は、書き込みシーケンスの繰り返し回数が最大回数に達したか否かを判定する（ステップＳ１５）。達していれば、プログラムフェイルで書き込み動作は終了する（ステップＳ１６）。達していなければ、ステップＳ１１の処理に戻る。この際、シーケンサ１２１はプログラム電圧ＶＰＧＭをステップアップさせる（ステップＳ１７）。
【００６４】
上記書き込み動作時における各配線の電圧変化の様子につき、図１０を用いて説明する。図１０は、各配線の電圧変化を示すタイミングチャートであり、１回の書き込みシーケンスを示している。
【００６５】
図示するように、時刻ｔ０においてロウデコーダ１１２は選択ストリングユニットのセレクトゲート線ＳＧＤに電圧ＶＳＧＤ_prog（＞ＶＳＧＤ）を印加する。電圧ＶＳＧＤ_pr

Micron Ex. 1016, p. 73
Micron v. YMTC
IPR2024-00795

ogは、選択トランジスタＳＴ１をオンさせる電圧である。

【００６６】

センスアンプ１１３は、プログラムベリファイにまだパスしていないビット線ＢＬに対しては０Ｖを印加し、既にパスしたビット線ＢＬ及び非選択のビット線ＢＬに対しては電圧Ｖ１を印加する（図示せず）。選択トランジスタＳＴ１は、これらの電圧をドレインからソースへ転送する。

【００６７】

引き続き時刻ｔ１において、ロウデコーダ１１２は、セレクトゲート線ＳＧＤの電位をＶＳＧＤに低下させる。これにより、既にベリファイにパスしたビット線ＢＬ及び非選択のビット線ＢＬに対応する選択トランジスタＳＴ１はカットオフされる。

【００６８】

そして、ロウデコーダ１１２は、選択ワード線及び非選択ワード線並びにバックゲート線ＢＧに電圧ＶＰＡＳＳを印加する（時刻ｔ２）。その後、選択ワード線の電位がＶＰＧＭに上昇されることで、プログラム動作が実行される。

【００６９】

他方で、既にベリファイにパスしたビット線ＢＬ及び非選択のビット線ＢＬに対応するＮＡＮＤストリングでは、選択トランジスタＳＴ１がカットオフ状態であるので、チャネルは電気的にフローティングとなる。その結果、チャネルの電位がワード線とのカップリングにより上昇し、プログラムが禁止される。

【００７０】

その後、シーケンサ１２１はプログラムベリファイ動作を実行する。すなわちロウデコーダ１１２は、ワード線ＷＬの電位を０Ｖに低下させると共に、選択ストリングユニットＳＵにおけるセレクトゲート線ＳＧＤ及びＳＧＳに電圧ＶＳＧを印加して、選択トランジスタＳＴ１及びＳＴ２をオンさせる（時刻ｔ６）。

【００７１】

引き続きロウデコーダ１１２は、選択ワード線にベリファイ電圧Ｖpvを印加し、非選択ワード線に電圧ＶＲＥＡＤを印加する。そして、センスアンプ１１３は、ビット線ＢＬに読み出されたデータをセンス・増幅する。この読み出し結果に従ってシーケンサ１２１は、選択ページに対する書き込みが完了したか否か（つまりベリファイにパスしたか否か）を判定する。書き込みが完了していなければ、選択ページに対するプログラム動作が繰り返される。

【００７２】

１．１．４　プログラム電圧ＶＰＧＭについて

次に、上記プログラム動作時に選択ワード線ＷＬに印加されるプログラム電圧ＶＰＧＭについて説明する。

【００７３】

本実施形態に係るプログラム電圧ＶＰＧＭの初期値は、下層のワード線ＷＬに印加されるものほど小さく、上層のワード線ＷＬに印加されるものほど大きい。換言すれば、プログラム電圧ＶＰＧＭは、貫通するメモリホール径が大きいワード線ＷＬに印加されるものほど大きく、メモリホール径が小さいワード線ＷＬに印加されるものほど小さい。

【００７４】

図１１は、書き込み動作時に選択ワード線ＷＬに印加されるプログラム電圧ＶＰＧＭ及びプログラムベリファイ電圧Ｖpvのタイミングチャートである。図示するように、下層のワード線ＷＬに印加されるプログラム電圧ＶＰＧＭの初期値はＶＰＧＭ１であり、中間層のワード線ＷＬに印加されるプログラム電圧ＶＰＧＭの初期値はＶＰＧＭ２（＝ＶＰＧＭ１＋ΔＶ）であり、上層のワード線ＷＬに印加されるプログラム電圧ＶＰＧＭの初期値はＶＰＧＭ３（＝ＶＰＧＭ２＋ΔＶ）である。そしてプログラム電圧ＶＰＧＭは、書き込みシーケンスを繰り返すたびに、ΔＶＰＧＭだけステップアップされる。従って、同じ書き込みシーケンス回数で比較すれば、常に上層のワード線ＷＬに印加されるＶＰＧＭ（例えば１７～２０Ｖ程度）は、下層のワード線ＷＬに印加されるＶＰＧＭ（例えば１３～１５

Micron Ex. 1016, p. 74
Micron v. YMTC
IPR2024-00795

Ｖ程度）よりも大きい。

【００７５】

次に、プログラム電圧ＶＰＧＭの詳細な一例につき以下説明する。図１２は、ＮＡＮＤストリング１１５のより詳細な断面図である。

【００７６】

図示するようにＮＡＮＤストリング１１５は、ビット線ＢＬ側とソースＳＬ線側にそれぞれ積層された（ｎ＋１）層のワード線を有する。ｎは１以上の自然数である。ビット線側のバックゲートＢＧ上には、ダミーワード線ＷＬＤＤ０、ワード線ＷＬＤ０、ＷＬＤ１、…、ＷＬＤｋ-2、ＷＬＤｋ-1、ＷＬＤｋ、ＷＬＤｋ+1、ＷＬＤｋ+2、…、ＷＬＤｎ-3、ＷＬＤｎ-2、ＷＬＤｎ-1、ＷＬＤｎ、ダミーワード線ＷＬＤＤ１、ＷＬＤＤ２が順に積層されている。ダミーワード線ＷＬＤＤ２上には、セレクトゲート線ＳＧＤが例えば４本積層されている。これらの４層のセレクトゲート線ＳＧＤは電気的に共通に接続されており、１つの選択トランジスタＳＴ１と等価である。さらに、セレクトゲート線ＳＧＤ上にはビット線ＢＬが配置され、ビット線ＢＬはメモリホールＭＨ内の半導体層と電気的に接続されている。

【００７７】

ソース線側のバックゲートＢＧ上には、ダミーワード線ＷＬＳＤ０、ワード線ＷＬＳ０、ＷＬＳ１、…、ＷＬＳｋ-2、ＷＬＳｋ-1、ＷＬＳｋ、ＷＬＳｋ+1、ＷＬＳｋ+2、…、ＷＬＳｎ-3、ＷＬＳｎ-2、ＷＬＳｎ-1、ＷＬＳｎ、ダミーワード線ＷＬＳＤ１、ＷＬＳＤ２が順に積層されている。ダミーワード線ＷＬＳＤ２上には、セレクトゲート線ＳＧＳが４本積層されている。これらの４層のセレクトゲート線ＳＧＳは電気的に共通に接続されており、１つの選択トランジスタＳＴ２と等価である。さらに、セレクトゲート線ＳＧＳ上にはソース線ＳＬが配置され、ソース線ＳＬはメモリホールＭＨ内の半導体層と電気的に接続されている。

【００７８】

図１２において、（ｎ＋１）層のワード線ＷＬは、下層から順番に領域Ａ１、Ａ２、及びＡ３に属する。そして各領域Ａ１、Ａ２、及びＡ３に含まれるワード線ＷＬの層数は、それぞれ、ａ１、ａ２、及びａ２であり、いずれも２以上の自然数である（ａ１＋ａ２＋ａ３＝（ｎ＋１））。

【００７９】

図１３は、ワード線ＷＬの位置（領域Ａ１～Ａ３）に対するメモリホール径とプログラム電圧ＶＰＧＭの初期値の関係を示すグラフである。

【００８０】

前述のように、メモリホールの直径D_{MH}は上層のワード線ＷＬを貫通するものほど大きく、下層のワード線ＷＬを貫通するものほど小さい。そしてロウデコーダ１１２は、領域Ａ１、Ａ２、及びＡ３のワード線ＷＬに印加するプログラム電圧ＶＰＧＭの初期値を、それぞれＶＰＧＭ１、ＶＰＧＭ２、及びＶＰＧＭ３とする。そして、これらの初期値の間には、ＶＰＧＭ１＞ＶＰＧＭ２＞ＶＰＧＭ３なる関係がある。すなわちロウデコーダ１１２は、上層側のワード線ほど、プログラム電圧ＶＰＧＭの初期値を高く設定し、下層側のワード線ほど低く設定する。換言すればロウデコーダ１１２は、メモリホールの直径D_{MH}の大きいワード線には大きなプログラム電圧ＶＰＧＭを印加し、メモリホールの直径D_{MH}の小さいワード線には小さいプログラム電圧ＶＰＧＭを印加する。メモリホールの直径D_{MH}は、メモリセルのトランジスタサイズ、と読み替えても良い。

【００８１】

１．３　第１実施形態に係る効果

図４及び図１２で説明したように、メモリホールＭＨの直径D_{MH}は、上層から下層へ向かって徐々に小さくなるテーパー状になっている。すなわち、下層のメモリホールＭＨの直径は上層のメモリホールＭＨの直径より小さい。

【００８２】

この理由は、複数層に積層されたワード線ＷＬを一括してエッチングすることによりメ

Micron Ex. 1016, p. 75
Micron v. YMTC
IPR2024-00795

モリホールが形成されるからであり、メモリホールＭＨが深くなるほど、その傾向は顕著になる。

【００８３】

すると、同一の電圧を各ワード線に供給したとき、メモリホールＭＨの直径が大きい位置の半導体層では、メモリホールＭＨの直径が小さい位置の半導体層に比べて、印加される電界が弱くなる。このため、メモリホールＭＨの直径が大きい位置に配置されたメモリセルトランジスタは、メモリホールＭＨの直径が小さい位置のメモリセルトランジスタに比べて、チャネルが形成されにくい。言い換えれば、上層のメモリセルトランジスタほどデータはプログラムされ難く、下層のメモリセルトランジスタほどデータはプログラムされ易い。

【００８４】

このようなメモリセルトランジスタのレイヤ依存性を考慮し、本実施形態では、上層側から下層側に向かって、すなわちメモリホールＭＨの直径が小さくなるのに従って、選択ワード線に印加するプログラム電圧ＶＰＧＭの初期値を徐々に低くする。すなわち、下層のメモリセルに印加するプログラム電圧ＶＰＧＭの初期値を、上層のメモリセルに印加する初期値よりも低くする。これにより、上層側及び下層側のメモリセルに対して、適切なプログラム電圧ＶＰＧＭで書き込み動作を実行することが可能となり、書き込み動作を高速化することができる。

【００８５】

なお、プログラム電圧ＶＰＧＭの初期値は図１３の関係に限られるものでは無い。図１４は、ワード線ＷＬの位置（レイヤ）とＶＰＧＭの初期値との関係を示すグラフである。図示するように、領域Ａ３における最上層のワード線ＷＬＤｎ及びＷＬＳｎに印加されるＶＰＧＭの初期値は、領域Ａ３内のそれ以外のワード線に印加されるＶＰＧＭの初期値と異なっていても良い（図１４の例では大きくされているが（ＶＰＧＭ４）、これに限られない）。同様に、領域Ａ１における最下層のワード線ＷＬＤ０、ＷＬＳ０に印加されるＶＰＧＭの初期値は、領域Ａ１内のそれ以外のワード線に印加されるＶＰＧＭの初期値と異なっていても良い（図１４の例では小さくされている（ＶＰＧＭ０）が、これに限られない）。

【００８６】

更に、図１２乃至図１４ではＮＡＮＤストリングが３つの領域Ａ１～Ａ３に分割される例を説明したが、２つの領域に分割される場合であっても良いし、あるいは４つ以上の領域に分割される場合であっても良く、限定されない。

【００８７】

２．第２実施形態

次に、第２実施形態に係る半導体記憶装置について説明する。本実施形態は、上記第１実施形態において、１つのメモリセルトランジスタが２ビット以上のデータを保持可能な場合（ＭＬＣ(Multi-Level Cell)）に関するものである。以下では、第１実施形態と異なる点についてのみ説明する。

【００８８】

２．１　メモリセルトランジスタの閾値分布について

本実施形態に係るメモリセルトランジスタの閾値分布を図１５に示す。図示するように、本実施形態に係るメモリセルトランジスタＭＴは、その閾値に応じて例えば２ビットのデータを保持可能である。この２ビットデータは、閾値の低いものから順番に、例えば“Ｅ”レベル、“Ａ”レベル、“Ｂ”レベル、及び“Ｃ”レベルである。“Ａ”～“Ｃ”レベルは、電荷蓄積層内に電荷が注入された状態の閾値であり、“Ａ”レベルは読み出しレベル“ＡＲ”よりも高く、且つ読み出しレベル“ＢＲ”より低い閾値を有する。“Ｂ”レベルは、読み出しレベル“ＢＲ”よりも高く、且つ読み出しレベル“ＣＲ”より低い閾値を有する。“Ｃ”レベルは、読み出しレベル“ＣＲ”よりも高い閾値を有する。

【００８９】

このように、４つの閾値レベルを取り得ることにより、個々のメモリセルトランジスタ

Micron Ex. 1016, p. 76
Micron v. YMTC
IPR2024-00795

ＭＴは２ビットのデータ(4-level data)を記憶できる。

【００９０】

図１６は、データ書き込み時における閾値分布の変化を示すグラフである。消去状態にあるメモリセルトランジスタに対して、始めに２ビットデータのうちの下位ビットがプログラムされる（Lower program）。これにより、“Ｂ”レベルまたは“Ｃ”レベルデータを書き込むべきメモリセルトランジスタＭＴの閾値は、“Ｍ”レベルまで上昇する。“Ｍ”レベルは、電圧ＶＭより大きな閾値を有し、例えば“ＡＲ”より高く“ＣＲ”よりも低い範囲の値である。

【００９１】

次に、上位ビットデータがプログラムされる（Upper program）。これにより、各メモリセルトランジスタＭＴの閾値は所望の値に設定される。なお、下位ビットプログラムも上位ビットプログラムも、共にページ単位で行われる。

【００９２】

２．２　データの書き込み動作について

次に、本実施形態に係る書き込み動作について説明する。図１７は、本実施形態に係る２ビットデータの書き込み動作の流れを示すフローチャートであり、第１実施形態で説明した図７に対応する。

【００９３】

書き込み動作は、大まかには、下位ページプログラムとそのプログラムベリファイとの組の繰り返しと、下位ページプログラムに基づくセル特性の検知動作と、その後の上位ページプログラムとそのプログラムベリファイとの組の繰り返し、である。なお、図１７に示す処理も主にシーケンサ１２１の制御によって実行される。

【００９４】

図示するように、ステップＳ１０及びＳ１１の後、下位ページプログラムが行われる（ステップＳ２０）。下位ページプログラムで使用されるＶＰＧＭは、上記第１実施形態で説明したようにレイヤ依存性を持ち、上層のワード線ほど高い値に設定される。

【００９５】

引き続きステップＳ１３～Ｓ１６が実行される。ステップＳ１３で使用されるベリファイレベルＶpvは、例えば図１６で説明した電圧ＶＭである。最大繰り返し回数に達してもベリファイにパスしなければ、プログラムフェイルで書き込みは終了する。

【００９６】

最大繰り返し回数に達していない場合（ステップＳ１５、ＮＯ）、シーケンサ１２１は、繰り返し回数が所定の回数に達したか否かを判定する（ステップＳ２１）。達していなければ（ステップＳ２１、ＮＯ）、ステップＳ１７に進み、再び下位ページ書き込みを繰り返す。

【００９７】

所定の回数に達していれば（ステップＳ２１、ＹＥＳ）、シーケンサ１２１は検知動作を実行する（ステップＳ２２）。検知動作では、ステップＳ１３におけるベリファイ電圧よりも低い検知電圧ＶＬ１を用いたプログラムベリファイ動作が行われる。そしてシーケンサ１２１は、このプログラムベリファイ動作の結果に基づいて、検知電圧ＶＬ１以上の閾値を有するメモリセルトランジスタ数をカウントし、それが所定の数に達しているか否かを判定する。そして、所定の数に達していた場合、シーケンサ１２１はその時点でのプログラム回数を例えばレジスタ１２３等に保持させる。

【００９８】

検知動作の後、ステップＳ１７に進む。

【００９９】

ステップＳ１４において、規定数以上のメモリセルトランジスタがベリファイにパスすれば（ステップＳ１４、ＹＥＳ）、シーケンサ１２１は下位ページデータの書き込みを完了し、次に上位ページデータの書き込みを実行する。

【０１００】

Micron Ex. 1016, p. 77
Micron v. YMTC
IPR2024-00795

すなわち、シーケンサ１２１は、ステップＳ２２で得られた検知結果に基づいてプログラム電圧ＶＰＧＭを選択し、その選択結果をチャージポンプ１２２に命令する。チャージポンプ１２２は、シーケンサ１２１の命令に応答して、適切なプログラム電圧ＶＰＧＭを生成し、これをドライバ１２４に供給する（ステップＳ２３）。

【０１０１】

次に、シーケンサ１２１の命令に応答して、ロウデコーダ１１２はワード線ＷＬを選択し、選択ワード線ＷＬにプログラム電圧ＶＰＧＭを印加する。さらに、センスアンプ１１３がビット線ＢＬに電圧を印加する。これにより上位ページデータがプログラムされる（ステップＳ２４）。

【０１０２】

その後は下位ページ書き込みと同様であり、上位ページプログラムベリファイを行い（ステップＳ２６）、パスすれば（ステップＳ２６、ＹＥＳ）、書き込み動作は完了する。他方で、フェイルした場合は（ステップＳ２６、ＮＯ）、上位ページプログラムを繰り返し（ステップＳ２４）、プログラム回数が最大繰り返し回数に達した場合には、書き込み動作はプログラムフェイルで終了する。

【０１０３】

下位ページ書き込み時の各配線の電圧は、第１実施形態で説明した図１０の通りであり、ベリファイ電圧Ｖpvとして例えば電圧ＶＭが使用される。プログラム電圧ＶＰＧＭにレイヤ依存性がある点も、第１実施形態と同様である。

【０１０４】

図１８は、上位ページ書き込み時の各配線の電圧を図１８に示す。下位ページ書き込みと異なる点は、プログラム電圧ＶＰＧＭがレイヤに依存するのでは無く、検知動作結果に依存する点と、ベリファイ電圧として、Ｖpv1、Ｖpv2、及びＶpv3が用いられる点である。ベリファイ電圧Ｖpv1、Ｖpv2、及びＶpv3は、例えば図１５における“ＡＲ”、“ＢＲ”、及び“ＣＲ”に相当する。

【０１０５】

図１９は、下位ページ書き込み時における選択ワード線ＷＬの電位変化を示すタイミングチャートであり、一例として下層（領域Ａ１）に位置するワード線ＷＬが選択された場合を示している。

【０１０６】

図示するように、最初のプログラム時にはＶＰＧＭ１を用いて下位ページプログラムが行われ、次に電圧ＶＭを用いてプログラムベリファイが行われる（第１ループ）。その後、同様の動作が、プログラム電圧がステップアップされつつ繰り返される。そして、図１７のステップＳ２１における所定の繰り返し回数が“３回”であったとすると、図１９に示すように第３ループの直後に検知動作が行われる。すなわち、検知電圧ＶＬ１を用いてプログラムベリファイ動作が実行される。その後は、引き続き下位ページ書き込みが繰り返される。

【０１０７】

検知動作を行う意味につき、図２０を用いて説明する。図２０は、検知動作において、検知電圧ＶＬ１以上の閾値を有するメモリセルトランジスタ数が規定数以上になった書き込みループ回数と、この回数に応じたメモリセルトランジスタの特性と、上位ページプログラム時に使用するプログラム電圧ＶＰＧＭの初期値とを示す表である。

【０１０８】

図示するように、少ない書き込みループ数で多くのメモリセルトランジスタの閾値がＶＬ１に達したということは、当該ページ内のメモリセルトランジスタは、プログラムし易い（閾値が上昇し易い、またはプログラム速度が速い）という特性を持つことを意味する。逆に、多数回にわたって書き込みループを実行しなければ、規定数のメモリセルトランジスタの閾値がＶＬ１に達しなかったということは、当該ページ内のメモリセルトランジスタは、プログラムし難い（閾値が上昇し難い、またはプログラム速度が遅い）という特性を持つことを意味する。

Micron Ex. 1016, p. 78
Micron v. YMTC
IPR2024-00795

【０１０９】
従って、上位ページプログラムの際には、上記セル特性に基づいてプログラム電圧ＶＰＧＭの初期値を選択する。すなわち、プログラムし易いページに対しては、比較的低い電圧ＶＰＧＭ１’を用い、プログラムし難いページに対しては比較的高い電圧ＶＰＧＭ３’（＞ＶＰＧＭ１’）を用い、通常のプログラム速度のページに対しては、中間電圧ＶＰＧＭ２’（但しＶＰＧＭ１’＜ＶＰＧＭ２’＜ＶＰＧＭ３’）を用いる。
【０１１０】
そしてシーケンサ１２１またはレジスタ１２３は、図２０における少なくとも書き込みループ数とＶＰＧＭの初期値との関係を保持する。
【０１１１】
２．３　検知電圧ＶＬ１について
次に、上記検知動作時に選択ワード線ＷＬに印加される検知電圧ＶＬ１について説明する。
【０１１２】
本実施形態に係る検知電圧ＶＬ１の初期値は、下層のワード線ＷＬに印加されるものほど小さく、上層のワード線ＷＬに印加されるものほど大きい。換言すれば、検知電圧ＶＬ１は、貫通するメモリホール径が大きいワード線ＷＬに印加されるものほど大きく、メモリホール径が小さいワード線ＷＬに印加されるものほど小さい。すなわち、プログラム電圧ＶＰＧＭとワード線レイヤとの関係と同様の関係を有している。
【０１１３】
図２１は、図１２で説明した領域Ａ１～Ａ３に対するメモリホール径と検知電圧ＶＬ１との関係を示すグラフである。
【０１１４】
図示するようにロウデコーダ１１２は、領域Ａ１、Ａ２、及びＡ３のワード線ＷＬに印加する検知電圧ＶＬ１の値を、それぞれＶＬ１－１、ＶＬ１－２、及びＶＬ１－３とする。そして、これらの間には、ＶＬ１－１＞ＶＬ１－２＞ＶＬ１－３なる関係がある。但し、ＶＬ１－１～ＶＬ１－３はいずれもＶＭよりも小さい電圧である。
【０１１５】
２．４　第２実施形態に係る効果
本実施形態によれば、下位ページ書き込み時に、メモリセルトランジスタＭＴの特性を判断する検知動作を行っている。そして、この検知動作の結果に基づき、各ページがプログラムし易いページか否かを判断し、この判断結果に基づいて上位ページ書き込み時のプログラム電圧ＶＰＧＭの大きさを決定している。つまり、プログラムし易いページには低いプログラム電圧ＶＰＧＭを使用し、プログラムし難いページには高いプログラム電圧ＶＰＧＭを使用する。これにより、書き込み動作を高速化出来る。
【０１１６】
この際、本実施形態によれば、検知動作を行う際に選択ワード線ＷＬに印加する検知電圧にレイヤ依存性を持たせている。第１実施形態で説明した通り、メモリホールはテーパー形状を有するため、レイヤによってメモリセルトランジスタの特性（プログラムしやすさ）が異なる。
【０１１７】
そこで、本実施形態では、この特性に合わせて検知電圧ＶＬ１を適切に設定している。従って、メモリセル特性を正確に求めることが可能となる。
【０１１８】
なお、検知動作の方法は上記実施形態で説明したものに限らず、種々の変形が可能である。
【０１１９】
図２２は選択ワード線ＷＬの電位変化を示すタイミングチャートであり、第３ループから第４ループまでの様子を示している。図２２では下層のワード線の例を示しているが、中間層や上層のワード線についても同様である。

Micron Ex. 1016, p. 79
Micron v. YMTC
IPR2024-00795

【０１２０】
（ａ）図は、上記実施形態で説明した図１９と同様である。これに対して（ｂ）図のように、検知動作と、第３ループのベリファイ動作の順序を入れ替えても良い。また（ｃ）図に示すように、検知動作とベリファイ動作とを連続して行っても良い。また（ｃ）図において、検知動作とベリファイ動作の順序を逆にしても構わない。
【０１２１】
図２３は、また別の例を示すタイミングチャートであり、（ａ）図は上層のワード線が選択された場合を示し、（ｂ）図は下層のワード線が選択された場合を示す。
【０１２２】
図示するように、検知動作を行う頻度にレイヤ依存性を持たせても良い。より具体的には、上層のワード線に関しては検知動作の頻度を低めに設定し、下層のワード線に関しては検知動作の頻度を高めに設定しても良い。図２３の例であると、（ａ）図に示すように上層のワード線は、４回の書き込み動作につき１回、検知動作が行われる。他方で（ｂ）図に示すように下層のワード線は、２回の書き込み動作につき１回、検知動作が行われる。
【０１２３】
前述のように、下層のメモリセルトランジスタほど書き込み易い。換言すれば、メモリホールの小さいメモリセルトランジスタほど書き込み速度が速い。すると、上層のメモリセルトランジスタが検知動作にパスするには比較的多くの書き込みループ回数が必要であり、下層のメモリセルトランジスタは比較的少ない書き込みループ回数で検知動作にパスすることが分かる。
【０１２４】
従って、上層のメモリセルトランジスタの検知動作の頻度を低めにすることで、無駄な検知動作を省くことが出来、書き込み速度を向上出来る。
【０１２５】
もちろん、図２３において、例えば中間層に位置するワード線に対しては、３回の書き込み動作につき１回、検知動作を行っても良い。これらの回数は任意であり、上層ほど頻度が低くされれば良い。
【０１２６】
また本実施形態では検知電圧ＶＬ１に関して、ワード線を下層、中間層、及び上層の３つの領域Ａ１～Ａ３に分けて説明したが、２つの領域や４つ以上の領域であっても良く、また領域の分割の仕方は、電圧ＶＰＧＭを設定するための図１２とは異なっていても良い。そして、電圧ＶＰＧＭに関する領域数と、検知電圧ＶＬ１に関する領域数が互いに異なっていても良い。
【０１２７】
３．第３実施形態
次に、第３実施形態に係る半導体記憶装置について説明する。本実施形態は、上記第１または第２実施形態において、更に電圧ＶＰＡＳＳにもレイヤ依存性を持たせたものである。以下では、第１、第２実施形態と異なる点についてのみ説明する。
【０１２８】
３．１　電圧ＶＰＡＳＳのレイヤ依存性について
図２４は、ワード線の位置に対するメモリホール径と電圧ＶＰＡＳＳの関係を示すグラフである。
【０１２９】
図示するように、電圧ＶＰＡＳＳの値は下層のワード線ほど小さく、上層のワード線ほど大きく設定される。換言すれば、プログラム電圧ＶＰＧＭの場合と同様に、メモリホールの直径D_{MH}の大きいワード線には大きな電圧ＶＰＡＳＳが印加され、メモリホールの直径D_{MH}の小さいワード線には小さい電圧ＶＰＡＳＳが印加される。
【０１３０】
また、ＮＡＮＤストリング内では、隣接する複数のワード線の組毎にグループ化され、

Micron Ex. 1016, p. 80
Micron v. YMTC
IPR2024-00795

同一グループ内のワード線に印加されるＶＰＡＳＳは同一の値とされる。

【０１３１】

３．２　電圧ＶＰＡＳＳとＶＰＧＭとの関係について

図２５は、図１２の構成において、ビット線側における比較的上層に位置するいずれかのワード線ＷＬＤｋ（ｋは０～ｎのいずれか）が選択された際の、ビット線側のワード線ＷＬＤ０～ＷＬＤｎ及びソース線側のワード線ＷＬＳ０～ＷＬＳｎに印加される電圧を示すグラフである。

【０１３２】

図示するように本例では、隣接する非選択ワード線は２本一組でグループ化されて、同一の電圧ＶＰＡＳＳを印加される。まず、選択ワード線ＷＬＤｋを含むビット線側のワード線ＷＬＤ０～ＷＬＤｎについて説明する。ビット線側では、ワード線ＷＬＤｎ及びＷＬＤ（ｎ－１）に電圧ＶＰＡＳＳＤ４が印加され、そこから下層にいくに従って印加される電圧ＶＰＡＳＳは低くされる（図２５において、ＶＰＡＳＳＤ４＞ＶＰＡＳＳＤ５＞ＶＰＡＳＳＤ６）。

【０１３３】

選択ワード線ＷＬＤｋに上層側で隣接するｍ２本の非選択ワード線と、下層側で隣接するｍ１本の非選択ワード線に関しては、上記とは異なる扱いとされる。

【０１３４】

選択ワード線ＷＬＤｋには、プログラム電圧ＶＰＧＭ１１が印加される。選択ワード線ＷＬＤｋに上層側で隣接するｍ２本のワード線ＷＬ（ｋ＋１）～ＷＬＤ（ｎ－６）には、電圧ＶＰＧＡＭ１１から電圧ＶＰＡＳＳＤ６に向かって徐々に低下する電圧ＶＰＡＳＳＤ（ｋ＋１）～ＶＰＡＳＳＤ（ｋ＋ｍ２）が印加される。すなわち、以下の（１）式の関係が成立する。

VPGM11＞VPASSD(k+1)＞VPASSD(k+2)＞…＞VPASSD(k+m2-1)＞VPASSD(k+m2)

…（１）式

また、選択ワード線ＷＬＤｋに下層側で隣接するｍ１本のワード線ＷＬ（ｋ－１）～ＷＬＤ（ｋ－ｍ１）には、電圧ＶＰＧＡＭ１１から徐々に低下する電圧ＶＰＡＳＳＤ（ｋ－１）～ＶＰＡＳＳＤ（ｋ－ｍ１）が印加される。すなわち、以下の関係が成立する。

【０１３５】

VPGM11＞VPASSD(k-1)＞VPASSD(k-2)＞…＞VPASSD(k-m1+1)＞VPASSD(k-m1)

…（２）式

そして、ワード線ＷＬＤ（ｋ－ｍ１－１）からワード線ＷＬＤ０には、２本毎に順次低下する電圧ＶＰＡＳＳが印加する。例えばワード線ＷＬＤ（ｋ－ｍ１－１）及びＷＬＤ（ｋ－ｍ１－２）には電圧ＶＰＡＳＳＤ１が印加され、ワード線ＷＬＤ（ｋ－ｍ１－３）及びＷＬＤ（ｋ－ｍ１－４）には電圧ＶＰＡＳＳＤ２が印加され、ワード線ＷＬＤ（ｋ－ｍ１－５）及びＷＬＤ（ｋ－ｍ１－６）には電圧ＶＰＡＳＳＤ３が印加される。そして、ＶＰＡＳＳＤ１＞ＶＰＡＳＳＤ２＞ＶＰＡＳＳＤ３の関係が成立する。またＶＰＡＳＳＤ６とＶＰＡＳＳＤ１との間には、ＶＰＡＳＳＤ６≧ＶＰＡＳＳ１なる関係が成立する。

【０１３６】

以上のように電圧ＶＰＡＳＳは、基本的には上層のワード線ほど高い値に設定され、下層のワード線ほど低い値に設定される。そして、電圧ＶＰＡＳＳの値は、例えば２本以上の単位で変化する。但し、選択ワード線に下層側で隣接する複数の非選択ワード線（これを領域Ｍ１と呼ぶ）と、上層側で隣接する複数の非選択ワード線（これを領域Ｍ２と呼ぶ）に関しては異なる扱いがなされる。

【０１３７】

領域Ｍ２では、上記説明した（１）式を満たす電圧ＶＰＡＳＳが印加される。すなわち領域Ｍ２では、上層から下層に向かって徐々に電圧ＶＰＡＳＳの値が上昇される。他方で領域Ｍ１では、上記説明した（２）式を満たす電圧ＶＰＡＳＳが印加される。すなわち領域Ｍ２では、下層から上層に向かって徐々に電圧ＶＰＡＳＳの値が低下される。これにより、隣接するワード線間の電圧差が緩やかにされる。

Micron Ex. 1016, p. 81
Micron v. YMTC
IPR2024-00795

【０１３８】
以上の電圧ＶＰＡＳＳの印加方法をより一般化すれば、次のように説明できる。すなわち、最下層のワード線ＷＬＤ０から領域Ｍ１までの複数のワード線を、下層から順にワード線層数がｃ１である領域Ｃ１、及びワード線層数がｃ２である領域Ｃ２とする。また、最上層のワード線ＷＬＤｎから領域Ｍ２までの複数のワード線を、上層から順にワード線層数がｄ２である領域Ｄ２、及びワード線層数がｄ１である領域Ｄ１とする。すると、ｃ１＋ｃ２＋ｍ１＋１＋ｍ２＋ｄ１＋ｄ２＝ｎが成立する。そして、次のようにして電圧ＶＰＡＳＳが印加される。

【０１３９】
領域Ｃ１とＣ２との境界においては、次の関係が成立する。
VPASSD(k-m1-c2+1)≧VPASSD(k-m1-c2)＞VPASSD(k-m1-c2-1)≧VPASSD(k-m1-c2-2)
但し、VPASSD(k-m1-c2)は、領域Ｃ２における非選択ワード線ＷＬＤ（ｋ－ｍ１－ｃ２）に印加される電圧ＶＰＡＳＳの値であり、VPASSD(k-m1-c2-1)は、領域Ｃ１における非選択ワード線ＷＬＤ（ｋ－ｍ１－ｃ２－１）に印加される電圧ＶＰＡＳＳの値である。

【０１４０】
同様に領域Ｄ２とＤ１との境界においては、次の関係が成立する。
VPASSD(k+m2+d1+2)≧VPASSD(k+m2+d1+1)＞VPASSD(k+m2+d1)≧VPASSD(k+m2+d1-1)
但し、VPASSD(k+m2+d1+1)は、領域Ｄ２における非選択ワード線ＷＬＤ（ｋ＋ｍ２＋ｄ１＋１）に印加される電圧ＶＰＡＳＳの値であり、VPASSD(k+m2+d1)は、領域Ｄ１における非選択ワード線ＷＬＤ（ｋ＋ｍ２＋ｄ１）に印加される電圧ＶＰＡＳＳの値である。

【０１４１】
もちろん、上記説明において、領域Ｍ１より下の領域の分割数及び領域Ｍ２より上層の分割数は２つに限らず、３つ以上の領域にワード線が分割されても良い。

【０１４２】
次に、選択ワード線を含まないソース線側のワード線ＷＬＳ０～ＷＬＳｎについて説明する。ソース線側では、最上層のワード線ＷＬＳｎ及びＷＬＳ（ｎ－１）に電圧ＶＰＡＳＳＳ１１が印加され、そこから下層にいくに従って印加される電圧ＶＰＡＳＳは低くされる（図２５において、ＶＰＡＳＳＳＳ１１＞ＶＰＡＳＳＳＳ１２＞ＶＰＡＳＳＳＳ１３）。

【０１４３】
ソース線側の電圧ＶＰＡＳＳを一般化すれば、次のように説明できる。すなわち、最下層のワード線ＷＬＳ０から順番に、ワード線層数がｅ１である領域Ｅ１、ワード線層数がｅ２である領域Ｅ２、及びワード線層数がｅ３である領域Ｅ３とする。すると、ｅ１＋ｅ２＋ｅ３＝ｎが成立する。そして、次のようにして電圧ＶＰＡＳＳが印加される。

【０１４４】
領域Ｅ１とＥ２との境界においては、次の関係が成立する。
VPASSS(e1+1)≧VPASSS(e1)＞VPASSS(e1-1)≧VPASSS(e1-2)
但し、VPASSS(e1)は、領域Ｅ２における非選択ワード線ＷＬＳ（ｅ１）に印加される電圧ＶＰＡＳＳの値であり、VPASSS(e1-1)は、領域Ｅ１における非選択ワード線ＷＬＳ（ｅ１－１）に印加される電圧ＶＰＡＳＳの値である。

【０１４５】
同様に、領域Ｅ２とＥ３との境界においては、次の関係が成立する。
VPASSS(e1+e2+1)≧VPASSS(e1+e2)＞VPASSS(e1+e2-1)≧VPASSS(e1+e2-2)
但し、VPASSS(e1+e2)は、領域Ｅ３における非選択ワード線ＷＬＳ（ｅ１＋ｅ２）に印加される電圧ＶＰＡＳＳの値であり、VPASSS(e1+e2-1)は、領域Ｅ２における非選択ワード線ＷＬＳ（ｅ１＋ｅ２－１）に印加される電圧ＶＰＡＳＳの値である。

【０１４６】
なお、最上層の非選択ワード線ＷＬＳｎの電圧ＶＰＡＳＳＳｎは、同じ領域Ｅ３に含まれるその他の非選択ワード線ＷＬＳに印加される電圧と異なっていても良い。また、最下層の非選択ワード線ＷＬＳ０の電圧ＶＰＡＳＳＳ０は、同じ領域Ｅ１に含まれるその他の非選択ワード線ＷＬＳに印加される電圧と異なっていてもよい。これは、第１実施形態で

Micron Ex. 1016, p. 82
Micron v. YMTC
IPR2024-00795

説明した図１４と同様の関係である。

【０１４７】

もちろん、上記説明において、ソース線側のワード線が３つの領域に分割される例につき説明したが、２つの領域に分割しても良いし、あるいは４つ以上の領域に分割しても良い。

【０１４８】

なお、上記説明における定数ｍ（本例ではｍ１及びｍ２）、ｃ（本例ではｃ１及びｃ２）、ｄ（本例ではｄ１及びｄ２）、ｅ（本例ではｅ１及びｅ２）は任意であり、選択されるワード線ＷＬの位置（すなわちｋの値）や、ワード線層数ｎによって適宜変更出来る。

【０１４９】

ソース線側のワード線が選択される場合には、上記説明において、ＷＬＤをＷＬＳに読み替え、ＷＬＳをＷＬＤに読み替え、ＶＰＡＳＳＤをＶＰＡＳＳＳに読み替え、ＶＰＡＳＳをＶＰＡＳＳＤに読み替えれば良い。

【０１５０】

図２６及び図２７はそれぞれ、中間層のワード線が選択された場合、及び下層のワード線が選択された場合について示している。この場合も、図２５と同様の関係が成立する。

【０１５１】

３．３　本実施形態に係る効果

第１実施形態で説明したように、メモリホールのサイズによってメモリセルトランジスタのサイズが異なる。これにより、プログラム特性だけでなく読み出し特性も異なる。より具体的には、メモリホールのサイズが小さいほどオンし易く、メモリホールのサイズが大きいほどオンし難い。

【０１５２】

そこで本実施形態によれば、メモリホールのサイズの小さい下層の非選択ワード線ほど電圧ＶＰＡＳＳを小さくし、メモリホールのサイズの大きい上層の非選択ワード線ほど電圧ＶＰＡＳＳを大きくする。

【０１５３】

これにより、非選択ワード線に適切な電圧を印加出来、書き込み動作信頼性を向上出来る。

【０１５４】

また、ＶＰＡＳＳの値をレイヤに応じて単純に変化させるだけでなく、選択ワード線に近接する非選択ワード線では、隣接ワード線間の電位差が徐々に変化するようにＶＰＡＳＳの値が設定される（図２５の領域Ｍ１及びＭ２）。これにより、ワード線間の耐圧に関してもケアすることが出来る。

【０１５５】

なお、電圧ＶＰＡＳＳの値は、プログラム動作を繰り返す間、一定値に維持されても良いし、あるいはＶＰＧＭと同様にステップアップされても良い。

【０１５６】

また、上記ＶＰＡＳＳに関する実施形態は、全く同様にして読み出し電圧ＶＲＥＡＤにも適用出来る。つまり、メモリホールの直径にあわせて電圧ＶＲＥＡＤの大きさを変えることが出来る。

【０１５７】

４．第４実施形態

次に第４実施形態に係る半導体記憶装置について説明する。本実施形態は、上記第１乃至第３実施形態において、メモリホールを複数回のエッチングにより形成するものである。以下では、第１乃至第３実施形態と異なる点についてのみ説明する。

【０１５８】

４．１　ＮＡＮＤストリングの構成について

まず、本実施形態に係るＮＡＮＤストリングの構成について、図２８を用いて説明する。図２８はＮＡＮＤストリングの断面図である。図２８では、３ステップによりメモリホ

Micron Ex. 1016, p. 83
Micron v. YMTC
IPR2024-00795

ールが形成される場合について示している。４ステップ以上で形成される場合も同様である。

【０１５９】

図示するように、ビット線ＢＬまたはソース線ＳＬからバックゲートトランジスタＢＴに達するメモリホールは、それぞれ３つのメモリホールＭＨ１、ＭＨ２及びＭＨ３が下層から順次形成されたものである。

【０１６０】

そしてそれぞれのメモリホールＭＨ１～ＭＨ３がテーパー形状を有している。従って、最下層のメモリホールＭＨ１の上端の直径は、中間層のメモリホールＭＨ２の下端の直径よりも大きく、中間層のメモリホールＭＨ２の上端の直径は、最上層のメモリホールＭＨ３の下端の直径よりも大きく、最上層のメモリホールＭＨ３の直径は、その下端の直径よりも大きい。

【０１６１】

４．２　プログラム電圧ＶＰＧＭについて

図２９は、ワード線の位置に対するメモリホール径とプログラム電圧ＶＰＧＭとの関係を示すグラフである。

【０１６２】

図示するようにＶＰＧＭの値は、各メモリホールＭＨ１～ＭＨ３の直径に合わせて設定される。すなわち、メモリホールＭＨ１の最下層の領域Ａ１に対応するワード線が選択された際にはＶＰＧＭ１－１が印加され、メモリホールＭＨ１の中間層の領域Ａ２に対応するワード線が選択された際にはＶＰＧＭ２－１が印加され、メモリホールＭＨ１の最上層の領域Ａ３に対応するワード線が選択された際にはＶＰＧＭ３－１が印加される。そして、ＶＰＧＭ１－１＜ＶＰＧＭ２－１＜ＶＰＧＭ３－１なる関係が成立する。

【０１６３】

また、メモリホールＭＨ２の最下層の領域Ａ１に対応するワード線が選択された際にはＶＰＧＭ１－２が印加され、メモリホールＭＨ２の中間層の領域Ａ２に対応するワード線が選択された際にはＶＰＧＭ２－２が印加され、メモリホールＭＨ２の最上層の領域Ａ３に対応するワード線が選択された際にはＶＰＧＭ３－２が印加される。そして、ＶＰＧＭ１－２＜ＶＰＧＭ２－２＜ＶＰＧＭ３－２なる関係が成立し、メモリホールＭＨ１とＭＨ２との段差部分においては、ＶＰＧＭ１－２＜ＶＰＧＭ３－１なる関係が成立する。

【０１６４】

更に、メモリホールＭＨ３の最下層の領域Ａ１に対応するワード線が選択された際にはＶＰＧＭ１－３が印加され、メモリホールＭＨ３の中間層の領域Ａ２に対応するワード線が選択された際にはＶＰＧＭ２－３が印加され、メモリホールＭＨ３の最上層の領域Ａ３に対応するワード線が選択された際にはＶＰＧＭ３－３が印加される。そして、ＶＰＧＭ１－３＜ＶＰＧＭ２－３＜ＶＰＧＭ３－３なる関係が成立し、メモリホールＭＨ２とＭＨ３との段差部分においては、ＶＰＧＭ１－３＜ＶＰＧＭ３－２なる関係が成立する。

【０１６５】

なお、ＶＰＧＭ１－１、ＶＰＧＭ１－２、及びＶＰＧＭ１－３は同じ値であっても良いし、異なる値であっても良い。これらの値は、メモリホールＭＨ１～ＭＨ３のサイズに応じて決定される。このことは、ＶＰＧＭ２－１、ＶＰＧＭ２－２、及びＶＰＧＭ２－３についても同様であり、またＶＰＧＭ３－１、ＶＰＧＭ３－２、及びＶＰＧＭ３－３についても同様である。

【０１６６】

４．３　電圧ＶＰＡＳＳについて

図３０は、ワード線の位置に対するメモリホール径と電圧ＶＰＡＳＳとの関係を示すグラフである。

【０１６７】

図示するようにＶＰＡＳＳの値は、ＶＰＧＭと同様に各メモリホールＭＨ１～ＭＨ３の直径に合わせて設定される。図３０の例では、各メモリホールＭＨ１～ＭＨ３に対応する

Micron Ex. 1016, p. 84
Micron v. YMTC
IPR2024-00795

ワード線ＷＬは、複数のワード線毎に５つの領域に分けられている。もちろん、この領域数は４つ以下であっても良いし、６つ以上であっても良い。

【０１６８】

そして、メモリホールＭＨ３に対応する領域では、上層から順番に電圧ＶＰＡＳＳとして、ＶＰＡ１、ＶＰＡ２、ＶＰＡ３、ＶＰＡ４、及びＶＰＡ５が与えられる。ここでは、ＶＰＡ１＞ＶＰＡ２＞ＶＰＡ３＞ＶＰＡ４＞ＶＰＡ５なる関係が成立する。

【０１６９】

またメモリホールＭＨ２に対応する領域では、上層から順番に電圧ＶＰＡＳＳとして、ＶＰＡ６、ＶＰＡ７、ＶＰＡ８、ＶＰＡ９、及びＶＰＡ１０が与えられる。ここでは、ＶＰＡ６＞ＶＰＡ７＞ＶＰＡ８＞ＶＰＡ９＞ＶＰＡ１０なる関係が成立する。

【０１７０】

更にメモリホールＭＨ３に対応する領域では、上層から順番に電圧ＶＰＡＳＳとして、ＶＰＡ１１、ＶＰＡ１２、ＶＰＡ１３、ＶＰＡ１４、及びＶＰＡ１５が与えられる。ここでは、ＶＰＡ１１＞ＶＰＡ１２＞ＶＰＡ１３＞ＶＰＡ１４＞ＶＰＡ１５なる関係が成立する。

【０１７１】

なお、ＶＰＡ１、ＶＰＡ６、及びＶＰＡ１１は同じ値であっても良いし、異なる値であっても良い。これらの値は、メモリホールＭＨ１～ＭＨ３のサイズに応じて決定される。このことは、ＶＰＡ２、ＶＰＡ７、及びＶＰＡ１２についても同様であり、ＶＰＡ３、ＶＰＡ８、及びＶＰＡ１３についても同様であり、ＶＰＡ４、ＶＰＡ９、及びＶＰＡ１４についても同様であり、ＶＰＡ５、ＶＰＡ１０、及びＶＰＡ１５についても同様である。

【０１７２】

４．４　本実施形態に係る効果

三次元積層型ＮＡＮＤ型フラッシュメモリでは、ワード線ＷＬの積層数を増やすほど集積度を向上出来る。しかし、積層数を増やすほどメモリホールは深くなり、その結果、メモリホールの上端と下端との直径の差が大きくなる。換言すれば、下層のメモリセルトランジスタと上層のメモリセルトランジスタとの特性の違いが大きくなる。

【０１７３】

従って、メモリホールを一括加工によって作成するのではなく、複数回に分けて形成することが好ましい。この場合、メモリホールの直径は、上層から下層に向かって単調に小さくなるのでは無く、図２８に示すように段差を有する複雑な形状となる。

【０１７４】

このような場合であっても、メモリホールの直径にあわせて適切にＶＰＧＭ及びＶＰＡＳＳの値を設定することで、ＮＡＮＤ型フラッシュメモリの動作信頼性を向上出来る。説明は省略したが、検知電圧ＶＬ１についても同様である。

【０１７５】

なお、図２８のような構成の場合、メモリホールの境界部分では、非選択ワード線間の電位差が小さくなるようにＶＰＡＳＳの値を設定しても良い。このような例を図３１に示す。

【０１７６】

図示するように、メモリホールＭＨ３の最下層の領域のワード線に印加される電圧ＶＰＡＳＳの値ＶＰＡ５は、ＶＰＡ４＜ＶＰＡ５＜ＶＰＡ６の関係を満たすように設定される。またメモリホールＭＨ２の最下層の領域のワード線に印加される電圧ＶＰＡＳＳの値ＶＰＡ１０は、ＶＰＡ９＜ＶＰＡ１０＜ＶＰＡ１１の関係を満たすように設定される。

【０１７７】

あるいは、図３０において、ＶＰＡ６の値を、ＶＰＡ５＜ＶＰＡ６＜ＶＰＡ７の関係を満たすように設定し、ＶＰＡ１１の値を、ＶＰＡ１０＜ＶＰＡ１１＜ＶＰＡ１２の関係を満たすように設定しても良い。

【０１７８】

更に、メモリホールの段差部分にダミーワード線を設けても良い。このような例を図３

Micron Ex. 1016, p. 85
Micron v. YMTC
IPR2024-00795

２に示す。図３２はＮＡＮＤストリングの断面図である。

【０１７９】

図示するように、メモリホールＭＨ３の最下層にはダミーワード線ＷＬＤＤＭ１及びＷＬＳＤＭ１が設けられ、メモリホールＭＨ２の最下層にはダミーワード線ＷＬＤＤＭ２及びＷＬＳＤＭ２が設けられる。

【０１８０】

５．第５実施形態

次に、第５実施形態に係る半導体記憶装置について説明する。本実施形態は、上記第１乃至第４実施形態を、別のＮＡＮＤストリング形状を有するＮＡＮＤ型フラッシュメモリに適用したものである。以下では、第１乃至第４実施形態と異なる点についてのみ説明する。

【０１８１】

５．１　第１の例

図３３は、第１の例に係るＮＡＮＤストリングの断面図である。図示するように、本例では、半導体基板上方にまずソース線ＳＬが形成される。そしてソース線ＳＬの上方にセレクトゲート線ＳＧＳが形成され、セレクトゲート線ＳＧＳの上方にダミーワード線ＷＬＤＳ０及びＷＬＤＳ１が順次形成され、ダミーワード線ＷＬＤＳ１の上方にワード線ＷＬ０～ＷＬｎが順次形成され、ワード線ＷＬｎの上方にダミーワード線ＷＬＤＤ１及びＷＬＤＤ２が順次形成され、ダミーワード線ＷＬＤＤ２の上方にセレクトゲート線ＳＧＤが形成される。そして、これらを１つのメモリホールＭＨが貫通し、メモリホールＭＨ内に半導体層ＡＡが形成される。そして半導体層ＡＡ上にビット線ＢＬが形成される。

【０１８２】

本構成においても、プログラム電圧ＶＰＧＭを図１３及び図１４で説明したように設定することが出来る。また、検知電圧ＶＬ１を図２１で説明したように設定出来る。更に、電圧ＶＰＡＳＳを図２４乃至図２７で説明したように設定出来る。なお電圧ＶＰＡＳＳに関しては、図２４乃至図２７において、ビット線ＢＬ側で説明したようにして印加出来る。

【０１８３】

５．２　第２の例

図３４は、第２の例に係るＮＡＮＤストリングの断面図である。図示するように本例は、第１の例で説明した図３３において、メモリホールを複数回の加工（本例では３回）により形成したものである。

【０１８４】

本構成においても、プログラム電圧ＶＰＧＭを図２９で説明したように設定することが出来、電圧ＶＰＡＳＳを図３０及び図３１で説明したように設定出来る。検知電圧ＶＬ１についても同様である。

【０１８５】

５．３　第３の例

図３５は、第３の例に係るＮＡＮＤストリングの断面図である。図示するように、本例ではｐ型ウェル領域上にＮＡＮＤストリングが形成される。ｐ型ウェル領域内には、n^+型不純物拡散層及びp^+型不純物拡散層が形成される。そして、n^+型不純物拡散層上にはコンタクトプラグＣＰ１が形成され、コンタクトプラグＣＰ１上にソース線ＳＬが形成される。また、p^+型不純物拡散層上にはコンタクトプラグＣＰ２が形成され、コンタクトプラグＣＰ２上にウェル配線ＣＰＷＥＬＬが形成される。セレクトゲート線ＳＧＳは、n^+型不純物拡散層の近傍まで形成される。そして読み出し時には、セレクトゲート線ＳＧＳによって選択トランジスタＳＴ２に形成されたチャネルにより、メモリセルトランジスタＭＴに形成されたチャネルがn^+型不純物拡散層まで電気的に接続される。そして本構成によれば、ウェル配線ＣＰＷＥＬＬにより、データの消去時に半導体層ＡＡに対して消去電圧を印加することが出来る。

【０１８６】

Micron Ex. 1016, p. 86
Micron v. YMTC
IPR2024-00795

本構成においても、プログラム電圧ＶＰＧＭを図１３及び図１４で説明したように設定することが出来る。また、検知電圧ＶＬ１を図２１で説明したように設定出来る。更に、電圧ＶＰＡＳＳを図２４乃至図２７で説明したように設定出来る。なお電圧ＶＰＡＳＳに関しては、図２４乃至図２７において、ビット線ＢＬ側で説明したようにして印加出来る。

【０１８７】

５．４　第４の例

図３６は、第４の例に係るＮＡＮＤストリングの断面図である。本例は、上記第３の例で説明した図３３５おいて、メモリホールを複数回の加工（本例では３回）により形成したものである。

【０１８８】

本構成においても、プログラム電圧ＶＰＧＭを図２９で説明したように設定することが出来、電圧ＶＰＡＳＳを図３０及び図３１で説明したように設定出来る。検知電圧ＶＬ１についても同様である。

【０１８９】

５．５　本実施形態に係る効果

以上のように、第１乃至第４実施形態で説明した方法は、メモリセルトランジスタＭＴのチャネルとなる半導体層がＵ字型では無く、１本の柱状の形状を有する構成にも適用可能である。

【０１９０】

６．第６実施形態

次に、第６実施形態に係る半導体記憶装置について説明する。本実施形態は、第１乃至第４実施形態を、更に異なるメモリセルアレイに適用したものである。以下では、第１乃至第４実施形態と異なる点についてのみ説明する。

【０１９１】

６．１　第１の例

６．１．１　メモリセルアレイの構成について

図３７は本実施形態に係るメモリセルアレイ１１１の回路図であり、いずれか１つのブロックＢＬＫの構成を示している。図示するように、ブロックＢＬＫは複数のメモリユニットＭＵ（ＭＵ１、ＭＵ２）を備えている。図３７では２つのメモリユニットＭＵのみが図示されているが、３つ以上であっても良く、その数は限定されるものではない。

【０１９２】

メモリユニットＭＵの各々は、例えば４つのストリンググループＧＲ（ＧＲ１～ＧＲ４）を備えている。なお、メモリユニットＭＵ１及びＭＵ２間で区別する際には、メモリユニットＭＵ１のストリンググループＧＲをそれぞれＧＲ１－１～ＧＲ４－１と呼び、メモリユニットＭＵ２のストリンググループＧＲをそれぞれＧＲ１－２～ＧＲ４－２と呼ぶ。

【０１９３】

ストリンググループＧＲの各々は、例えば３つのＮＡＮＤストリングＳＲ（ＳＲ１～ＳＲ３）を備えている。もちろん、ＮＡＮＤストリングＳＲの数は３つに限らず、４つ以上であっても良い。ＮＡＮＤストリングＳＲの各々は、選択トランジスタＳＴ１及びＳＴ２、並びに４つのメモリセルトランジスタＭＴ（ＭＴ１～ＭＴ４）を備えている。メモリセルトランジスタＭＴの数は４つに限らず、５つ以上であっても良いし、３つ以下であっても良い。

【０１９４】

ストリンググループＧＲ内において、３つのＮＡＮＤストリングＳＲ１～ＳＲ３は、半導体基板上に順次積層されており、ＮＡＮＤストリングＳＲ１が最下層に形成され、ＮＡＮＤストリングＳＲ３が最上層に形成される。すなわち、第１実施形態で説明した図４ではＮＡＮＤストリング内のメモリセルトランジスタＭＴが半導体基板面の垂直方向に積層されていたのに対して、本実施形態ではＮＡＮＤストリング内のメモリセルトランジスタＭＴが半導体基板面と平行方向に配列され、このＮＡＮＤストリングが垂直方向に積層さ

Micron Ex. 1016, p. 87
Micron v. YMTC
IPR2024-00795

れている。そして、同一のストリンググループＧＲに含まれる選択トランジスタＳＴ１及びＳＴ２は、それぞれ同一のセレクトゲート線ＧＳＬ１及びＧＳＬ２に接続され、同一列に位置するメモリセルトランジスタＭＴの制御ゲートは同一のワード線ＷＬに接続される。更に、あるストリンググループＧＲ内の３つの選択トランジスタＳＴ１のドレインは、互いに異なるビット線ＢＬに接続され、選択トランジスタＳＴ２のソースは同一のソース線ＳＬに接続される。

【０１９５】

奇数番目のストリンググループＧＲ１及びＧＲ３と、偶数番目のストリンググループＧＲ２及びＧＲ４とでは、選択トランジスタＳＴ１及びＳＴ２は、その位置関係が逆になるように配置される。すなわち図３７の例であると、ストリンググループＧＲ１及びＧＲ３の選択トランジスタＳＴ１はＮＡＮＤストリングＳＲの左端に配置され、選択トランジスタＳＴ２はＮＡＮＤストリングＳＲの右端に配置される。これに対して、ストリンググループＧＲ２及びＧＲ４の選択トランジスタＳＴ１はＮＡＮＤストリングＳＲの右端に配置され、選択トランジスタＳＴ２はＮＡＮＤストリングＳＲの左端に配置される。

【０１９６】

そして、ストリンググループＧＲ１及びＧＲ３の選択トランジスタＳＴ１のゲートは、同一のセレクトゲート線ＧＳＬ１に接続され、選択トランジスタＳＴ２のゲートは、同一のセレクトゲート線ＧＳＬ２に接続される。他方、ストリンググループＧＲ２及びＧＲ４の選択トランジスタＳＴ１のゲートは、同一のセレクトゲート線ＧＳＬ２に接続され、選択トランジスタＳＴ２のゲートは、同一のセレクトゲート線ＧＳＬ１に接続される。

【０１９７】

また、あるメモリユニットＭＵに含まれる４つのストリンググループＧＲ１～ＧＲ４は互いに同一のビット線ＢＬに接続され、異なるメモリユニットＭＵは互いに異なるビット線ＢＬに接続される。より具体的には、メモリユニットＭＵ１において、ストリンググループＧＲ１～ＧＲ４におけるＮＡＮＤストリングＳＲ１～ＳＲ３の選択トランジスタＳＴ１のドレインはそれぞれ、カラム選択ゲートＣＳＧ（ＣＳＧ１～ＣＳＧ４）を介してビット線ＢＬ１～ＢＬ３に接続される。カラム選択ゲートＣＳＧは、例えばメモリセルトランジスタＭＴや選択トランジスタＳＴ１及びＳＴ２等と同様の構成を有しており、各メモリユニットＭＵにおいて、ビット線ＢＬに選択する１つのストリンググループＧＲを選択する。従って、各ストリンググループＧＲに対応付けられたカラム選択ゲートＣＳＧ１～ＣＳＧ４のゲートは、それぞれ異なる制御信号線ＳＳＬ１～ＳＳＬ４によって制御される。

【０１９８】

以上説明した構成を有するメモリユニットＭＵが、図３７を記載した紙面において上下方向に複数配列される。これらの複数のメモリユニットＭＵは、メモリユニットＭＵ１とワード線ＷＬ及びセレクトゲート線ＧＳＬ１及びＧＳＬ２を共有する。他方で、ビット線ＢＬは独立しており、例えばメモリユニットＭＵ２に対しては、メモリユニットＭＵ１と異なる３本のビット線ＢＬ４～ＢＬ６が対応付けられる。各メモリユニットＭＵに対応付けられるビット線ＢＬの本数は、１つのストリンググループＧＲに含まれるＮＡＮＤストリングＳＲの総数に対応する。従って、ＮＡＮＤストリングが４層あればビット線ＢＬも４本設けられ、その他の数の場合も同様である。また、制御信号ＳＳＬ１～ＳＳＬ４は、メモリユニットＭＵ間で共通にされていても良いし、あるいは独立して制御されても良い。

【０１９９】

上記構成において、各メモリユニットＭＵから１つずつ選択されたストリンググループＧＲにおける同一ワード線ＷＬに接続された複数のメモリセルトランジスタＭＴの集合が、「ページ」となる。

【０２００】

図３８及び図３９はブロックＢＬＫの斜視図及び平面図であり、図４０は図３９における４０－４０線に沿った断面図であり、図４１は図３９における４１－４１線に沿った断面図であり、図４２は図３９における４２－４２線に沿った断面図である。図３７、図４

Micron Ex. 1016, p. 88
Micron v. YMTC
IPR2024-00795

０、及び図４２では１つのメモリユニットＭＵを図示しており、図３９及び図４１は２つのメモリユニットＭＵ１及びＭＵ２を図示している。

【０２０１】

図示するように、半導体基板２０上には絶縁膜２１が形成され、絶縁膜２１上にブロックＢＬＫが形成される。

【０２０２】

絶縁膜２１上には、半導体基板２０表面に対する垂直方向である第１方向に直交する第２方向に沿ったストライプ形状の、例えば４つのフィン型構造２４（２４－１～２４－４）が形成されることで、１つのメモリユニットＭＵが形成されている。フィン型構造２４の各々は、第２方向に沿って設けられた絶縁膜２２（２２－１～２２－４）と半導体層２３（２３－１～２３－３）とを含む。そしてフィン型構造２４の各々では、絶縁膜２２－１～２２－４と半導体層２３－１～２３－３とが交互に積層されることで、半導体基板２０の表面に対して垂直方向に延びる４本の積層構造が形成されている。このフィン型構造２４の各々が、図３７で説明したストリンググループＧＲに相当する。そして、最下層の半導体層２３－１がＮＡＮＤストリングＳＲ１の電流経路（チャネルが形成される領域）に相当し、最上層の半導体層２３－３がＮＡＮＤストリングＳＲ３の電流経路に相当し、その間に位置する半導体層２３－２がＮＡＮＤストリングＳＲ２の電流経路に相当する。

【０２０３】

フィン型構造２４の上面及び側面には、ゲート絶縁膜２５、電荷蓄積層２６、ブロック絶縁膜２７、及び制御ゲート２８が順次形成されている（図４０参照）。電荷蓄積層２６は例えば絶縁膜により形成される。また制御ゲート２８は導電膜で形成され、ワード線ＷＬまたはセレクトゲート線ＧＳＬ１及びＧＳＬ２として機能する。ワード線ＷＬ及びセレクトゲート線ＧＳＬ１及びＧＳＬ２は、複数のメモリユニットＭＵ間で、複数のフィン型構造２４を跨ぐようにして形成される。他方で制御信号線ＳＳＬ１～ＳＳＬ４は、個々のフィン型構造２４毎に独立している。

【０２０４】

フィン型構造２４は、その一端部がブロックＢＬＫの端部に引き出され、引き出された領域においてビット線ＢＬと接続される。すなわち、一例としてメモリユニットＭＵ１に着目すると、奇数番目のフィン型構造２４－１及び２４－３の一端部は、第２方向に沿ってある領域まで引き出されて共通に接続され、この領域にコンタクトプラグＢＣ１～ＢＣ３が形成される。この領域に形成されたコンタクトプラグＢＣ１は、ストリンググループＧＲ１及びＧＲ３の半導体層２３－１とビット線ＢＬ１とを接続し、半導体層２３－２及び２３－３とは絶縁されている。コンタクトプラグＢＣ２は、ストリンググループＧＲ１及びＧＲ３の半導体層２３－２とビット線ＢＬ２とを接続し、半導体層２３－１及び２３－３とは絶縁されている。コンタクトプラグＢＣ３は、ストリンググループＧＲ１及びＧＲ３の半導体層２３－３とビット線ＢＬ３とを接続し、半導体層２３－１及び２３－２とは絶縁されている。

【０２０５】

他方で、偶数番目のフィン型構造２４－２及び２４－４の一端部は、フィン型構造２４－１及び２４－３の一端部と第２方向で対向する領域まで引き出されて共通に接続され、この領域にコンタクトプラグＢＣ１～ＢＣ３が形成される。この領域に形成されたコンタクトプラグＢＣ１は、ストリンググループＧＲ２及びＧＲ４の半導体層２３－１とビット線ＢＬ１とを接続し、半導体層２３－２及び２３－３とは絶縁されている。コンタクトプラグＢＣ２は、ストリンググループＧＲ２及びＧＲ４の半導体層２３－２とビット線ＢＬ２とを接続し、半導体層２３－１及び２３－３とは絶縁されている。コンタクトプラグＢＣ３は、ストリンググループＧＲ２及びＧＲ４の半導体層２３－３とビット線ＢＬ３とを接続し、半導体層２３－１及び２３－２とは絶縁されている。

【０２０６】

もちろん、上記の説明はメモリユニットＭＵ１の場合のものであり、例えばメモリユニットＭＵ２の場合には、コンタクトプラグＢＣ４～ＢＣ６が形成され、これらが半導体層

Micron Ex. 1016, p. 89
Micron v. YMTC
IPR2024-00795

２３－１～２３－３をそれぞれビット線ＢＬ４～ＢＬ６に接続する（図４１参照）。

【０２０７】

また、フィン型構造２４の他端上にはコンタクトプラグＳＣが形成される。コンタクトプラグＳＣは、半導体層２３－１～２３－３をソース線ＳＬに接続する。

【０２０８】

上記構成において、ＮＡＮＤストリングＳＲ１～ＳＲ３に含まれるメモリセルトランジスタは、そのサイズが互いに異なる。より具体的には、図４０に示すように各フィン型構造２４において、半導体層２３の第３方向に沿った幅は、低いレイヤに位置するもの程大きく、高いレイヤに位置するもの程小さい。すなわち、半導体層２３－１の幅が最も広く、半導体層２３－３の幅が最も狭く、半導体層２３－２の幅はその中間である。つまり、互いに特性の異なる複数のメモリセルトランジスタＭＴが１ページに含まれる。

【０２０９】

６．１．２　読み出し動作について

次に、本実施形態に係る読み出し動作について図４３を用いて説明する。図４３は、データの読み出し動作時における各配線の電圧変化を示すタイミングチャートであり、一例としてストリンググループＧＲ１－１からデータを読み出す場合について示している。

【０２１０】

まず、信号ＳＳＬ１が“Ｈ”レベルとされて、ストリンググループＧＲ１－１がセンスアンプ１１３に接続される。そして図４３に示すように、まずセレクトゲート線ＧＳＬ１に電圧ＶＳＧが印加され、選択トランジスタＳＴ１がオン状態とされる。また、例えばシーケンサ１２１がレギュレータ１４０を制御することにより、ソース線制御回路１１４が適切な電圧をソース線ＳＬ１に印加する（図４３の例では電源電圧Ｖddが印加されているが、０～Ｖddの間の値を適宜設定出来、例えば１Ｖ程度である。

【０２１１】

引き続き、信号ＢＬＰ及びＢＬＳが“Ｈ”レベルとされて、センスアンプ１１３におけるトランジスタ１３２及び１３４がオン状態とされる。そしてシーケンサ１２１がレギュレータ１３１を制御して、信号ＢＬＣが生成される。この際、シーケンサ１２１は、対応するビット線ＢＬが接続されるＮＡＮＤストリングＳＲに応じて信号ＢＬＣの電圧値を制御する。より具体的には、最下層のＮＡＮＤストリングＳＲ１に対応する場合には、信号ＢＬＣの電圧値をＶＢＬＣ１に設定し、中間層のＮＡＮＤストリングＳＲ２に対応する場合にはＶＢＬＣ２に設定し、最上層のＮＡＮＤストリングＳＲ３に対応する場合にはＶＢＬＣ３に設定する。そしてこれらの間には、ＶＢＬＣ１＜ＶＢＬＣ２＜ＶＢＬＣ３なる関係がある。

【０２１２】

その結果、ビット線ＢＬ１～ＢＬ３のプリチャージ電位は、それぞれＶＰＲＥ１、ＶＰＲＥ２、ＶＰＲＥ３となり、これらの間にはＶＰＲＥ１＜ＶＰＲＥ２＜ＶＰＲＥ３なる関係がある。

【０２１３】

その後、非選択ワード線に電圧ＶＲＥＡＤが印加され、選択ワード線に電圧ＶＣＧＲＶ（読み出しレベルに応じた電圧）が印加され、セレクトゲート線ＧＳＬ２に電圧ＶＳＧが印加される。

【０２１４】

この結果、選択ワード線に接続されたメモリセルトランジスタがオン状態となれば、ビット線の電位は低下し、オフすればプリチャージレベルをほぼ維持する。そしてこの電位をセンスアンプユニット１３０がセンス・増幅する。

【０２１５】

なお、本実施形態では、ビット線ＢＬ１～ＢＬ３のプリチャージ電位は、それぞれＶＰＲＥ１、ＶＰＲＥ２、ＶＰＲＥ３となり、ビット線単位でプリチャージ電位を変更しているが、かかる場合に限定されることなく例えば複数本のビット線ごとにプリチャージ電位を変更してもよい。３本のビット線ＢＬ１～ＢＬ３のプリチャージ電位はＶＰＲＥ１、３

Micron Ex. 1016, p. 90
Micron v. YMTC
IPR2024-00795

本のビット線ＢＬ４～ＢＬ６のプリチャージ電位はＶＰＲＥ２、３本のビット線ＢＬ７～ＢＬ９のプリチャージ電位はＶＰＲＥ３としてもよい。

【０２１６】

６．１．３　書き込み動作について

次に、本例に係る書き込み動作について、図４４を参照して説明する。図４４は、本例に係る書き込み動作のタイミングチャートであり、第１実施形態で説明した図１０とほぼ対応する。書き込み動作の流れは、ほぼ図７と同様であるが、第１実施形態と異なる点は、読み出し動作と同様に、レイヤ依存性が与えられるのはワード線電圧ではなくビット線電圧という点である。また、図４４では図７の説明と異なりプログラム動作よりも先にベリファイ動作が実行されているが、この順序は問わない。さらに図４４では、クイックパスライト（Quick pass write）方式を用いた例を挙げて説明している。クイックパスライト方式に関しては、例えば“NONVOLATILE SEMICONDUCTOR MEMORY DEVICE”なる名称の２００９年６月２５日に出願された米国特許出願１２／４９１，６３８号に記載されている。この特許出願は、その全体が本願明細書において参照により援用される。

【０２１７】

図示するように本例では、上記６．１．２の項で説明した読み出し動作と同様に、プログラムベリファイ時におけるビット線電圧にレイヤ依存性を与える。すなわち、シーケンサ１２１の制御によってレギュレータ１３１がレイヤに応じた信号ＢＬＣを生成する。

【０２１８】

その結果、プログラムベリファイ時におけるビット線電圧は、下層のＮＡＮＤストリングＳＲ１ほど低く、上層のＮＡＮＤストリングＳＲ３ほど高く設定される。

【０２１９】

６．２　第２の例

次に、第２の例に係るメモリセルアレイについて説明する。本例は第１の例と異なり、ＮＡＮＤストリングＳＲ１～ＳＲ３をソース線ＳＬによって選択するものである。

【０２２０】

図４５は本実施形態に係るブロックＢＬＫの斜視図であり、いずれか１つのメモリユニットＭＵを示している。図４６はメモリユニットＭＵの平面図であり、図４７は図４６における４７－４７線に沿った断面図であり、図４８は図４６における４８－４８線に沿った断面図である。

【０２２１】

図示するように本例に係る構成は、上記第１の例で説明した構成において、複数のフィン型構造２４の一端部がブロックＢＬＫの端部に引き出され、引き出された領域においてビット線ＢＬと接続され、他端部がレイヤ毎に共通に接続されて、且つソース線ＳＬに接続されたものである。そしてビット線ＢＬは、対応するフィン型構造２４における各半導体層２３－１～２３－３に共通に接続される（図４８参照）。他方でソース線ＳＬは、共通に接続されたフィン型構造２４における各半導体層２３－１～２３～３の各々に対して独立に設けられる（図４７参照）。また本例では、第１の例における制御信号線ＳＳＬが廃されている。

【０２２２】

６．２　読み出し動作及び書き込み動作について

本例に係る読み出し動作及び書き込み動作は、図４３及び図４４で説明した第１の例と基本的には同じである。但し、本例であると、ビット線ＢＬは、１つのストリンググループＧＲに含まれる複数のＮＡＮＤストリングＳＲで共通に接続されている。従って、ソース線ＳＬの電位を制御することにより、各ストリンググループＧＲからいずれか１つのＮＡＮＤストリングＳＲが選択される。

【０２２３】

例えば、最下層のＮＡＮＤストリングＳＲ１が選択される際には、対応するソース線ＳＬ１が選択されて、選択ソース線ＳＬ１には適切な選択ソース線電圧が印加される。その他の非選択ソース線ＳＬ２及びＳＬ３には、非選択ソース線電圧が印加される。

Micron Ex. 1016, p. 91
Micron v. YMTC
IPR2024-00795

【０２２４】
ビット線電圧は、選択されたビット線の対応するレイヤに応じて、第１の例と同様に設定される。
【０２２５】
６．３　本実施形態に係る効果
以上のように、本実施形態に係る構成のメモリセルアレイを有する場合であっても、第１乃至第４実施形態が適用出来る。
【０２２６】
７．変形例等
上記のように、実施形態に係る半導体記憶装置は、半導体基板の上方に積層された第１及び第２メモリセルと、第１及び第２メモリセルの上方に積層された第３及び第４メモリセルと、第１乃至第４メモリセルのゲートにそれぞれ電気的に接続された第１乃至第４ワード線と、第１乃至第４ワード線に電圧を印加するロウデコーダとを具備する。ロウデコーダは、第１メモリセルへの書き込み動作時に、第１ワード線に第１プログラム電圧を印加し、第２メモリセルへの書き込み動作時に、第２ワード線に前記第１プログラム電圧を印加する。またロウデコーダは、第３メモリセルへの書き込み動作時に、第３ワード線に第２プログラム電圧を印加し、第４メモリセルへの書き込み動作時に、第４ワード線に第２プログラム電圧を印加する。そして、第２プログラム電圧は第１プログラム電圧より電圧が高い。
【０２２７】
上記構成によれば、メモリセルが三次元に積層された半導体記憶装置において、レイヤに応じて特性の異なるメモリセルに対して、適切なプログラム電圧を印加出来る。従って、半導体記憶装置の動作性能を向上出来る。
【０２２８】
しかし、実施形態は上記説明した第１乃至第７実施形態に限定されず、種々の変形が可能である。
【０２２９】
例えば、セレクトゲート線ＳＧＤ、ＳＧＳがそれぞれ複数のレイヤの配線層によって形成される際には（図１２等の例では、それぞれ４層の配線層によって形成されている）、これらに印加される電圧もＶＰＧＭやＶＰＡＳＳと同様に上層ほど高い電圧としても良い。
【０２３０】
なお、セレクトゲート線ＳＧＳ、ＳＧＤに印加される電圧については、例えば、“NONVOLATILE SEMICONDUCTOR DEVICE”という２０１０年７月２９日に出願された米国特許出願番号１２／８４６，２３４号に記載されている。この特許出願は、その全体が本願明細書において参照により援用される。
【０２３１】
また、上記実施形態はＮＡＮＤ型フラッシュメモリに限らず、レイヤに応じてセル特性の異なる記憶装置全般に適用出来、また記憶装置に限定されるものでもない。更に、各実施形態はそれぞれが単独で実施されても良いが、組み合わせ可能な複数の実施形態が組み合わされて実施されても良い。
【０２３２】
なお、本発明に関する各実施形態において、
（１）読み出し動作では、各メモリセルトランジスタMTが２ビットデータを保持可能であり、閾値の低い順番から“Ｅ”レベル（消去レベル）、“Ａ”レベル、“Ｂ”レベル、及び“Ｃ”レベルと定義した場合、
Ａレベルの読み出し動作に選択されたワード線に印加される電圧は、例えば0V～0.55Vの間である。これに限定されることなく、0.1V～0.24V，0.21V～0.31V，0.31V～0.4V，0.4V～0.5V，0.5V～0.55Vいずれかの間にしてもよい。
Ｂレベルの読み出し動作に選択されたワード線に印加される電圧は、例えば1.5V～2.3V

Micron Ex. 1016, p. 92
Micron v. YMTC
IPR2024-00795

の間である。これに限定されることなく、1.65V～1.8V，1.8V～1.95V，1.95V～2.1V，2.1V～2.3Vいずれかの間にしてもよい。

Ｃレベルの読み出し動作に選択されたワード線に印加される電圧は、例えば3.0V～4.0Vの間である。これに限定されることなく、3.0V～3.2V，3.2V～3.4V，3.4V～3.5V，3.5V～3.6V，3.6V～4.0Vいずれかの間にしてもよい。

読み出し動作の時間（tR）としては、例えば25μs～38μs，38μs～70μs，70μs～80μsの間にしてもよい。

【０２３３】

（２）書き込み動作は、上述したとおりプログラム動作とベリファイ動作を含む。書き込み動作では、

プログラム動作時に選択されたワード線に最初に印加される電圧は、例えば13.7V～14.3Vの間である。これに限定されることなく、例えば13.7V～14.0V，14.0V～14.6Vいずれかの間としてもよい。

奇数番目のワード線を書き込む際の、選択されたワード線に最初に印加される電圧と、偶数番目のワード線を書き込む際の、選択されたワード線に最初に印加される電圧を変えてもよい。

【０２３４】

プログラム動作をISPP方式（Incremental Step Pulse Program）としたとき、ステップアップの電圧として、例えば0.5V程度が挙げられる。

非選択のワード線に印加される電圧としては、例えば6.0V～7.3Vの間としてもよい。この場合に限定されることなく、例えば7.3V～8.4Vの間としてもよく、6.0V以下としてもよい。

非選択のワード線が奇数番目のワード線であるか、偶数番目のワード線であるかで、印加するパス電圧を変えてもよい。

書き込み動作の時間（tProg）としては、例えば1700μs～1800μs，1800μs～1900μs，1900μs～2000μsの間にしてもよい。

【０２３５】

（３）消去動作では、

半導体基板上部に形成され、かつ、上記メモリセルが上方に配置されたウェルに最初に印加する電圧は、例えば12V～13.6Vの間である。この場合に限定されることなく、例えば13.6V～14.8V，14.8V～19.0V，19.0～19.8V，19.8V～21Vの間であってもよい。

消去動作の時間（tErase）としては、例えば3000μs～4000μs，4000μs～5000μs，4000μs～9000μsの間にしてもよい。

【０２３６】

（４）メモリセルの構造は、

半導体基板（シリコン基板）上に膜厚が４～１０ｎｍのトンネル絶縁膜を介して配置された電荷蓄積層を有している。この電荷蓄積層は膜厚が２～３ｎｍのＳｉＮ、またはＳｉＯＮなどの絶縁膜と膜厚が３～８ｎｍのポリシリコンとの積層構造にすることができる。また、ポリシリコンにはＲｕなどの金属が添加されていても良い。電荷蓄積層の上には絶縁膜を有している。この絶縁膜は、例えば、膜厚が３～１０ｎｍの下層Ｈｉｇｈ－ｋ膜と膜厚が３～１０ｎｍの上層Ｈｉｇｈ－ｋ膜に挟まれた膜厚が４～１０ｎｍのシリコン酸化膜を有している。Ｈｉｇｈ－ｋ膜はＨｆＯなどが挙げられる。また、シリコン酸化膜の膜厚はＨｉｇｈ－ｋ膜の膜厚よりも厚くすることができる。絶縁膜上には膜厚が３～１０ｎｍの仕事関数調整用の材料を介して膜厚が３０ｎｍ～７０ｎｍの制御電極が形成されている。ここで仕事関数調整用の材料はＴａＯなどの金属酸化膜、ＴａＮなどの金属窒化膜である。制御電極にはＷなどを用いることができる。

また、メモリセル間にはエアギャップを形成することができる。

【０２３７】

本発明のいくつかの実施形態を説明したが、これらの実施形態は、例として提示したものであり、発明の範囲を限定することは意図していない。これら実施形態は、その他の様

Micron Ex. 1016, p. 93
Micron v. YMTC
IPR2024-00795

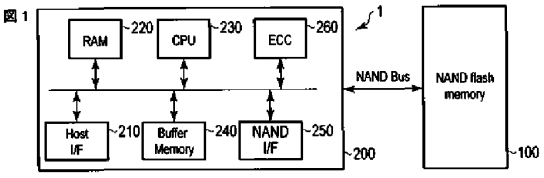
々な形態で実施されることが可能であり、発明の要旨を逸脱しない範囲で、種々の省略、置き換え、変更を行うことができる。これら実施形態やその変形は、発明の範囲や要旨に含まれると同様に、特許請求の範囲に記載された発明とその均等の範囲に含まれるものである。

【符号の説明】

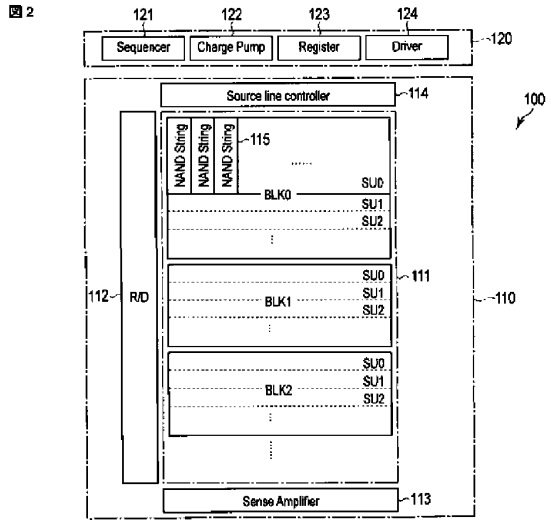
【０２３８】

１…メモリシステム、１００…ＮＡＮＤ型フラッシュメモリ、１１０…コア部、１１１…メモリセルアレイ、１１２…ロウデコーダ、１１３…センスアンプ、１１４…ソース線制御回路、１１５…ＮＡＮＤストリング、１２０…周辺回路部、１２１…シーケンサ、１２２…チャージポンプ、１２３…レジスタ、１２４…ドライバ、２００…コントローラ、２１０…ホストインターフェイス、２２０…内蔵メモリ、２３０…ＣＰＵ、２４０…バッファメモリ、２５０…ＮＡＮＤインターフェイス。

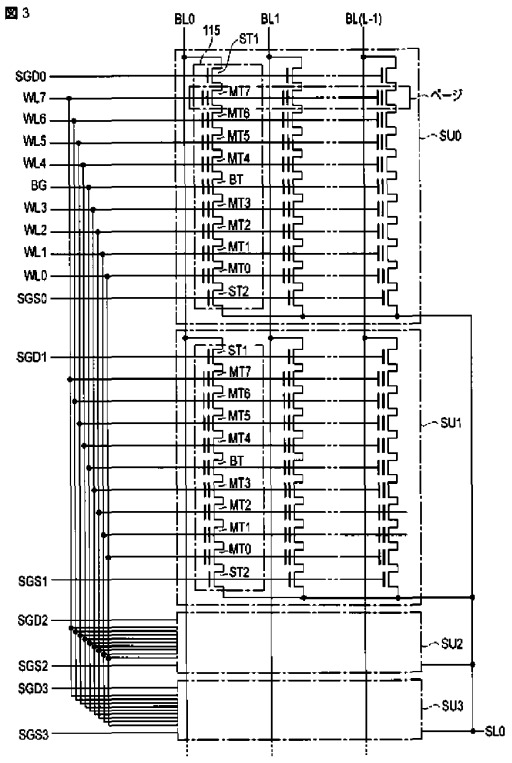
【図１】



【図２】



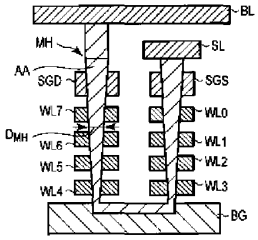
【図３】



Micron Ex. 1016, p. 94
Micron v. YMTC
IPR2024-00795

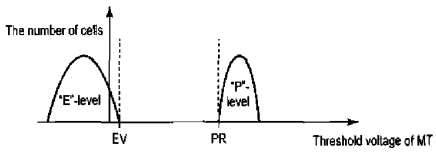
【図４】

図4



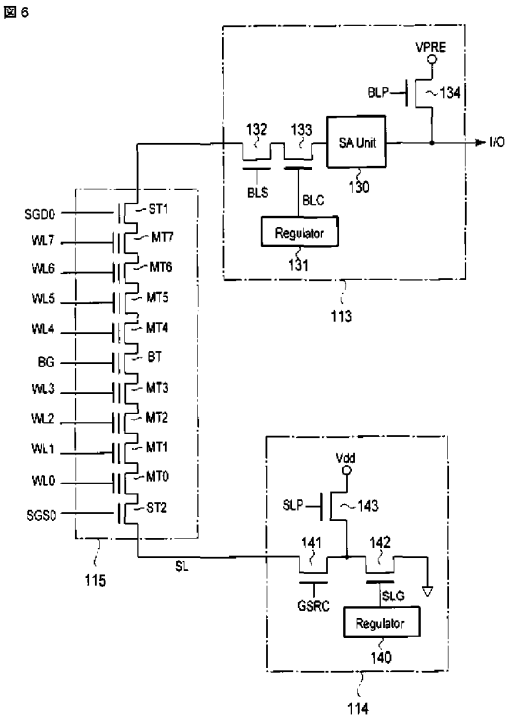
【図５】

図5



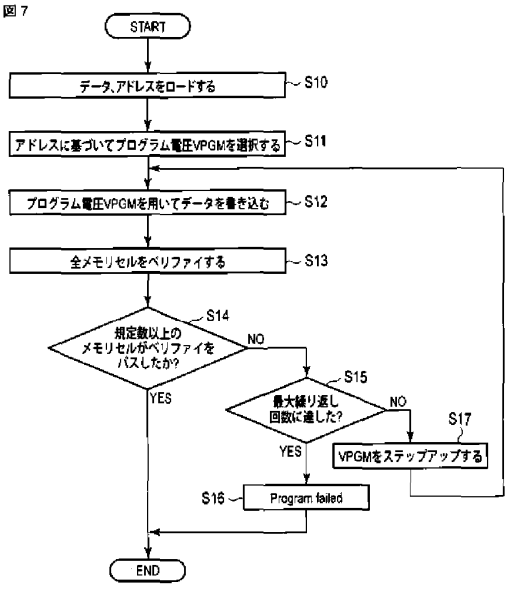
【図６】

図6



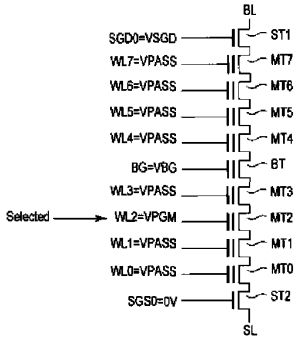
【図７】

図7



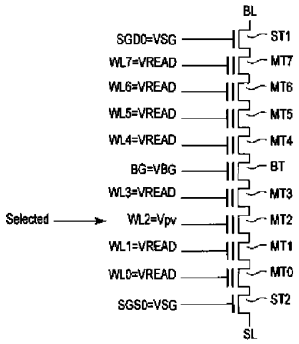
【図８】

図8



【図９】

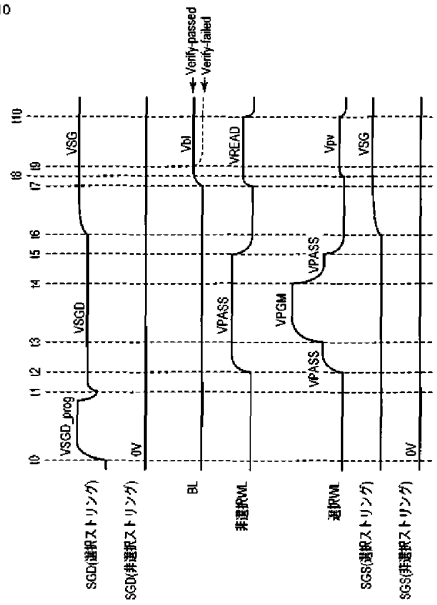
図9



Micron Ex. 1016, p. 95
Micron v. YMTC
IPR2024-00795

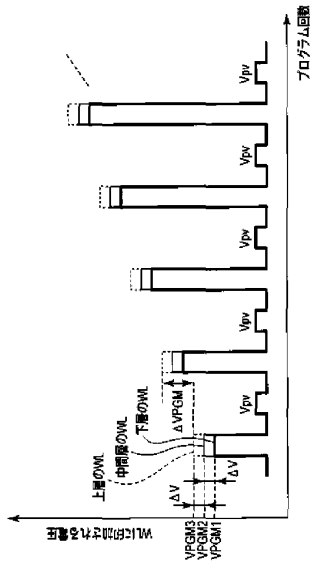
【図１０】

図10



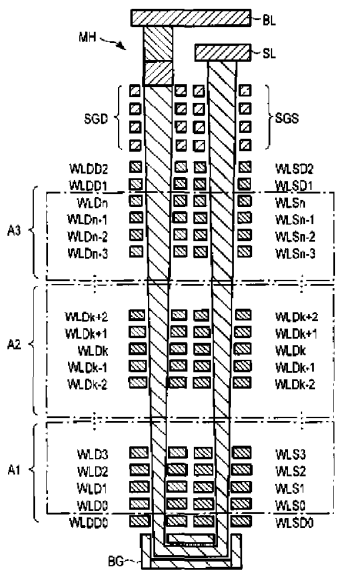
【図１１】

図11



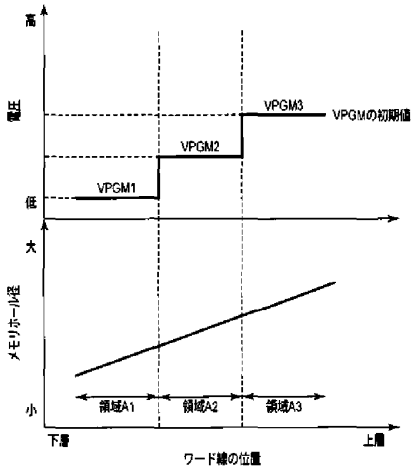
【図１２】

図12



【図１３】

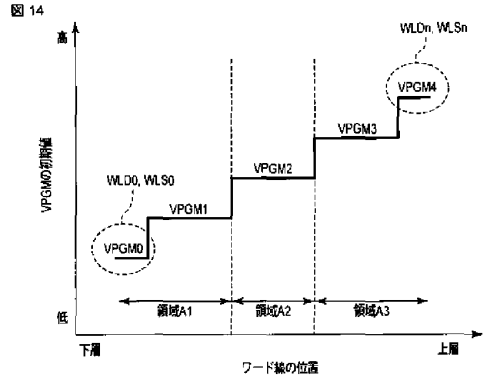
図13



Micron Ex. 1016, p. 96
Micron v. YMTC
IPR2024-00795

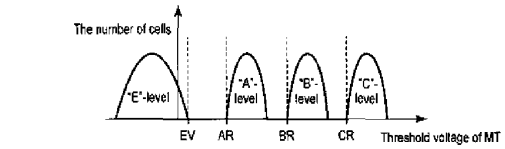
【図１４】

図 14



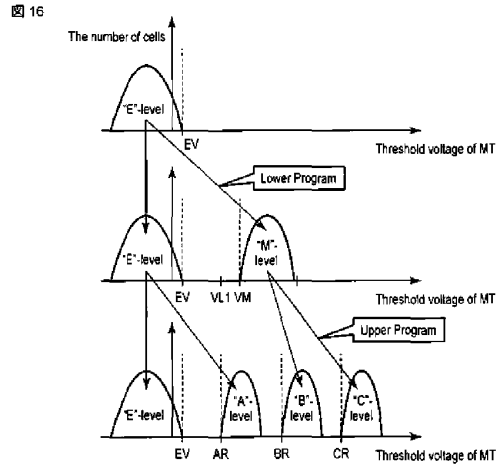
【図１５】

図 15



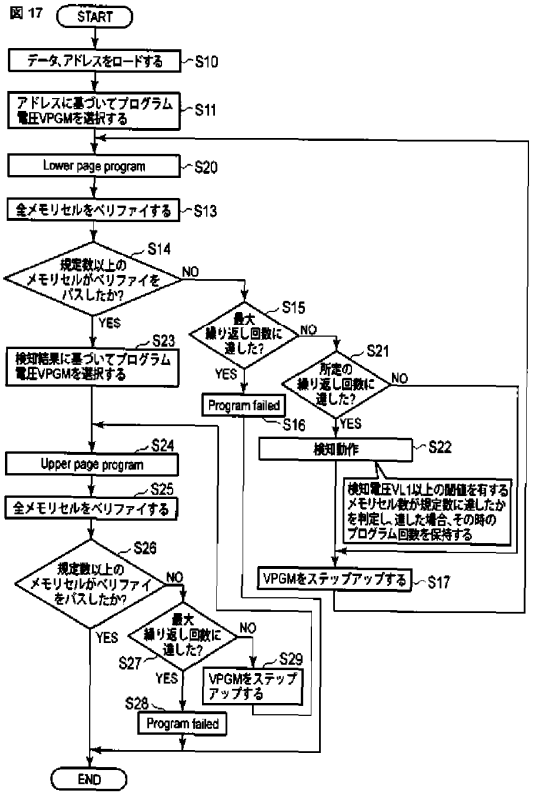
【図１６】

図 16



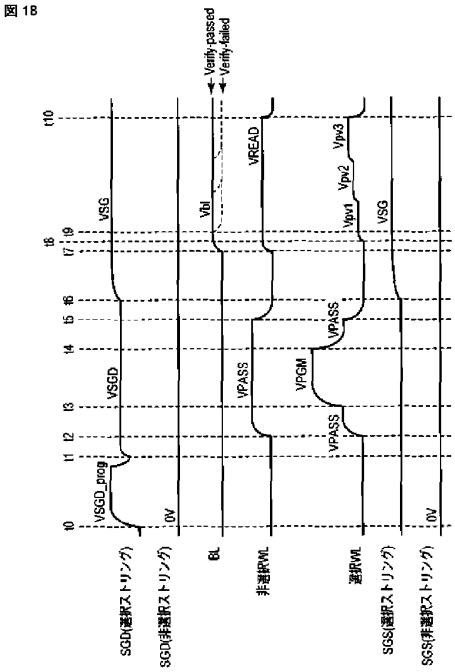
【図１７】

図 17



【図１８】

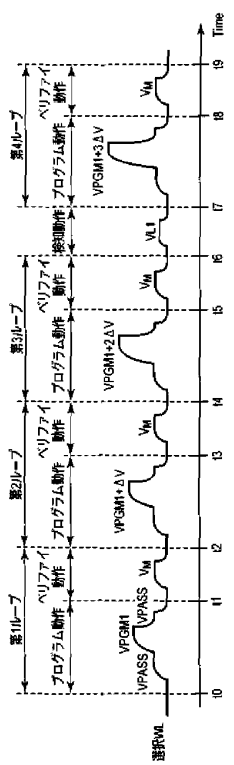
図 18



Micron Ex. 1016, p. 97
Micron v. YMTC
IPR2024-00795

【図１９】

図 19



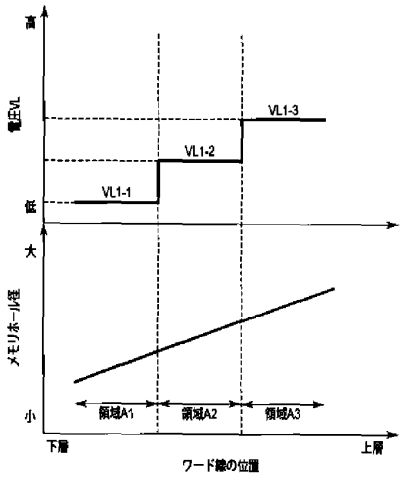
【図２０】

図 20

書き込みループ回数	1~N1回	(N1+1)~N2回	(N2+1)~N3回
セル特性	プログラムし易い	通常	プログラムし難い
Upper page program時のVPGM	VPGM1'	VPGM2' (<VPGM1')	VPGM3' (<VPGM2')

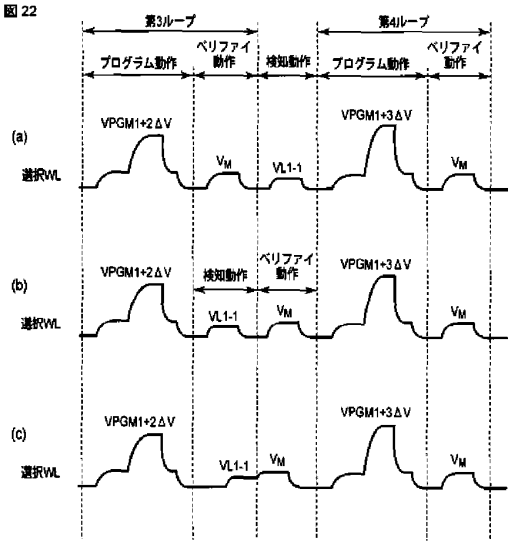
【図２１】

図 21



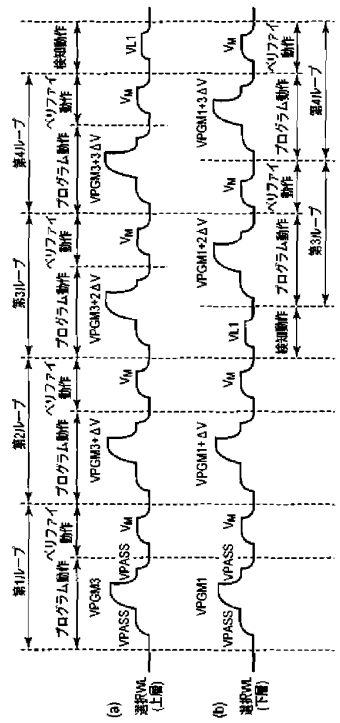
【図２２】

図 22

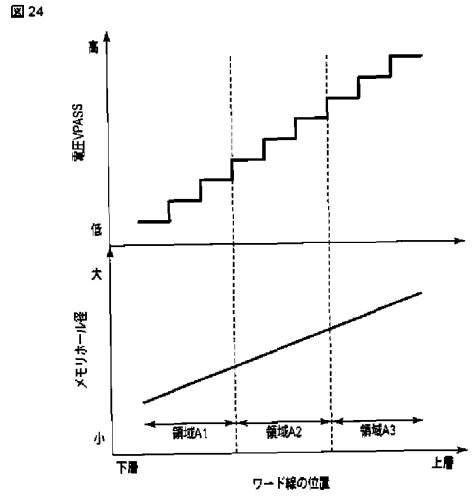


【図２３】

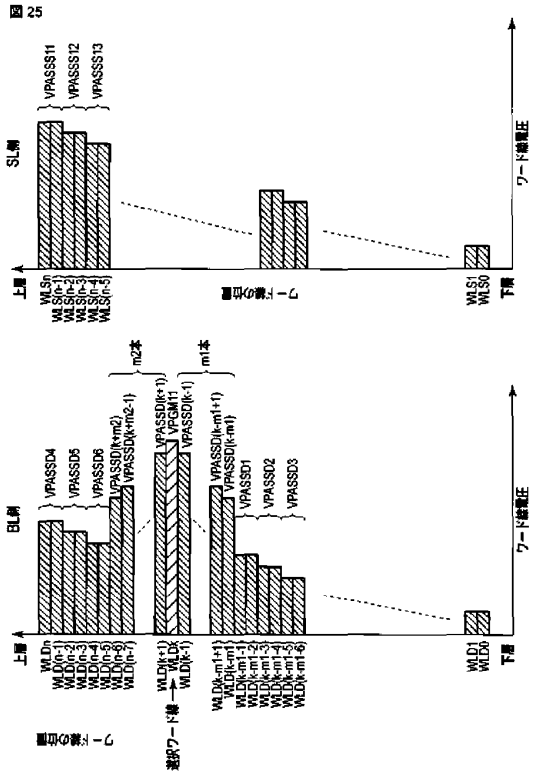
図 23



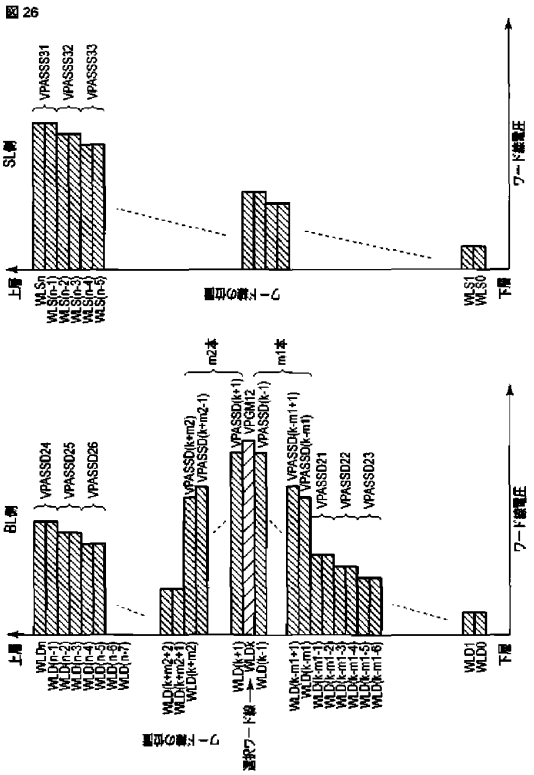
【図２４】



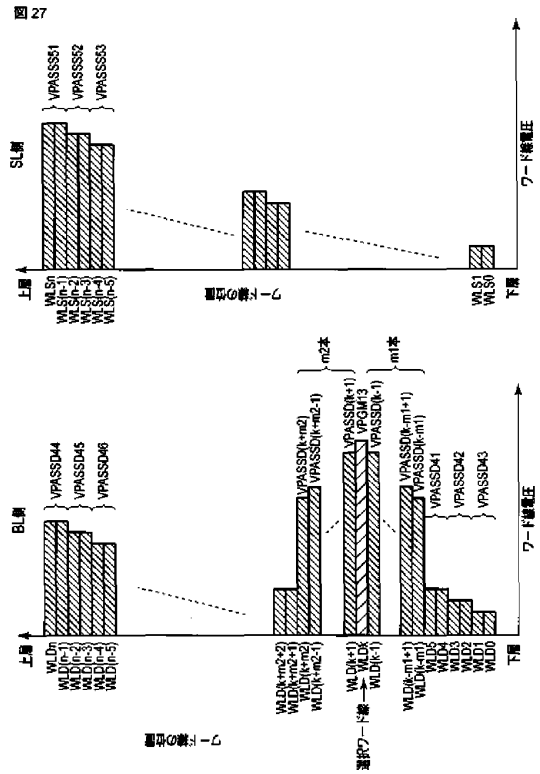
【図２５】



【図２６】



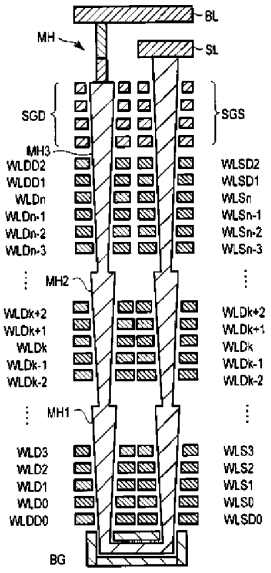
【図２７】



Micron Ex. 1016, p. 99
Micron v. YMTC
IPR2024-00795

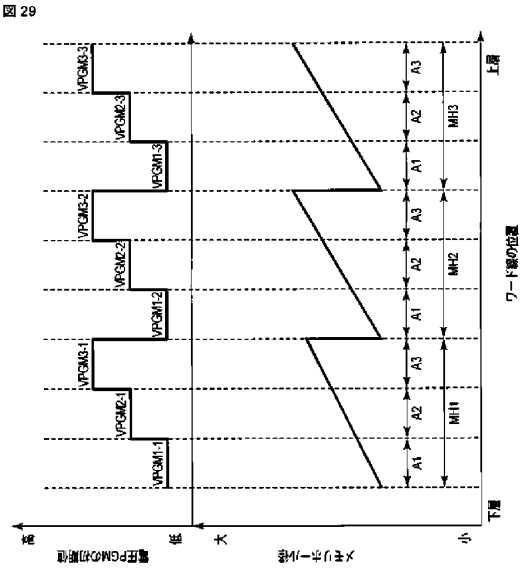
【図２８】

図 28



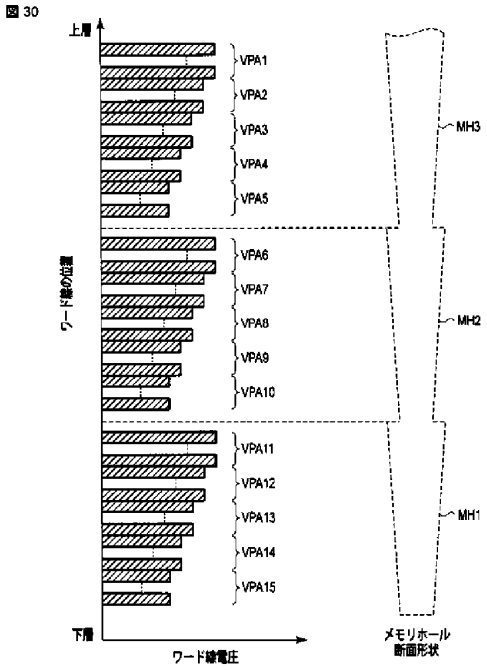
【図２９】

図 29



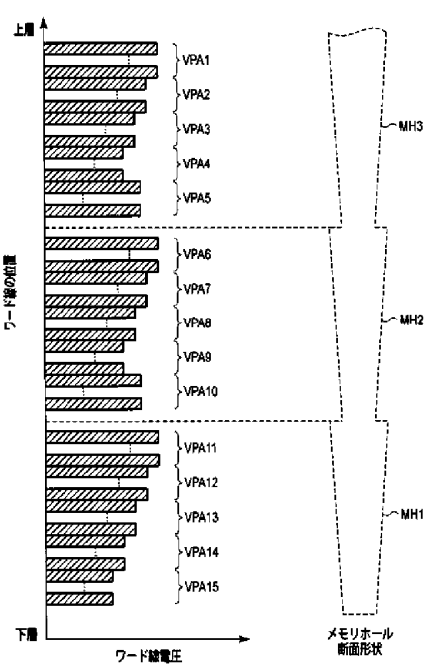
【図３０】

図 30



【図３１】

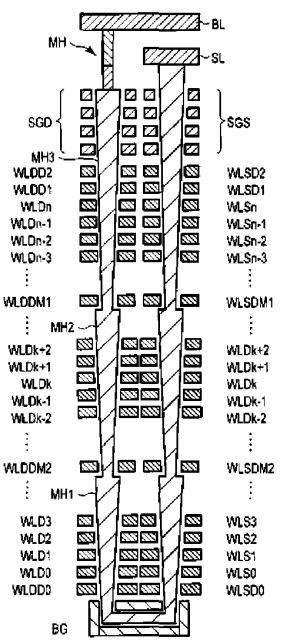
図 31



Micron Ex. 1016, p. 100
Micron v. YMTC
IPR2024-00795

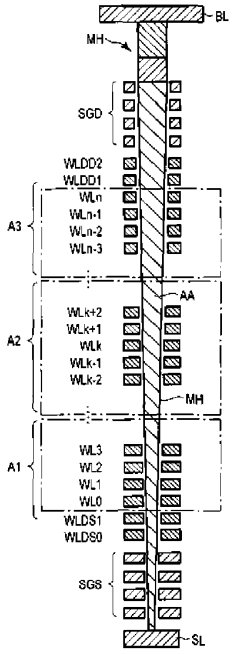
【図３２】

図32



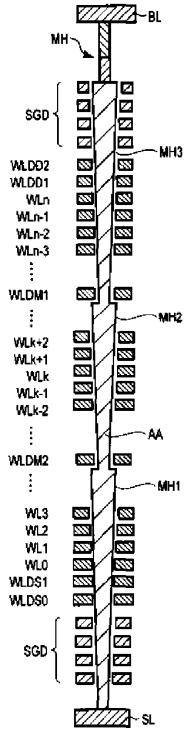
【図３３】

図33



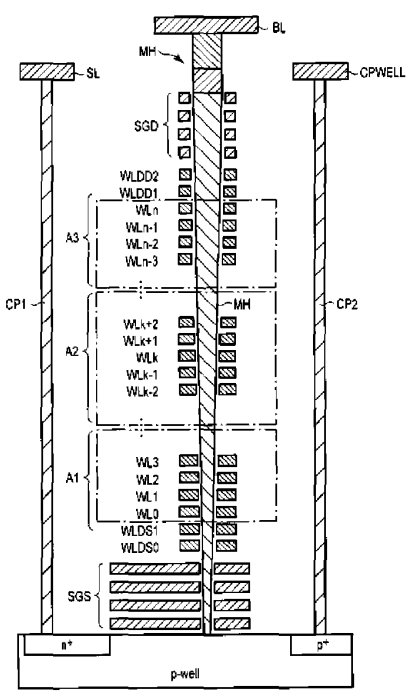
【図３４】

図34



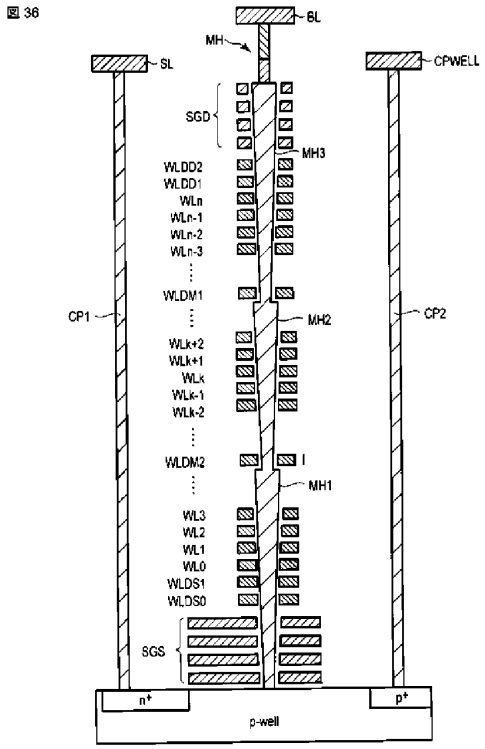
【図３５】

図35

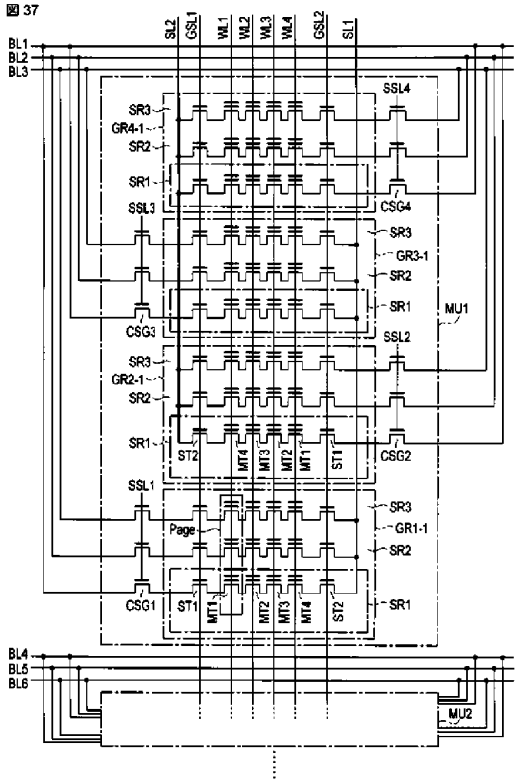


Micron Ex. 1016, p. 101
Micron v. YMTC
IPR2024-00795

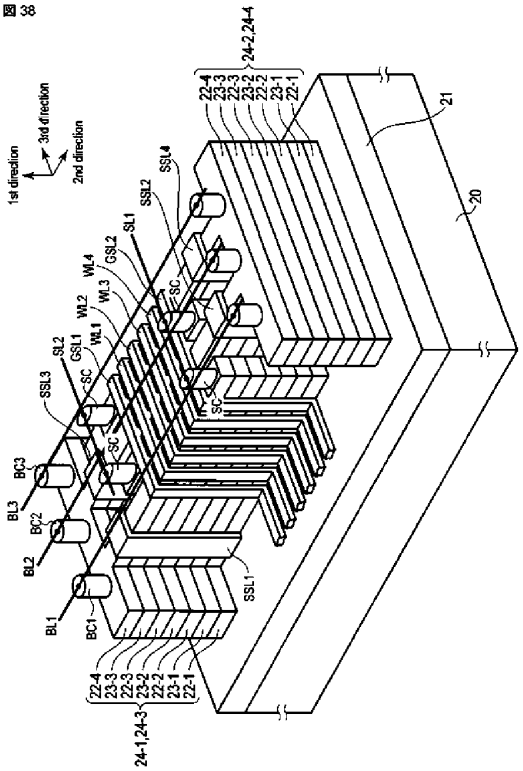
【図３６】



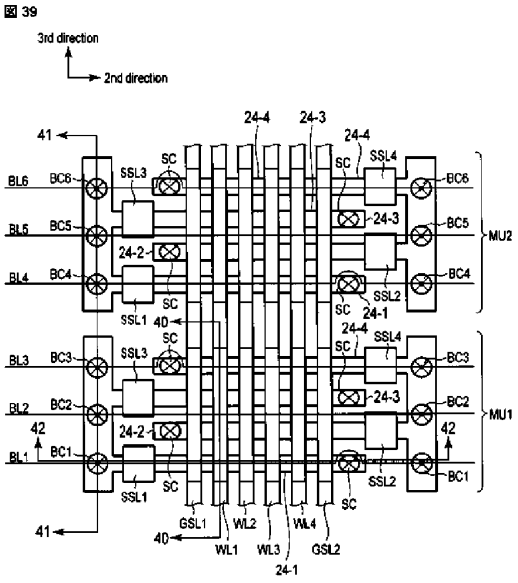
【図３７】



【図３８】



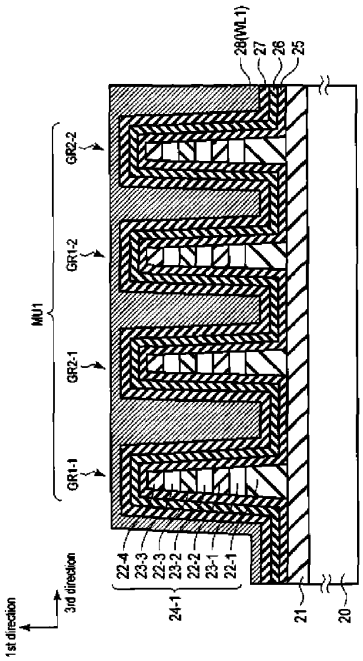
【図３９】



Micron Ex. 1016, p. 102
Micron v. YMTC
IPR2024-00795

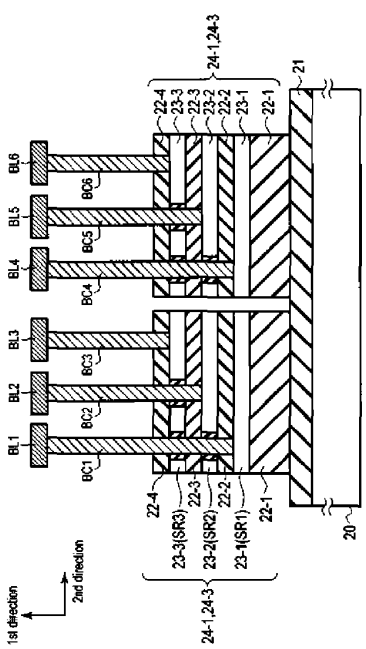
【図４０】

図40



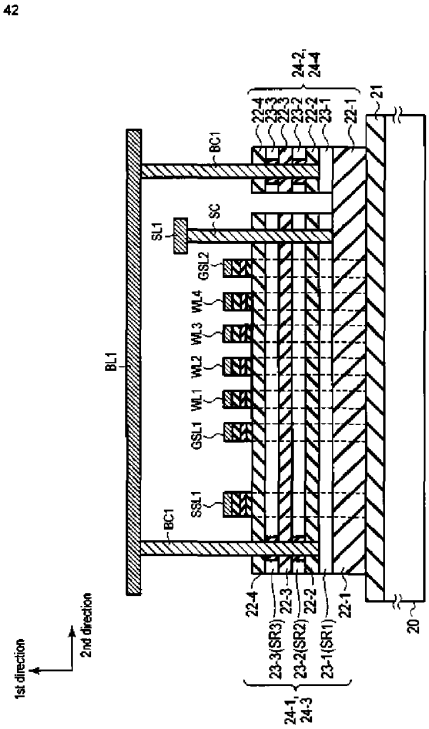
【図４１】

図41



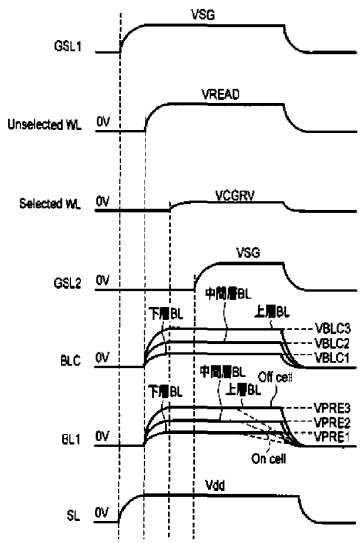
【図４２】

図42



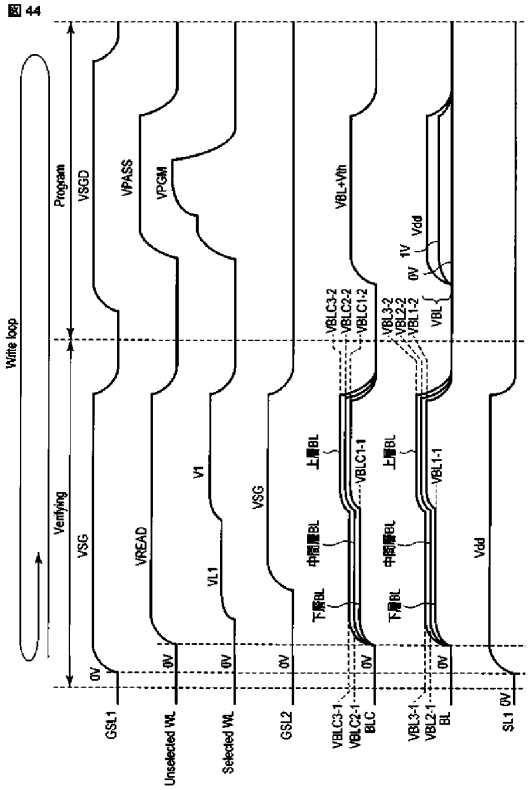
【図４３】

図43

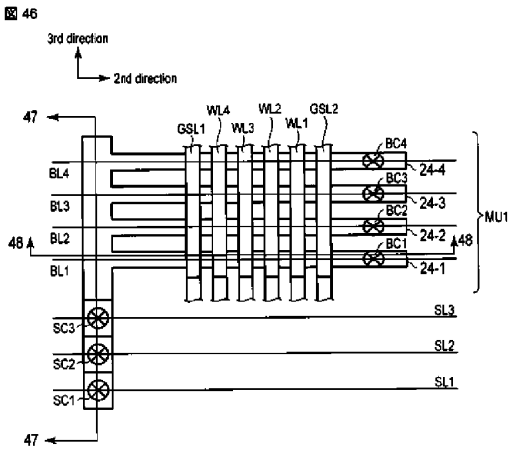


Micron Ex. 1016, p. 103
Micron v. YMTC
IPR2024-00795

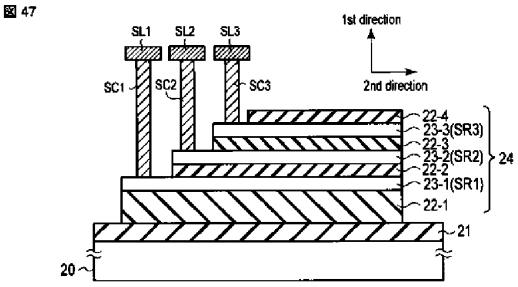
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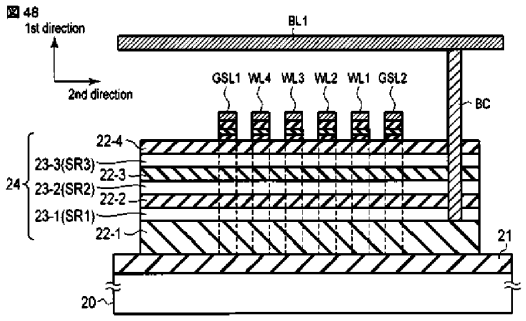
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【図４７】



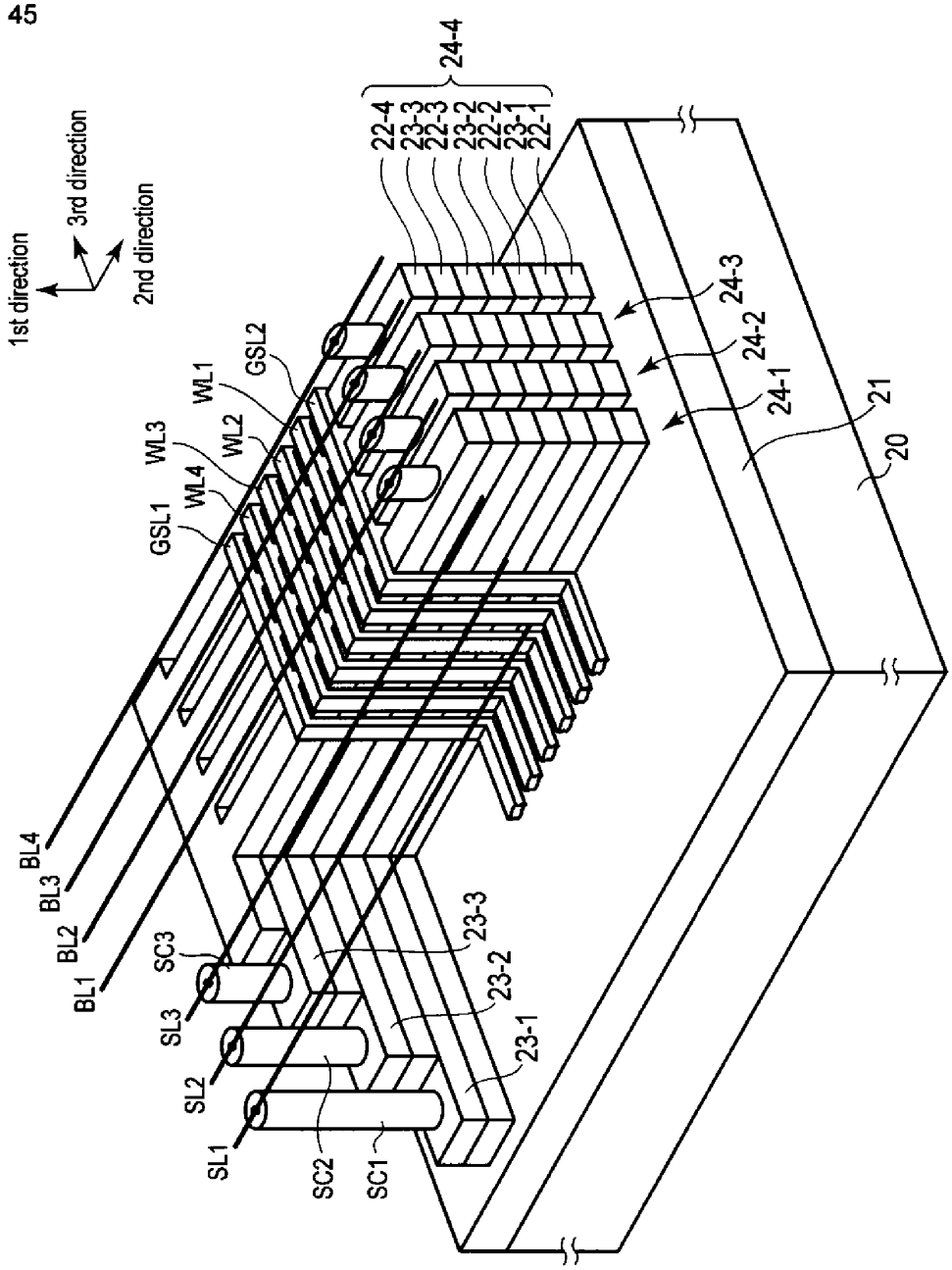
【図４８】



Micron Ex. 1016, p. 104
Micron v. YMTC
IPR2024-00795

【図４５】

図 45



Micron Ex. 1016, p. 105
Micron v. YMTC
IPR2024-00795

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Micron Ex. 1016, p. 106
Micron v. YMTC
IPR2024-00795

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Customer Number:	153988
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	10018-01-0242-US-CON2_IDS2-SB08.pdf	612031 4b29146e74936d8c125232880d1e677a769b991e	no	4

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2	Foreign Reference	JP2015176620A_Bibl.pdf	4331116 88e9a9e3ec9243e98cee577cabdb32b9393b7ab0	no	46
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	10018-01-0242-US-CON2

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	2	20180137925	A1	2018-05-17	NAM et al.	
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	1	108389601	CN	A	2018-08-10	SAMSUNG ELECTRONICS CO LTD		

Micron Ex. 1016, p. 109
Micron v. YMTC
IPR2024-00795

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Micron Ex. 1016, p. 110
Micron v. YMTC
IPR2024-00795

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	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

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Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-27
Name/Print	Zhiwei Zou	Registration Number	66,041

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Micron Ex. 1016, p. 111
Micron v. YMTC
IPR2024-00795

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Micron Ex. 1016, p. 112
Micron v. YMTC
IPR2024-00795

Espacenet

CN108389601A Soft erase method of Non volatile memory device

Applicants: SAMSUNG ELECTRONICS CO LTD

Inventors: JONG-HOON LEE,DOO-HYUN KIM,IL-HAN PARK

Classifications:
IPC ***G11C16/34;***

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Publication: CN108389601A·2018-08-10

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Soft erase method of Non volatile memory device

Abstract

A soft erase method of a memory device including applying a program voltage to a first memory cell in at least one of program loops when a plurality of program loops are performed to program the firstmemory cell into a Nth programming state, wherein the first memory cell is included in a selected memory cell string connected to a selected first bit line and is connected to a selected word line; and soft erasing a second memory cell by applying, in a first verification interval, a read voltage for verifying a programming state of the first memory cell to the selected word line and applying a first pre-pulse to a gate of a string select transistor of each of a plurality of unselected memory cell strings connected to the first bin line and a plurality of unselected memory cell strings connected to an unselected second bit line.

Micron Ex. 1016, p. 113
Micron v. YMTC
IPR2024-00795

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代理人 姜长星 张川绪

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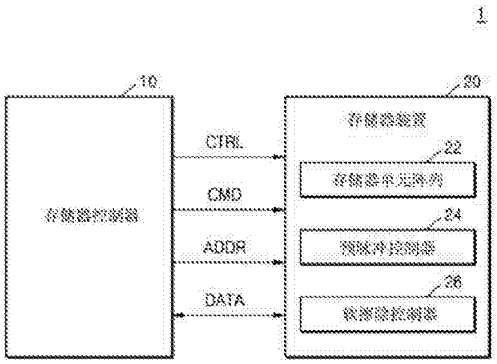
权利要求书3页 说明书14页 附图23页

(54)发明名称

非易失性存储器装置的软擦除方法

(57)摘要

一种非易失性存储器装置的软擦除方法。所述方法包括:当执行多个编程循环以将第一存储器单元编程到第N编程状态时,在至少一个编程循环中将编程电压施加到被包括在连接到选择的第一位线的选择的存储器单元串中并连接到选择的字线的第一存储器单元;在第一验证间隔中,通过将用于验证第一存储器单元的编程状态的读取电压施加到选择的字线以及将第一预脉冲施加到连接到第一位线的多个未选择的存储器单元串和连接到未选择的第二位线的多个未选择的存储器单元串中的每一个未选择的存储器单元串的串选择晶体管的栅极,来对第二存储器单元进行软擦除。



CN 108389601 A

Micron Ex. 1016, p. 114
Micron v. YMTC
IPR2024-00795

1.一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法，所述三维存储器单元阵列包括多个存储器单元串，每个存储器单元串包括垂直堆叠在硅基底上的串选择晶体管、多个存储器单元和地选择晶体管，每个存储器单元串分别连接到位线和共源极线，所述方法包括：

执行多个编程循环来将第一存储器单元编程为第一编程状态，第一编程状态是第一存储器单元的N个编程状态之一，并且第一存储器单元包括在连接到选择的第一位线的选择的存储器单元串中且连接到选择的字线；

所述多个编程循环中的至少一个编程循环包括：

在第一区间期间，通过将第一预脉冲施加到连接到选择的第一位线的一个或多个未选择的存储器单元串和连接到未选择的第二位线的多个未选择的存储器单元串中的每一个存储器单元串的串选择晶体管的栅极，而对第二存储器单元执行软擦除操作，第二存储器单元包括在连接到未选择的第二位线的选择的存储器单元串中且连接到选择的字线；

在第二区间期间，通过将选择电压施加到连接到选择的第一位线的选择的存储器单元串的串选择晶体管的栅极和连接到未选择的第二位线的选择的存储器单元串的串选择晶体管的栅极，来对第一存储器单元执行验证操作。

2.根据权利要求1所述的软擦除方法，还包括：对连接到未选择的第二位线的多个存储器单元串中的每一个存储器单元串的通道进行升压。

3.根据权利要求2所述的软擦除方法，其中，对连接到未选择的第二位线的多个存储器单元串中的每一个存储器单元串的通道进行升压的步骤包括：对包括第二存储器单元的多个存储器单元执行预脉冲编程操作。

4.根据权利要求3所述的软擦除方法，其中，第二存储器单元被预先确定为处于具有比第一存储器单元的第一编程状态的阈值电压电平高的阈值电压电平的第二编程状态。

5.根据权利要求1所述的软擦除方法，其中，包括在每个存储器单元阵列中的多个存储器单元是多层单元，

第N编程状态是第一编程状态，

第二存储器单元被预先确定为根据第二编程状态或更高编程状态而被编程。

6.根据权利要求1所述的软擦除方法，其中，施加第一预脉冲的步骤还包括：在第一区间中，将读取通过电压施加到多个未选择的字线。

7.根据权利要求1所述的软擦除方法，其中，第二区间在时间上比第一区间晚。

8.根据权利要求1所述的软擦除方法，其中，执行软擦除操作的步骤还包括：在第一区间中，将第二预脉冲施加到连接到选择的第一位线的选择的存储器单元串的串选择晶体管的栅极和连接到未选择的第二位线的选择的存储器单元串的串选择晶体管的栅极，以减少针对第二存储器单元的热载流子注入。

9.根据权利要求8所述的软擦除方法，其中，第二预脉冲具有比第一预脉冲的电压电平低的电压电平和/或具有比第一预脉冲的脉冲宽度窄的脉冲宽度。

10.一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法，包括：执行包括第N编程循环的多个编程循环以对包括在连接到至少一个选择的位线的选择的串中且连接到选择的字线的多个选择的存储器单元进行编程时，其中，N是1或者大于1的自然数，

其中，第N编程循环包括：

Micron Ex. 1016, p. 115
Micron v. YMTC
IPR2024-00795

将编程电压施加到所述多个选择的存储器单元；

控制用于基于编程电压电平消除连接到选择的位线的多个未选择的串的多个升压电荷的预脉冲操作；

执行针对所述多个选择的存储器单元的验证操作。

11.根据权利要求10所述的软擦除方法，其中，控制预脉冲操作的步骤还包括：

当编程电压电平超过参考电压电平时，确定执行预脉冲操作；

将预脉冲施加到连接到选择的位线的多个未选择的存储器单元串中的每个存储器单元串的串选择晶体管的栅极。

12.根据权利要求10所述的软擦除方法，其中，控制预脉冲操作的步骤还包括：当编程电压电平为参考电压电平或更低的电压电平时，确定跳过预脉冲操作。

13.根据权利要求10所述的软擦除方法，其中，控制预脉冲操作的步骤还包括：

当第N编程循环对应于需要预脉冲的循环时，确定执行预脉冲操作；以及

将预脉冲施加到连接到选择的位线的多个未选择的存储器单元串中的每个存储器单元串的串选择晶体管的栅极。

14.根据权利要求10所述的软擦除方法，其中，控制预脉冲操作的步骤还包括：

基于编程电压电平确定预脉冲施加时间；

基于确定的预脉冲施加时间，将预脉冲施加到连接到选择的位线的多个未选择的存储器单元串中的每个存储器单元串的串选择晶体管的栅极。

15.根据权利要求14所述的软擦除方法，其中，确定预脉冲施加时间的步骤包括：确定预脉冲施加时间随着编程电压电平的增加而变得更短。

16.一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法，三维存储器单元阵列包括多个存储器单元串，每个存储器单元串包括垂直堆叠在硅基底上的串选择晶体管、多个存储器单元和地选择晶体管，每一个存储器单元串分别连接到位线和共源极线，所述方法包括：

执行编程操作以对第一存储器单元进行编程，其中，第一存储器单元包括在经由第一串选择晶体管连接到选择的位线的选择的存储器单元串中且连接到选择的字线；

对第一存储器单元执行验证操作，执行验证操作的步骤包括：

在第一区间期间，将第一预脉冲施加到多个未选择的存储器单元串中的每一个存储器单元串的第二串选择晶体管的栅极，其中，所述多个未选择的存储器单元串中的每一个存储器单元串经由第二串选择晶体管连接到选择的位线；

在第二区间期间，将选择电压施加到选择的存储器单元串的第一串选择晶体管的栅极，

其中，第二区间在时间上比第一区间晚。

17.根据权利要求16所述的软擦除方法，还包括：对连接到未选择的位线的多个存储器单元串中的每一个存储器单元串的通道进行升压。

18.根据权利要求17所述的软擦除方法，其中，对连接到未选择的位线的多个存储器单元串中的每一个存储器单元串的通道进行升压的步骤包括：对包括在未选择的存储器单元串中的多个存储器单元执行预脉冲编程操作。

19.根据权利要求16所述的软擦除方法，其中，包括在每个存储器单元串中的多个存储

Micron Ex. 1016, p. 116
Micron v. YMTC
IPR2024-00795

器单元为多层单元。

20.根据权利要求19所述的软擦除方法，其中，执行验证操作的步骤还包括：在第一区间期间，将第二预脉冲施加到连接到选择的位线的选择的存储器单元串的第一串选择晶体管的栅极，以减少针对第二存储器单元的热载流子注入。

Micron Ex. 1016, p. 117
Micron v. YMTC
IPR2024-00795

非易失性存储器装置的软擦除方法

[0001] 本申请要求于2017年2月2日提交到韩国知识产权局的第10-2017-0015134号韩国专利申请的权益，所述韩国专利申请的公开通过引用全部合并于此。

技术领域

[0002] 本发明构思涉及一种非易失性存储器装置，更具体地，涉及包括三维存储器阵列的非易失性存储器装置的软擦除方法和编程方法。

背景技术

[0003] 存储器装置用于存储数据并且被分类成易失性存储器装置和非易失性存储器装置。非易失性存储器装置可用于移动电话、数码相机、便携式数字助理(PDA)、可移动计算机装置、固定型计算机装置和其他装置中。

发明内容

[0004] 本发明构思提供用于改善针对非易失性存储器装置的数据编程和数据读取操作性能的非易失性存储器装置的软擦除方法和编程方法。根据本发明构思的一方面，公开了一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法。所述三维存储器单元阵列包括多个存储器单元串，每个存储器单元串包括垂直堆叠在硅基底上的串选择晶体管、多个存储器单元和地选择晶体管。每个存储器单元串分别连接到位线和共源极线。所述方法包括：执行多个编程循环来将第一存储器单元编程为第一编程状态，第一编程状态是第一存储器单元的N个编程状态之一，并且第一存储器单元包括在连接到选择的位线的选择的存储器单元串中且连接到选择的字线；在第一验证区间期间，通过将第一预脉冲施加到连接到选择的位线的一个或多个未选择的存储器单元串中的每一个的串选择晶体管的栅极，而对一个或多个第二存储器单元执行软擦除操作，所述一个或多个第二存储器单元包括在所述连接到选择的位线的一个或多个未选择的存储器单元串中且连接到选择的字线；在第二验证区间期间，通过将选择电压施加到选择的存储器单元串的串选择晶体管的栅极来，对第一存储器单元执行验证操作，其中，第二验证区间在时间上比第一验证区间晚。

[0005] 根据本发明构思的另一方面，公开了一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法。三维存储器单元阵列包括多个存储器单元串，每个存储器单元串包括垂直堆叠在硅基底上的串选择晶体管、多个存储器单元晶体管和地选择晶体管，每一个存储器单元串分别连接到位线和共源极线。所述方法包括：执行多个编程循环来将第一存储器单元编程为第一编程状态，第一编程状态是第一存储器单元的N个编程状态之一，并且第一存储器单元包括在连接到选择的位线的选择的存储器单元串中且连接到选择的字线；在第一验证区间期间，通过将第一预脉冲施加到连接到选择的位线的一个或多个未选择的存储器单元串中的每一个的串选择晶体管的栅极，而对一个或多个第二存储器单元执行软擦除操作，所述一个或多个第二存储器单元包括在所述连接到选择的位线的一个或多

Micron Ex. 1016, p. 118
Micron v. YMTC
IPR2024-00795

个未选择的存储器单元串中且连接到选择的字线；在第二验证区间期间，通过将选择电压施加到选择的存储器单元串的串选择晶体管的栅极来，对第一存储器单元执行验证操作，其中，第二验证区间在时间上比第一验证区间晚，第一预脉冲的电压电平比第二预脉冲的电压电平高。

[0006] 根据本发明构思的另一方面，公开了一种包括三维存储器单元阵列的非易失性存储器装置的软擦除方法。三维存储器单元阵列包括多个存储器单元串，每个存储器单元串包括垂直堆叠在硅基底上的串选择晶体管、多个存储器单元和地选择晶体管，每一个存储器单元串分别连接到位线和共源极线。所述方法包括：执行编程操作以对经包括在由第一串选择晶体管连接到选择的位线的选择的存储器单元串中且连接到选择的字线的第一存储器单元进行编程；对第一存储器单元执行验证操作，执行验证操作的步骤包括：在第一验证区间期间，将第一预脉冲施加到一个或多个未选择的存储器单元串中的每一个的第二串选择晶体管的栅极，其中，所述一个或多个未选择的存储器单元串中的每一个经由第二串选择晶体管连接到选择的位线；在第二验证区间期间，将选择电压施加到选择的存储器单元串的第一串选择晶体管的栅极，其中，第二验证区间在时间上比第一验证区间晚。

附图说明

[0007] 从下面结合附图的详细描述，本发明构思的实施例将更容易理解，其中，在附图中：

[0008] 图1是示意性地示出根据实施例的存储器系统的框图；

[0009] 图2是详细示出根据实施例的存储器装置的框图；

[0010] 图3是示出根据实施例的图2所示的存储器块的电路图；

[0011] 图4是根据实施例的图2所示的存储器块BLK1的立体图；

[0012] 图5是示出根据实施例的软擦除操作的示意图；

[0013] 图6是示出根据实施例的编程循环与软擦除操作之间的关系的示图；

[0014] 图7和图8是示出根据实施例的软擦除操作的示图；

[0015] 图9A和图9B是示出根据实施例的控制针对存储器单元的软擦除操作的电位差的方法的曲线图；

[0016] 图10A和图10B是用于描述根据另一实施例的控制针对存储器单元的软擦除操作的电位差的方法的曲线图；

[0017] 图11A至图11D是用于具体描述根据实施例的软擦除操作的示图；

[0018] 图12是用于示出根据实施例的执行软擦除操作的方法的流程图；

[0019] 图13是用于示出根据实施例的执行软擦除操作的方法的流程图；

[0020] 图14A和图14B是用于示出根据实施例的基于编程电压电平来控制预脉冲操作的操作机制的示图；

[0021] 图15是用于示出根据实施例的基于编程电压电平来控制预脉冲操作的方法的流程图；

[0022] 图16A至图16C是用于示出根据实施例的基于各种标准来控制预脉冲操作的方法的流程图；

[0023] 图17是用于示出根据实施例的控制预脉冲操作的方法的示图；

Micron Ex. 1016, p. 119
Micron v. YMTC
IPR2024-00795

[0024] 图18A和图18B是用于示出根据实施例的执行预脉冲操作的预脉冲时间段的示图；

[0025] 图19是用于示出根据实施例的基于编程电压电平来控制预脉冲操作的方法的流程图；

[0026] 图20A、图20B和图20C是用于示出根据实施例的基于编程电压电平来确定和控制预脉冲的施加时间的方法的示图；

[0027] 图21是示出根据实施例的固态盘(SSD)系统的框图。

具体实施方式

[0028] 以下，将参照附图详细描述本发明的实施例。

[0029] 图1是示意性地示出根据实施例的存储器系统1的框图。

[0030] 参照图1，存储器系统1可包括存储器控制器10和存储器装置20。存储器装置20可包括存储器单元阵列22、预脉冲控制器24和软擦除控制器26。然而，图1所示的存储器装置20的结构仅作为示例而提供，并且所述结构不限于此，但是预脉冲控制器24和软擦除控制器26的结构可被包括在存储器控制器10中，或者存储器控制器10可执行预脉冲控制器24和软擦除控制器26的相同的功能。此外，预脉冲控制器24和软擦除控制器26可以以各种逻辑模式实现。以下，作为示例性实施例，将详细描述图1所示的存储器控制器10和存储器装置20的元件。

[0031] 存储器控制器10可执行针对存储器装置20的控制操作。具体地，存储器控制器10可通过将地址ADDR、命令CMD和控制信号CTRL提供给存储装置20来控制针对存储器装置20的编程(或写入)，读取(或理解)和擦除(或去除)操作。

[0032] 存储器单元阵列22可包括布置在多条字线(未示出)和多条位线(未示出)的交叉处的多个存储器单元(未示出)。进一步地，存储器单元阵列22可包括字线、至少一条串选择线和至少一条地选择线以及多个存储器块。多个存储块在基底上分别沿第一方向和第二方向布置，并且可包括沿第三方向(与由第一方向和第二方向形成的平面垂直的方向)布置的具有三维结构的多个串。所述多个串中的每一个串可包括沿垂直于基底的方向布置的至少一个串选择晶体管、多个存储器单元和至少一个地选择晶体管。将详细提供这方面的描述。

[0033] 在实施例中，所述多个存储器单元可以是闪存单元，存储器单元阵列22可以是NAND闪存单元阵列或NOR闪存单元阵列。以下，将参照多个存储器单元是闪存单元的情况来描述实施例。然而，存储器单元不限于此，并且在一些实施例中，所述多个存储器单元可以是诸如电阻RAM(RRAM)、相变RAM(PRAM)或磁性RAM(MRAM)的电阻存储器单元。

[0034] 根据实施例的预脉冲控制器24可控制经由与每一个未选择的存储器单元串的串选择晶体管连接的串选择线施加预定的预脉冲的操作。预脉冲控制器24可生成预脉冲，该预脉冲被施加到串通道以去除在未选择的存储器单元串的串通道的升压操作期间累积在串通道中的电荷。升压操作可在读取或验证操作期间发生。具体地，当执行用于将数据编程到存储器单元阵列22的存储器单元的多个编程循环时，预脉冲控制器24可基于每一个编程循环的编程电压来控制预脉冲操作。例如，当施加到选择的字线的选择的存储器单元的编程电压电平超过参考电压电平时，预脉冲控制器24可确定是否在第N编程循环中执行预脉冲操作，并且可控制预脉冲操作。编程循环可包括将编程电压施加到选择的存储器单元的编程区间和将验证电压施加到选择的存储器单元以确认选择的存储器单元的编程状态的

Micron Ex. 1016, p. 120
Micron v. YMTC
IPR2024-00795

验证区间，并且除了编程区间和验证区间之外，执行预脉冲操作的预脉冲区间还可被包括在编程循环中，或者预脉冲控制器24可控制预脉冲操作使得预脉冲区间被包括在验证间隔中。

[0035] 此外，预脉冲控制器24可基于正被施加到第N个编程循环的选择的存储器单元的的编程电压电平，来确定预脉冲施加时间，并且可基于预脉冲施加时间将预脉冲施加到未选择的存储器单元的串选择晶体管的栅极。预脉冲控制器24可确定在编程循环中需要预脉冲的循环。当编程循环被设置为需要预脉冲的循环时，可不管编程电压电平如何而控制预脉冲操作。此外，预脉冲控制器24可设置在编程循环之中的不执行预脉冲操作的预脉冲禁止循环，并且当编程循环被设置为预脉冲禁止循环时，可不管编程电压电平如何而禁止预脉冲操作。

[0036] 当执行根据实施例的预脉冲控制器24的预脉冲操作时，可防止由未选择的存储器单元串的升压电荷(boosting charge)引起的热载流子注入，使得读取或验证操作期间读取干扰的减少。

[0037] 当对于包括在连接到选择的位线的选择的存储器单元串中且连接到选择的字线的存储器单元执行多个编程循环时，软擦除控制器26可控制对于存储器单元的软擦除操作。在一个实施例中，软擦除控制器26可控制在编程循环期间要施加到存储器单元阵列22的电压电平。具体地，当执行多个编程循环以对包括在连接到选择的第一位线的选择的存储器单元串中且连接到选择的字线的第一存储器单元进行编程时，软擦除控制器26可控制用于验证第一存储器单元的编程状态而在如图7所示的第一验证区间A中将要施加到选择的字线的读取电压(以下，也可称为“验证电压”)。在编程区间之后，软擦除控制器26还可控制预脉冲被施加到连接到选择的位线的多个未选择的存储器单元串和连接到选择的位线的多个未选择的存储器单元串中的每一个未选择的存储器单元串的串选择晶体管的栅极，以对包括在连接到未选择的位线的选择的存储器单元串中并且连接到选择的字线的第二存储器单元执行软擦除。将参照图5至图13详细地提供这方面的描述。

[0038] 根据软擦除控制器26的软擦除操作，可提高编程操作期间存储器单元的阈值电压分布的形状，从而可提高存储器系统1的可靠性。

[0039] 图2是详细示出根据实施例的存储器装置100的框图。

[0040] 参照图2，存储器装置100可包括控制逻辑110、页缓冲器电路120、数据I/O电路130、电压生成器140、行解码器150和存储器单元阵列160。

[0041] 存储器单元阵列160可经由字线WL、串选择线SSL_a和SSL_b以及地选择线GSL连接到行解码器150，并且存储器单元阵列也可经由位线BL连接到数据I/O电路130。存储器单元阵列160可包括多个存储器块BLK1至BLKz。另外，便于描述，假设串选择线SSL_a是选择的串选择线且串选择线SSL_b是未选择的串选择线。

[0042] 存储器单元阵列160可包括多个NAND单元串。多个NAND单元串中的每一个NAND串(以下，为了便于描述，也称为“串”)可在垂直方向或水平方向上形成一个通道。在存储器单元阵列160中，可在垂直方向上堆叠多条字线WL。每条字线WL可形成串所包括的存储器单元的控制栅极。对于三维NAND单元串，可在垂直方向上形成存储器单元的通道。

[0043] 根据存储器单元阵列160的布置，共享一条位线BL的串中的每一个串可被单独选择。被单独选择的每一个串可连接到彼此电分离的多条地选择线GSL。因此，可经由控制地

Micron Ex. 1016, p. 121
Micron v. YMTC
IPR2024-00795

选择线GSL来选择性地对共享一条位线BL的串的通道进行预充电。例如，多个串可连接到施加了用于编程的0V的位线(以下，也称为“选择的位线”)。然而，存储器单元串中的禁止存储器单元串也可连接到选择的位线BL。禁止存储器单元串是编程操作被禁止的串。以下，禁止存储器单元串也被称为“未选择的存储器单元串”。当将编程电压施加到字线WL时，对未选择的存储器单元串的通道的电位需要进行充分升压，以防止连接到该字线WL的禁止单元被编程。

[0044] 行解码器150可通过对地址进行解码来选择存储器单元阵列160的多条字线WL中的一条字线。行解码器150可将从电压生成器140提供的字线电压提供给存储器单元阵列160的选择的字线WL。例如，在编程操作期间，行解码器150可将编程电压提供给选择的字线WL以及将通过电压提供给未选择的字线WL。此外，行解码器150可将选择电压提供给选择的串选择线SSL_a。

[0045] 页缓冲器电路120可根据由控制逻辑110执行的操作，而作为写入驱动器或感测放大器而操作。在编程操作的执行期间，页缓冲器电路120可将与将被编程的数据对应的电压提供给存储器单元阵列160的位线BL，其中，在存储器单元阵列160中以垂直结构形成串。在读取操作的执行期间，页缓冲器电路120可经由位线BL检测存储在选择的存储器单元中的数据，并将数据提供给数据I/O电路130。

[0046] 数据I/O电路130可经由数据线DL连接到页缓冲器电路120，并且可向页缓冲器电路120提供输入数据Data，或者可将从页缓冲器电路120提供的数据Data输出到外部。数据I/O电路130可向控制逻辑110或行解码器150提供输入地址或命令。

[0047] 控制逻辑110可包括预脉冲控制器114和软擦除控制器116。控制逻辑110可响应于从数据I/O电路130发送的命令，而控制编程操作、读取操作和擦除操作。预脉冲控制器114可在读取或者验证操作期间控制将预脉冲Pre-Pulse施加到连接到未选择的存储器单元串的串选择线SSL_b的操作，以去除未选择的存储器单元串的升压通道的电荷。为了解释本发明构思，与未选择的存储器单元串的串选择晶体管的栅极连接的串选择线可被称为“未选择的存储器单元串选择线或未选择的串选择线”。具体地，当控制逻辑110控制编程循环时，预脉冲控制器114可控制将在编程循环中执行的预脉冲操作，并且预脉冲控制器114可基于在编程循环的编程间隔中施加到存储器单元的编程电压电平来控制预脉冲操作。

[0048] 软擦除控制器116可控制在执行编程循环时对包括在连接到选择的位线的未选择的存储器单元串中且连接到选择的字线的存储器单元执行的软擦除操作。具体地讲，在第一验证区间，软擦除控制器116可控制施加到不是编程对象的未选择的存储器单元串选择线SSL_b的预脉冲Pre-Pulse。在第二验证区间期间，软擦除控制器116可将预定的选择电压施加到选择的存储器单元串选择线SSL_a。选择的存储器单元串选择线可连接到作为编程对象的至少一个选择的存储器单元串。也就是说，软擦除控制器116可控制将预脉冲Pre-Pulse施加到连接到未选择的存储器单元串的串选择线SSL_b的时序和将选择电压施加到连接到选择的存储器单元串的串选择线SSL_a的时序相互不同，从而可在如图7所示的第一验证区间A针对被包括在连接到未选择的位线的选择的存储器单元串中且连接到选择的字线的存储器单元执行软擦除操作。在这方面，软擦除控制器116可控制预脉冲控制器114或电压生成器140来控制施加预脉冲Pre-Pulse的时序，并且可控制电压生成器140和行解码器150以在预定的时序向存储器单元阵列160提供执行编程循环所需的电压。

Micron Ex. 1016, p. 122
Micron v. YMTC
IPR2024-00795

[0049] 虽然在控制软擦除操作方面描述了软擦除控制器116，但是软擦除控制器116的功能不限于此，并且软擦除控制器116可执行包括控制编程循环的各种操作。

[0050] 图3是示出根据实施例的图2中示出的存储器块BLK的电路图。这里，图3中示出的存储器单元块BLK作为图2中示出的存储器单元块BKL1至BKLz中的任意一个存储器单元块的示例而被示出。

[0051] 参照图3，存储器块BLK包括在三维存储器块的顶部沿Y方向形成的多条位线BL<0>至BL<2>。在存储器块BLK的底部的XY平面中可形成共源极线CSL。在多条位线BL<0>至BL<2>与共源极线CSL之间沿Z方向可形成多个串CSTR。连接到位线BL<1>的串CSTR中的每一个串可包括串选择晶体管SST。经由串选择晶体管SST，串CSTR可与位线BL<1>电连接。连接到位线BL<1>的串CSTR中的每一个串可包括地选择晶体管GST。经由地选择晶体管GST，串CSTR可与共源极线CSL电连接。串联连接的存储器单元晶体管MCT可在串选择晶体管SST与地选择晶体管GST之间沿Z方向连接。在根据实施例的存储器块BLK中，字线WL<3>可连接到在相同字线层中形成的存储器单元晶体管MCT。因此，一层中的存储器单元晶体管MCT可接收相同的字线电压。在编程操作期间，可将编程电压施加到字线WL<1>至WL<3>中的选择的字线，并且可将通过电压施加到其他未选择的字线。因此，与选择的字线对应的层中的所有存储器单元可接收编程电压。另一方面，在一层中形成的串选择晶体管SST可连接到多条串选择线SSL<0>至SSL<2>。多个串可连接到在编程操作期间被施加0V的编程位线BL<1>。

[0052] 以下，在编程操作期间被施加了0V的位线BL<1>被称为“选择的位线”，被施加了电源电压Vcc的位线被称为“未选择的位线”。在连接到选择的位线BL<1>的多个串中，可存在需要将选择的位线BL<1>与通道电连接的串(以下，也称为“选择的存储器单元串”)。连接到选择的位线BL<1>的多个串中的未选择的存储器单元串可以是选择的位线BL<1>与通道被电切断的串。可形成均在X方向上延伸的多条串选择线SSL<0>至SSL<2>，以选择未选择的存储器单元串和选择的存储器单元串。在一个实施例中，具有根据本发明构思的实施例的垂直串结构的图1的存储器单元阵列22可包括用于单独控制地选晶体管GST的地选择线GSL<0>至GSL<2>。在连接到选择的位线BL<1>的多个串中可存在未选择的存储器单元串。这里，X、Y和Z方向彼此垂直，并且在此作为示例提供以描述三维垂直结构存储器块BLK。然而，本发明构思的一个或多个实施例的结构不限于当X、Y和Z方向彼此垂直时的情况。

[0053] 图4是根据实施例的图2所示的存储器块BLK的立体图。这里，图4中示出的存储器单元块BLK作为图2中示出的存储器单元块BKL1至BKLz中的任意一个存储器单元块的示例而被示出。

[0054] 参照图4，存储器块BLK1包括共源极线CSL、多条位线BL<0>至BL<3>以及在共源极线CSL与位线BL<0>至BL<3>之间布置的多个串。共源极线CSL可以是设置在基底111上的导电薄膜或形成在基底111中的杂质区域。位线BL<0>至BL<3>可以是设置在基底111的顶部上的导电图案(例如，金属线)并且可与基底111分离。多个串并联连接到二维布置的位线BL<0>至BL<3>中的每一条位线。因此，多个串被二维地布置在共源极线CSL或基底111上。多个串中的每个串可包括连接到共源极线CSL的地选择晶体管GST、连接到位线BL<0>至BL<3>的串选择晶体管SST以及设置在地选择晶体管GST与串选择晶体管SST之间的多个存储器单元晶体管MCT。地选择晶体管、串选择晶体管SST和存储器单元晶体管MCT可串联连接。此外，设置在共源极线CSL与位线BL<0>至BL<3>之间的多条地选择线GSL<0>至GSL<6>、多条字线WL<0>

Micron Ex. 1016, p. 123
Micron v. YMTC
IPR2024-00795

至WL<3>以及多条串选择线SSL<0>至SSL<6>可分别用作地选择晶体管GST、存储器单元晶体管MCT和串选择晶体管SST的栅电极。所有的地选择晶体管GST可基本上设置在距基底111相同的距离处。此外，它们的栅电极可在Y方向上与多个导体分离。也就是说，多条地选择线GSL<0>至GSL<6>均可形成为与位线BL<0>至BL<3>相交。因此，可将不同的电压提供给多条地选择线GSL<0>至GSL<6>。

[0055] 通常，由于设置在距共源极线CSL基本上相同的距离的多个存储器单元晶体管的栅电极共同连接到字线WL<0>至WL<3>中的一条字线，因此相同电平的电压被施加到这些存储器单元晶体管的栅电极。在这方面，字线WL<0>至WL<3>中的每一条字线可以是与基底111的顶表面平行的具有平坦形状或梳状的导电图案。每个串可包括设置在距共源极线CSL不同的距离处的多个存储器单元晶体管。因此，字线WL<0>至WL<3>的多个层设置在共源极线CSL与位线BL<0>至BL<3>之间。每个串还可包括从共源极线CSL垂直延伸并连接到位线BL<0>至BL<3>的半导体柱PL。半导体柱PL可被形成为穿透地选择线GSL<0>至GSL<6>和字线WL<0>至WL<3>。此外，半导体柱PL可包括主体部分B和在主体部分B的一端或两端形成的杂质区域。信息存储层可设置在字线与半导体柱PL之间形成的串通道中。在一个实施例中，信息存储层可以是电荷存储层。例如，信息存储层可以是从捕获绝缘层和包括浮动栅极或导电纳米点的绝缘层选择的一个。用作地选择晶体管或串选择晶体管的栅极绝缘层的电介质层可设置在地选择线GSL<0>至GSL<6>中的每一条地选择线与半导体柱PL之间或串选择线SSL<0>至SSL<6>中的每一条串选择线与半导体柱PL之间。

[0056] 图5、图7和图8是示出根据实施例的软擦除操作的示图，图6是示出根据实施例的编程循环与软擦除操作之间的关系的曲线图。

[0057] 首先，参照图2和图6，控制逻辑110可执行多个编程循环第一Loop至第M Loop，以将存储器单元阵列160中的选择的存储器单元编程到预定编程状态。具体地，控制逻辑110可执行将具有预定电平的编程电压提供给选择的存储器单元的编程操作(PO)以及通过在执行每个编程循环之后提供验证电压来验证编程状态的验证操作(VO)。验证操作可通过提供验证电压来验证编程状态。软擦除控制器116可在从多个编程循环第一Loop至第M Loop中选择的至少一个编程循环中执行软擦除操作。

[0058] 如图5所示，将位线BL<2>和字线WL<1>均假定为被选择，以执行图6所示的多个编程循环第一Loop至第M Loop。因此，BL<1>及WL<0>、WL<2>和WL<3>可未被选择。连接到第一位线BL<1>的串210至240可与连接到第二位线BL<2>的串310至340共享串选择线SSL<0>至SSL<3>。

[0059] 在图7中，验证操作包括从第一时间t1到第二时间t2范围的第一验证区间A以及从第二时间t2到第三时间t3的第二验证区间B。第一验证区间和第二验证区间可遵循如图6所示的每个编程循环。

[0060] 参照图7，在第一验证区间A中，可将第一预脉冲V_{PRE}提供给与未选择的位线BL<1>的未选择的存储器单元串210、220和240对应的串选择线SSL<0>、SSL<1>、SSL<3>和地选择线GSL<0>、GSL<1>和GSL<3>(参照图5)以及Unsel_SSL&GSLs(参照图7)。同时，在第一验证区间A，可将读取通过电压V_{RP}提供给未选择的字线WL<0>、WL<2>和WL<3>，并且可将用于验证编程状态的读取电压V_{READ}施加到选择的字线WL<1>。由于在第一验证区间A提供给与未选择的位线BL<1>的未选择的存储器单元串210、220和240对应的串选择线SSL<0>、SSL<1>、SSL<3>

Micron Ex. 1016, p. 124
Micron v. YMTC
IPR2024-00795

和地选择线GSL<0>、GSL<1>和GSL<3>(参照图5)以及Unsel_SSL&GSLs(参照图7)的第一预脉冲V_{PRE},未选择的存储器单元串210、220和240与未选择的位线BL<1>和共源极线CSL电连接,从而可沿位线方向或者共源极线方向去除升压通道(BC)的电荷。

[0061] 结果,可降低未选择的存储器单元串210、220和240的通道的电位,从而可使包括在未选择的存储器单元串210、220和240中且连接到选择的字线WL<1>的存储器单元211、221和241的栅极电压电压下降(VD)。此外,包括在选择的存储器单元串230中且连接到选择的字线WL<1>的存储器单元231可通过连接到相同的字线WL<1>的相邻的存储器单元211、221和241的栅极电压降VD而被耦合,从而可生成存储器单元231的栅极电压降(VD')。因此,如在第一验证区间A,与经由选择的字线WL<1>施加的读取电压V_{READ}对应的存储器单元231的栅极电压的电平可暂时下降。

[0062] 参照图8,存储器单元231被包括在选择的存储器单元串230中且连接到选择的字线WL<1>。在编程操作期间,一些电荷可由于通道的升压,而在留在通道中。在第一验证区间A期间,连接到选择的字线WL<1>的存储器单元231的栅极电压Sel_WL_V可由于串通道与选择的字线之间的电荷耦合而暂时下降。因为选择的存储器单元串230的升压通道(BC)的电位被保持,所以可从选择的存储器单元串230的通道去除不稳定地捕获的电荷(例如,浅陷阱电荷)。由于这种通道电荷去除处理可对通道产生轻微的擦除效果,所以这种通道电荷去除处理可被称为"软擦除操作"。软擦除操作可在正常擦除操作期间使用的偏置条件下执行,其中,在所述操作中,存储器单元231的栅极电压Sel_WL_V与升压通道(BC)的电压之间的电压差形成负偏置条件。

[0063] 当在编程循环内执行针对存储器单元231的软擦除操作时,由于软擦除操作,在编程操作之后可不需要单独的操作来去除通道电荷,可通过去除导致存储器单元231的读取干扰的主要因素之一的不稳定捕获电荷,来更精确地读取在存储器单元231中编程的数据。

[0064] 返回图7,可在第二验证区间B将选择电压V_{SEL}提供给与未选择的位线BL<1>的选择的存储器单元串230和选择的位线BL<2>的选择的存储器单元串330对应的串选择线SSL<2>和地选择线GSL<2>(参照图5)以及Sel_SSL&GSL(参照图7)。此外,在第二验证区间B,用于激活位线选择晶体管的信号BLSHF可从低电平变为高电平,以执行用于验证通过使用读取电压VREAD读取的数据的操作,其中,位线选择晶体管连接到页缓冲器电路120与存储器单元阵列160之间的选择的位线BL<2>。也就是说,可经由第一验证区间A和第二验证区间B期间执行针对选择的存储器单元331的验证操作,具体地,可在第一验证区间A执行针对另一存储器单元231的软擦除操作。在上述实施例中,所述操作被假设并描述为通过将相同的电压提供给连接到未选择的存储器单元串的串选择线SSL和地选择线GSL来控制,但这仅是示例实施例,实施例不限于此,并且可通过将预脉冲仅施加到串选择线SSL来实现上述发明构思。此外,将不同的电压分别提供给串选择线SSL和地选择线GSL。

[0065] 图9A和9B示出根据实施例的控制针对存储器单元的软擦除操作的电位差的方法的曲线图。

[0066] 首先,如图8所示,当执行软擦除操作时,当存储器单元231的栅极电压Sel_WL_V与升压通道(BC)之间的电压差超过一定水平时,可发生可成为干扰因素的热载流子注入,因此所述电压差可需要被适当地调节。

[0067] 参照图5和图9A所示,与图7不同,可在第一验证区间A将第二预脉冲V_{PRE}"提供给连

Micron Ex. 1016, p. 125
Micron v. YMTC
IPR2024-00795

接到未选择的位线BL<1>的选择的存储器单元串230和选择的位线BL<2>的选择的存储器单元串330的串选择线SSL<2>和地选择线GSL<2>(参照图5)以及Sel_SSL&GSL(参照图9A)。第二预脉冲V_{PRE}"可具有比第一预脉冲V_{PRE}的最大电压电平小的最大电压电平,和/或者可具有比第一预脉冲V_{PRE}的脉冲宽度窄的脉冲宽度。

[0068] 参照图9B,通过提供第二预脉冲V_{PRE}"而去除在选择的存储器单元串230的升压通道Cha中存储的电荷中的一部分,选择的存储器单元串230的通道Cha的电位可从第一升压电压V_{BOOSTa}下降到第二升压电压$V_{BOOSTa'}$。在这方面,第一验证区间A中,存储器单元231的栅极电压Sel_WL_V与第一升压电压V_{BOOSTa}之间的差值G1可减小到存储器单元231的栅极电压Sel_WL_V与第二升压电压V_{BOOSTb}之间的差G1',其中,存储器单元231被包括在未选择的位线BL<1>的选择的存储器单元串230中且连接到选择的字线WL<1>。结果,当选择的存储器单元串230的通道Cha的电压与存储器单元231的栅极电压Sel WL V之间的差减小时,可以减少热载流子注入。

[0069] 图10A和10B是用于描述根据另一个实施例的控制针对存储器单元的软擦除操作的电位差的方法的曲线图。

[0070] 参照图5和图10A,提供给与未选择的位线BL<1>的未选择的存储器单元串210、220和240和选择的位线BL<2>的未选择的存储器单元串310、320和340连接的串选择线SSL<0>、SSL<1>、SSL<3>和地选择线GSL<0>、GSL<1>和GSL<3>(参照图5)以及Unsel_SSL&GSLs(参照图10A)的第一预脉冲V_{PRE}'的最大电压电平可比图7中示出的第一预脉冲V_{PRE}的最大电压电平低和/或者第一预脉冲V_{PRE}'的脉冲宽度PW'可比图7中示出的第一预脉冲V_{PRE}的脉冲宽度小。

[0071] 参照图10B,通过提供第一预脉冲V_{PRE}'来在第一验证区间A中从未选择的存储器单元串210、220和240的升压通道(BC)沿位线方向去除或沿共源极线方向去除的电荷量可与图7中去除的电荷量不同。结果,与图7中所示的栅极电压的电压降相比,包括在未选择的位线BL<1>的选择的存储器单元串230中且连接到选择的字线WL<1>的存储器单元231的栅极电压Sel_WL_V的电压降减小,因此,与图7中的差G2相比,可减小选择的存储器单元串230的针对通道Cha的电压V_{BOOSTa}的差G2'。结果,当选择的存储器单元串230的通道Cha的电压与存储器单元231的栅极电压之间的差减小时,可减少热载流子注入。

[0072] 图11A至图11D是用于根据实施例详细描述软擦除操作的曲线图。

[0073] 参照图2和图11A,当执行多个编程循环第一Loop至第M Loop对选择的存储器单元进行编程时,控制逻辑110可对存储器单元阵列160中的连接到未选择的位线的选择的存储器单元串中的且连接到选择的字线的存储器单元执行预脉冲编程PP_P操作。预脉冲编程PP_P可被定义为编程操作的一部分。预脉冲编程PP_P可在编程循环第一Loop至第M Loop的执行之前被执行。在一个实施例中,预编程PP_P可不包括单独的验证操作。

[0074] 参照图11B,存储器单元是可被编程为擦除状态E或第一编程状态P1至第七编程状态P7中的一个状态的存储3比特数据的三层单元(TLC)。本发明构思可应用于存储2比特或3比特或更高数据的多层单元(MLC)。进一步参照图11C,当第一存储器单元被调度为被编程到第七编程状态P7时,执行第一存储器单元的预脉冲编程PP P操作,以将第一存储器单元的阈值电压设置到与第七编程状态P7对应的阈值电压范围R7。也就是说,通过执行预脉冲编程PP_P操作,可在执行编程循环之前预先形成调度为被编程到第一编程状态P1至第七编

Micron Ex. 1016, p. 126
Micron v. YMTC
IPR2024-00795

程状态P7的存储器单元的阈值电压分布Prc_P1至Prc_P7。

[0075] 返回参照图2和图11A，软擦除控制器116可在多个编程循环第一LOOP至第M Loop中选择至少一个编程循环，并可将软擦除操作选择性控制为在选择的编程循环中被执行。此外，软擦除控制器116可选择多个编程状态中的一些编程状态，并且可将软擦除操作选择性控制为在将存储器单元编程到选择的编程状态的多个编程循环中被执行。例如，当对由控制逻辑110调度为将在第二编程状态P2至第七编程状态P7中编程的存储器单元执行预脉冲PP_P操作时，软擦除控制器116可进行控制，使得软擦除操作可在多个编程循环第一Loop至第M Loop中的用于将存储器单元编程至第一编程状态P1第一编程循环第一Loop中执行。

[0076] 具体地，参照图5和图11D，在第一编程循环第一Loop的编程操作PO区间中，用于在第一编程状态P1中对存储器单元进行编程的电压被施加到选择的字线SEL_WL，然后在验证操作VO区间中的第一验证区间A的将负的读取电压V_{r1}施加到选择的字线Sel WL，以验证编程状态。此外，如上所述，可通过在第一验证区间A施加预脉冲V_{PRE}来执行软擦除操作。结果，如图11C所示，通过去除不稳定地捕获的电荷，可将阈值电压分布Pre_P2至Pre_P7移位以具有较低阈值电压分布Prc_P2'至Prc_P7'。当形成理想的阈值电压分布时，可以提高读取性能。

[0077] 图11A至11D是本公开的示例性实施例，其不限于此，并且可通过使用根据预脉冲编程PP_P被执行的条件的各种方法来控制软擦除操作。

[0078] 图12是示出根据实施例的执行软擦除操作的方法的流程图。在针对附图12和13的下面的描述中，第一位线被假设为选择的位线，第二位线被假设为未选择的位线，但是未选择的位线不限于一条位线。

[0079] 参照图12，在一个编程循环(或者，一个编程循环的编程操作区间中)中，编程电压可被施加到包括在连接到选择的第一位线的选择的存储器单元串中且连接到选择的字线的第一存储器单元(S100)。此后，在第一验证区间，将用于验证第一存储器单元的编程状态的读取电压施加到选择的字线，可将第一预脉冲施加到连接到第一位线的多个未选择的存储器单元串中的每一个的串选择晶体管的栅极和连接到未选择的第二位线的多个未选择的存储器单元串中的每一个的串选择晶体管的栅极(S110)。在这方面，在第一验证区间，包括在连接到第二位线的选择的存储器单元串中且连接到选择的字线的第二存储器单元可被软擦除。然后，在第二验证区间，可将选择电压施加到与第一位线连接的选择的存储器单元串的串选择晶体管的栅极和与第二位线连接的选择的存储器单元串的串选择晶体管的栅极，从而可验证第一存储器单元的编程状态(S120)。

[0080] 图13是示出根据实施例的执行软擦除操作的方法的流程图。

[0081] 参照图13，可在执行S100之前对连接到第二位线的多个串的通道进行升压(S101)。例如，可通过对包括包括在连接到第二位线的多个串中的选择的存储器单元串中且连接到选择的字线的第二存储器单元的存储器单元执行预脉冲编程操作，来对连接到第二位线的多个串的通道进行升压。

[0082] 图14A和14B是用于解释根据实施例的基于编程电压电平的预脉冲操作的操作机制的示图。

[0083] 首先，参照图2和图5，预脉冲控制器114可选择编程循环第一Loop至第M Loop中的一些编程循环，并在选择的编程循环中经由连接到未选择的存储器单元串的串选择线SSL_b

Micron Ex. 1016, p. 127
Micron v. YMTC
IPR2024-00795

施加预脉冲Prc-Pulsc，来去除每一个未选择的存储器单元串的升压通道的电荷。然而，假设在图14A中预脉冲控制器114不执行如上所述的预脉冲操作，并且假设在图14B中，脉冲控制器114对所有的编程循环第一Loop至第M Loop执行预脉冲操作。

[0084] 参照图5和图14A，当执行编程循环时，可将0V的电压施加到选择的位线BL<2>，可将0V的电压施加到连接到未选择的存储器单元串320的串选择线SSL<1>，可将通过电压V_{PASS}施加到未选择的字线WL<0>、WL<2>和WL<3>，并且可将比参考电压电平低的编程电压V_{PGMa}施加到包括在与选择的位线BL<2>连接的未选择的存储器单元串320中且连接到选择的字线WL<1>(参照图5)以及Sel_WL(参照图14A)的存储器单元的栅极。这里，如上所述，由于未选择的存储器单元串320的通道的电压V_{BOOST1}为预定电压电平或更高以及未选择的存储器单元串320的通道的电压V_{BOOST1}与编程电压V_{PGMa}之间的差V_{GAPa}由于预脉冲操作而超过预定电平，因此可发生软擦除，其中，在所述软擦擦中，沿未选择的存储器单元串320的通道方向去除捕获在连接到选择的位线BL<2>的未选择的存储器单元串320所包括且连接到选择的字线WL<1>的存储器单元中的电荷。这可成为导致读取干扰的因素。因此，需要预脉冲操作来防止读取干扰。

[0085] 参照图7和图14B，当执行编程循环时，可将0V的电压施加到选择的位线BL<2>，可将0V的电压施加到连接到未选择的存储器单元串320的串选择线SSL<1>，可将电源电压V_{CC}施加到连接到未选择的存储器单元串320的地选择线GSL<1>，可将通过电压V_{PASS}施加到未选择的字线WL<0>、WL<2>和WL<3>，并且比参考电压电平高的编程电压V_{PGMb}可被施加到包括在连接到选择的位线BL<2>的未选择的存储器单元串320中且连接到选择的字线WL<1>的存储器单元的栅极。如上所述，由于未选择的存储器单元串320的通道的电压V_{BOOST2}被设置为比图14A中的电压V_{BOOST1}相对低以及未选择的存储器单元串320的通道的电压V_{BOOST2}与编程电压V_{PGMb}之间的差V_{GAPb}因预脉冲操作而超过预定电平，因此未选择的存储器单元串320的通道的电荷可沿包括在连接到选择的位线BL<2>的未选择的存储器单元串320中且连接到选择的字线WL<1>的存储器单元的方向注入。这可成为导致读取干扰的因素。因此，需要限制预脉冲操作来防止读取干扰。

[0086] 图15是示出根据实施例的基于编程电压电平来控制预脉冲操作的方法的流程图。

[0087] 参照图15，可开始编程循环以在编程区间中将编程电压施加到选择的存储器单元(S200)。可根据编程区间中的编程电压电平来确定在编程区间之后是否执行预脉冲操作(S210)。如果确定执行预脉冲操作(S220，是)，则可执行预脉冲操作和用于验证选择的存储器单元的编程状态的验证操作(S230)。如果确定不执行预脉冲操作(S220，否)，则可跳过预脉冲操作并且可执行验证操作(S240)。根据实施例，编程区间中的编程电压可以是反映在执行编程循环期间的存储器装置的温度和相应的偏移的电压，并且与编程电压一样，在确定预脉冲操作是否将被执行时使用的参考电压电平也可反映存储器装置的温度和相应的偏移。

[0088] 图16A至图16C是示出根据实施例的基于各种标准来控制预脉冲操作的方法的流程图。

[0089] 参照如16A，在图15中的步骤S200之后，可确定编程区间中的编程电压电平是否超过参考电压电平，以确定是否执行预脉冲操作(S215)。当编程电压电平超过参考电压电平(S215，是)时，可确定跳过预脉冲操作(S217)。当编程电压电平等于或低于参考电压电平

Micron Ex. 1016, p. 128
Micron v. YMTC
IPR2024-00795

(S215,否)时,可确定执行预脉冲操作(S219)。此后,可执行图15中的步骤S220。具体地,通过进一步参照图2,当编程电压电平等于或低于参考电压电平时,如14A中描述,预脉冲控制器114可执行预脉冲操作,使得未选择的存储器单元串320的通道的电压V_{BOOST1}与编程电压V_{PGMa}之间的差V_{GAPa}不超过预定电平,从而可减小未选择的存储器单元串320的通道的电压V_{BOOST1}。当编程电压电平超过参考电压电平时,如图14B中描述,预脉冲控制器114可跳过预脉冲操作,使得未选择的存储器单元串320的通道的电压V_{BOOST2}与的编程电压V_{PGMb}之间的差V_{GAPb}不超过预定电平,从而可增加未选择的存储器单元串320的通道的电压V_{BOOST2}。

[0090] 参照图16B,所述方法还可包括确定在图15中开始执行的编程循环是否对应于需要预脉冲的循环的步骤S213。当编程循环对应于需要预脉冲的循环(S213,是)时,不管编程电压电平,都可确定执行预脉冲操作(S219)。当编程循环不对应于需要预脉冲的循环(S213,否)时,可执行步骤S215。

[0091] 参照图16C,与图16B相比,所述方法还可包括步骤S211,其确定,在擦除状态的存储器块中被执行编程循环的对象是否是选择的第一页的第一字线中的第一串选择线。也就是说,除了执行编程循环的存储器单元之外的存储器单元都处于擦除状态,所以即使如图14A所示执行预脉冲操作也不会产生软擦除。因此如果选择的第一页的第一字线中的第一串选择线被选择作为被擦除状态的存储器块中的被执行编程循环的对象(S211,是),可确定跳过预脉冲操作(S217)。如果处于擦除状态的存储器块不是作为要编程循环的对象选择的第一页的第一字线中的第一串选择线(S211,否),则可执行步骤S213。

[0092] 图17是示出根据实施例的控制预脉冲操作的方法的曲线图;

[0093] 参照图2、图5和图17,控制逻辑110可对选择的存储器单元执行多个编程循环第一Loop至第M Loop,预脉冲控制器114可基于编程循环第一Loop至第M Loop中的每一个编程循环的编程电压电平,来控制对于选择的位线BL<2>的未选择的存储器单元串310、320和340的预脉冲操作(预脉冲操作PPO)。例如,当编程循环第一Loop至第M Loop中的每一个编程循环的编程电压电平等于或低于参考电压V_{REF}电平时,预脉冲控制器114可确定对选择的位线BL<2>的未选择的存储器单元串310、320和340执行预脉冲操作PPO。也就是说,预脉冲控制器114可在编程循环第一Loop至第K Loop中对选择的位线BL<2>的未选择的存储器单元串310、320和340执行预脉冲操作PPO,其中,编程循环第一Loop至第K Loop包括在通过使用等于或低于参考电压V_{REF}的电平的编程电压来执行编程操作的第一编程循环组Loop Group_1中。

[0094] 在一个实施例中,当编程循环第一Loop至第M Loop中的每一个编程循环的编程电压电平超过参考电压V_{REF}时,预脉冲控制器114可跳过对选择的位线BL<2>的未选择的存储器单元串310、320和340执行预脉冲操作PPO。也就是说,可在编程循环第K+1Loop至第N Loop中跳过选择的位线BL<2>的未选择的存储器单元串的预脉冲操作PPO,其中,编程循环第K+1Loop至第N Loop包括在通过使用超过参考电压V_{REF}的电平的编程电压来执行编程操作的第二编程循环组Loop Group_2。

[0095] 在另一个实施例中,预脉冲控制器114可在包括在被设置为需要预脉冲的循环的第三编程循环组Loop Group 3中的编程循环第N+1Loop至第M Loop对选择的位线BL<2>的未选择的存储器单元串310、320和340执行预脉冲操作PPO。预脉冲控制器114可从外部接收设置信号,可基于设置信号设置需要预脉冲的循环,并且可将因此而生成的设置信息存储

Micron Ex. 1016, p. 129
Micron v. YMTC
IPR2024-00795

在存储器单元阵列160的一部分中。

[0096] 图18A和图18B是用于解释执行根据实施例的预脉冲操作的预脉冲区间的示图。

[0097] 参照图18A，一个编程循环可包括编程区间PGM_INTV和验证区间VFY_INTV，在编程区间PGM_INTV与验证区间VFY_INTV之间设置预脉冲区间，使得可执行预脉冲操作。

[0098] 参照图18B，一个编程循环可包括编程区间PGM_INTV和验证区间VFY_INTV，在验证区间VFY_INTV设置预脉冲区间PP_INTV。

[0099] 图19是示出根据实施例的基于编程电压电平来控制预脉冲操作的方法的流程图。

[0100] 参照图19，可开始编程循环的操作，以在编程区间中将编程电压施加到选择的存储器单元(S300)。在编程区间之后，可基于编程区间中的编程电压电平确定预脉冲施加时间，其中，预脉冲施加时间是用于对未选择的存储单元串执行预脉冲操作的时间(S310)。可基于确定的预脉冲施加时间对未选择的存储器单元串执行预脉冲操作，并且可执行用于验证选择的存储器单元的编程状态的验证操作(S320)。具体地，参照图2，当编程电压电平较高时，预脉冲控制器114在执行预脉冲操作时缩短预脉冲的施加时间，并且减少在未选择的存储器单元的通道中去除的电荷量，从而如在附图14B所述，可将未选择的存储器单元串320的通道的电压V_{BOOST2}与的编程电压V_{PGMb}之间的差V_{GAPb}控制为不超过预定电平。也就是说，在执行多个编程循环方面，预脉冲控制器114可在编程进行到上循环时缩短预脉冲的施加时间。结果，当执行一定数量或更多次循环的编程循环时，可跳过预脉冲操作。

[0101] 图20A、图20B和图20C是示出根据实施例的基于编程电压电平来确定和控制预脉冲的施加时间的方法的示图。

[0102] 参照图2、图5和图20A，预脉冲控制器114可基于编程电压电平确定预脉冲施加时间PPST，其中，在预脉冲施加时间PPST期间，经由未选择的存储器单元串选择线和未选择的地选择线Unsel SSLs & GSLs，将预脉冲施加到包括在选择的位线BL<2>的未选择的存储器单元串310、320和340中的串选择晶体管的栅极和地选择晶体管的栅极。

[0103] 例如，当编程电压电平为第一电平(情况1)时，预脉冲控制器114控制预脉冲在预脉冲区间PP_INTV中的第一预脉冲施加时间PPSTa期间经由未选择的存储器单元串选择线和未选择的地选择线Unsel SSLs & GSLs而被施加到包括在选择的位线BL<2>的未选择的存储器单元串310、320和340中的串选择晶体管的栅极和地选择晶体管的栅极。预脉冲施加时间PPST可表示这种时间，即，在所述时间期间，施加串选择晶体管Vth_SST的栅极的阈值电压电平或者地选择晶体管的栅极的阈值电压电平或者更高阈值电压电平的预脉冲以激活串选择晶体管或地选择晶体管的栅极。

[0104] 参照图2、图5和图20B，当编程电压电平为比第一电平高的第二电平(情况2)时，预脉冲控制器114可控制预脉冲在预脉冲区间PP_INTV中的第二预脉冲施加时间PPSTb期间经由未选择的存储器单元串选择线和未选择的地选择线Unsel SSLs & GSLs而被施加到包括在选择的位线BL<2>的未选择的存储器单元串310、320和340中的串选择晶体管的栅极和地选择晶体管的栅极，其中，第二预脉冲施加时间PPSTb比第一预脉冲施加时间PPSTa短。

[0105] 参照图2和图20C，预脉冲控制器114可通过参考示出编程电压电平PVL和映射在其上的预脉冲施加时间PPST的表Table，基于编程电压电平PVL来确定用于对未选择的存储器单元串执行预脉冲操作的预脉冲施加时间。例如，当编程电压电平PVL是第一电平Lev_1时，预脉冲施加时间PPST可以是第一时间T_1。此外，当编程电压电平PVL为H电平Lev_H时，预脉

Micron Ex. 1016, p. 130
Micron v. YMTC
IPR2024-00795

冲施加时间PPST可以是H时间T_H。表格Table中的信息可存储在存储器单元阵列160的预定部分中，并且可基于从外部接收的信息来更新表格Table。

[0106] 图21是示出根据实施例的SSD系统2000的框图。

[0107] 参照图21，SSD系统2000可包括主机2100和SSD 2200。SSD 2200通过信号连接器与主机2100交换信号，并通过电源连接器接收电力。SSD 2200可包括SSD控制器2210、辅助电力装置2220和多个存储器装置2230、2240和2250。这里，可以使用图1至图20C所示的实施例来实现SSD 2200。

[0108] 具体地，当多个存储器装置2230至2250执行多个编程循环时，基于编程电压电平来控制对每个编程循环中的未选择的存储器单元串执行预脉冲操作。此外，多个存储器装置2230至2250可从多个编程循环选择至少一个编程循环，并且可在编程循环中对包括在连接到未选择的位线的选择的存储器单元串中且连接到选择的字线的存储器单元的存储器单元执行软擦除操作。

[0109] 可通过使用各种类型的封装在SSD系统2000中实现根据实施例的存储卡、非易失性存储器装置和卡控制器。例如，可通过使用以下封装在SSD系统2000中实现根据实施例的闪速存储器装置和/或存储器控制器：诸如，层叠封装(PoP)、球栅阵列(BGA)、芯片尺寸封装(CSP)、塑料引线芯片载体(PLCC)、塑料双列直插封装(PDIP)、华夫包装式裸片、晶片式裸片、板上芯片(COB)、陶瓷双列直插封装(CERDIP)、塑料公制四方扁平封装(MQFP)、薄型四方扁平封装(TQFP)、小外形集成电路(SOIC)，缩小型小外形封装(SSOP)、薄小外形封装(TSOP)、系统级封装(SIP)、多芯片封装(MCP)、晶圆片级构造封装(WFP)或晶片级处理堆叠封装(WSP)。

[0110] 虽然已经参照本发明构思的实施例具体示出和描述了本发明构思，但是应理解，在不脱离权利要求的精神和范围的情况下，可在形式和细节上进行各种改变。

Micron Ex. 1016, p. 131
Micron v. YMTC
IPR2024-00795

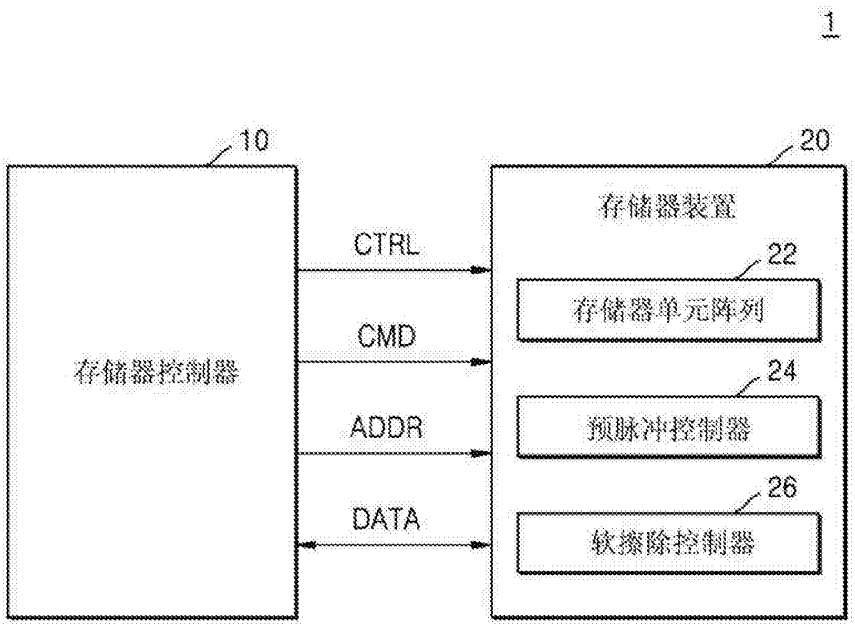


图1

Micron Ex. 1016, p. 132
Micron v. YMTC
IPR2024-00795

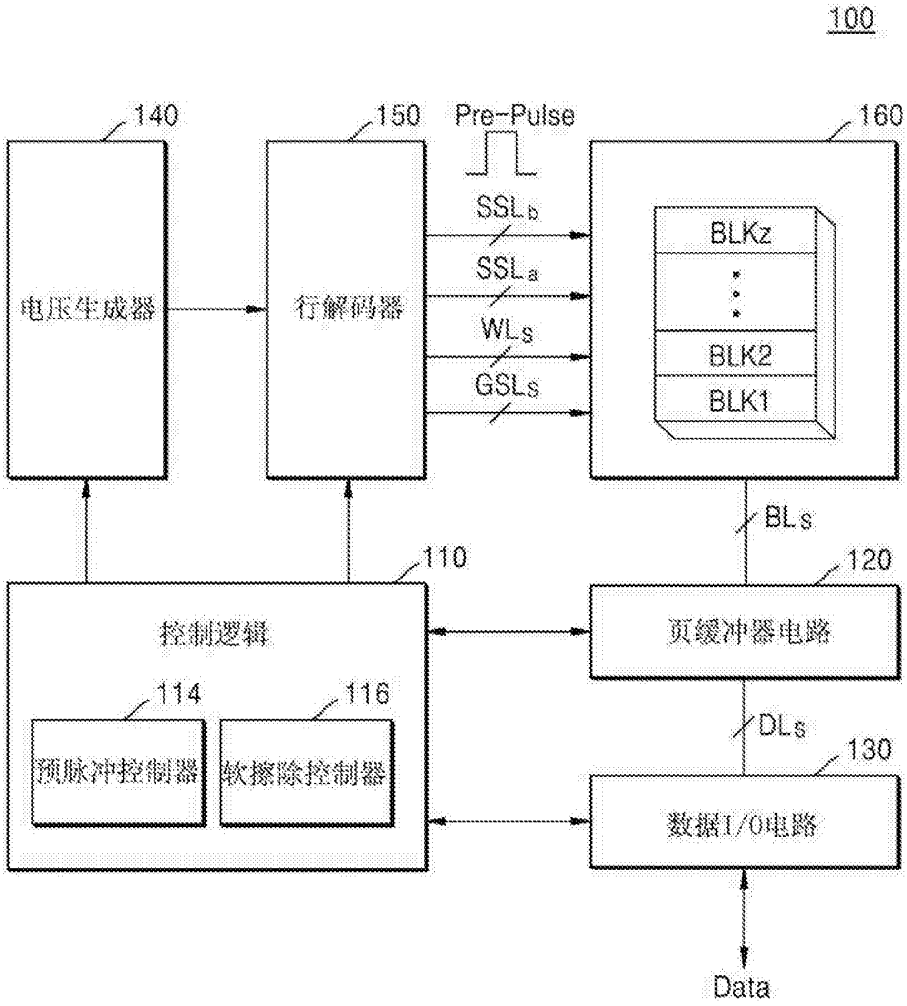


图2

Micron Ex. 1016, p. 133
Micron v. YMTC
IPR2024-00795

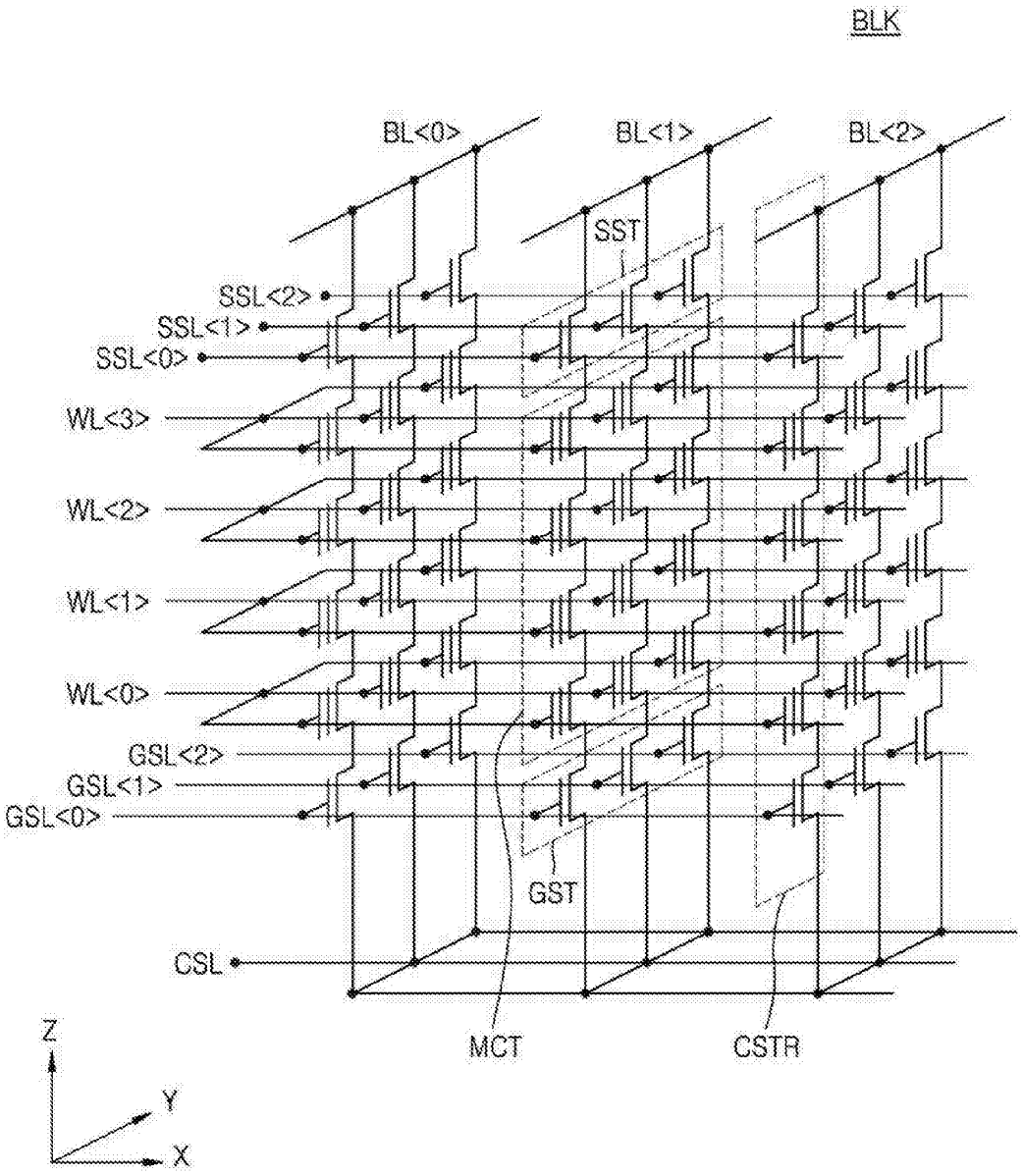


图3

Micron Ex. 1016, p. 134
Micron v. YMTC
IPR2024-00795

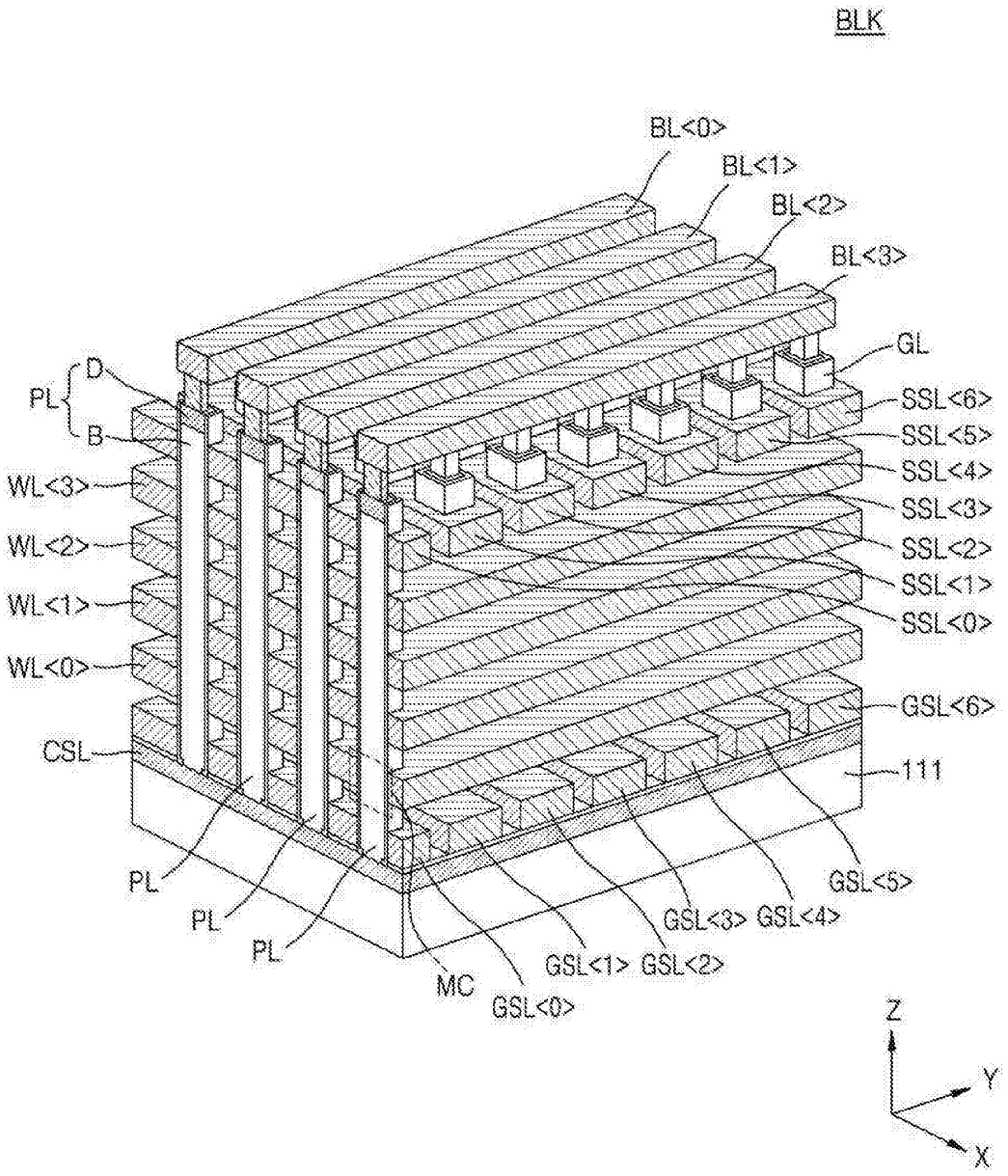


图4

Micron Ex. 1016, p. 135
Micron v. YMTC
IPR2024-00795

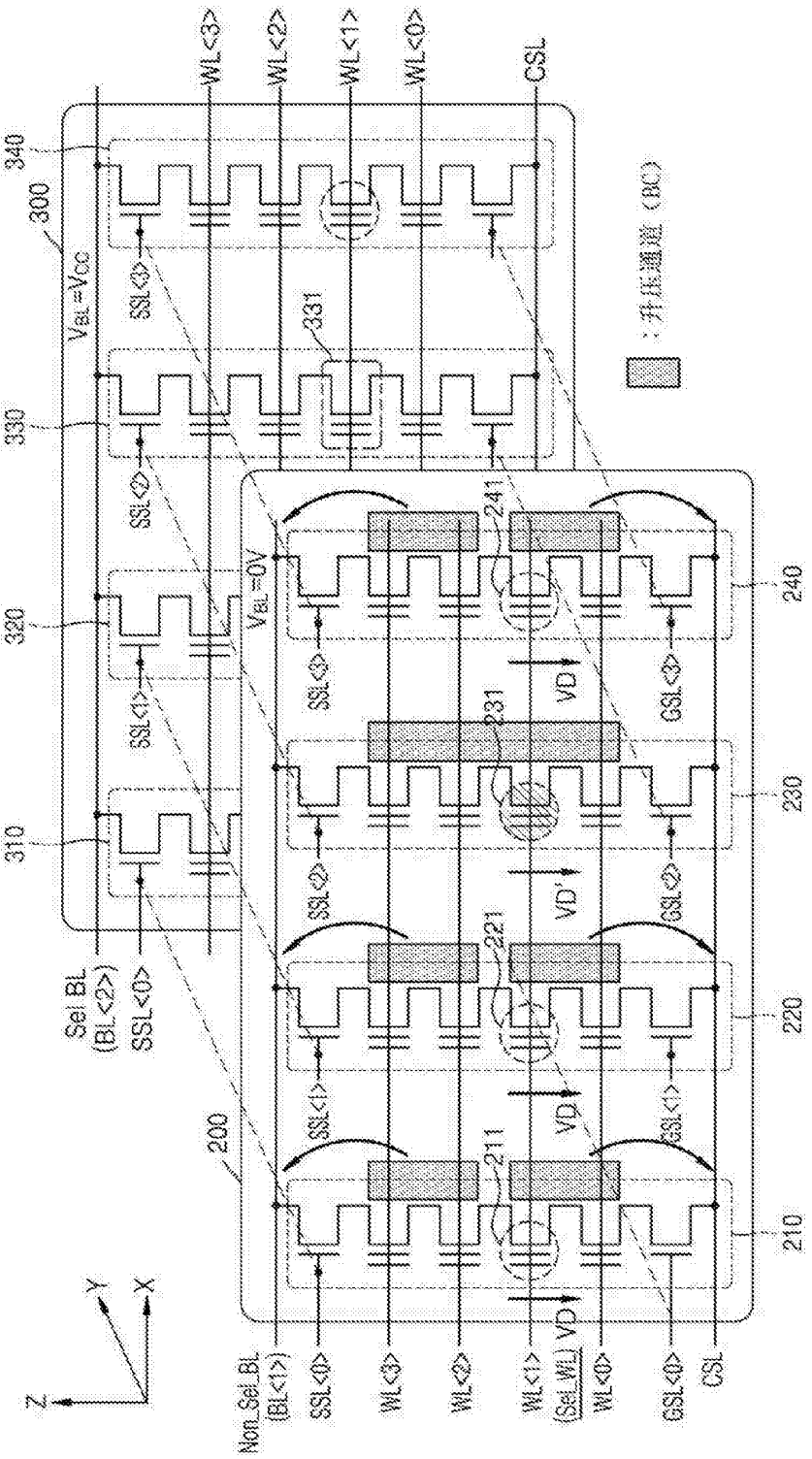


图5

Micron Ex. 1016, p. 136
Micron v. YMTC
IPR2024-00795

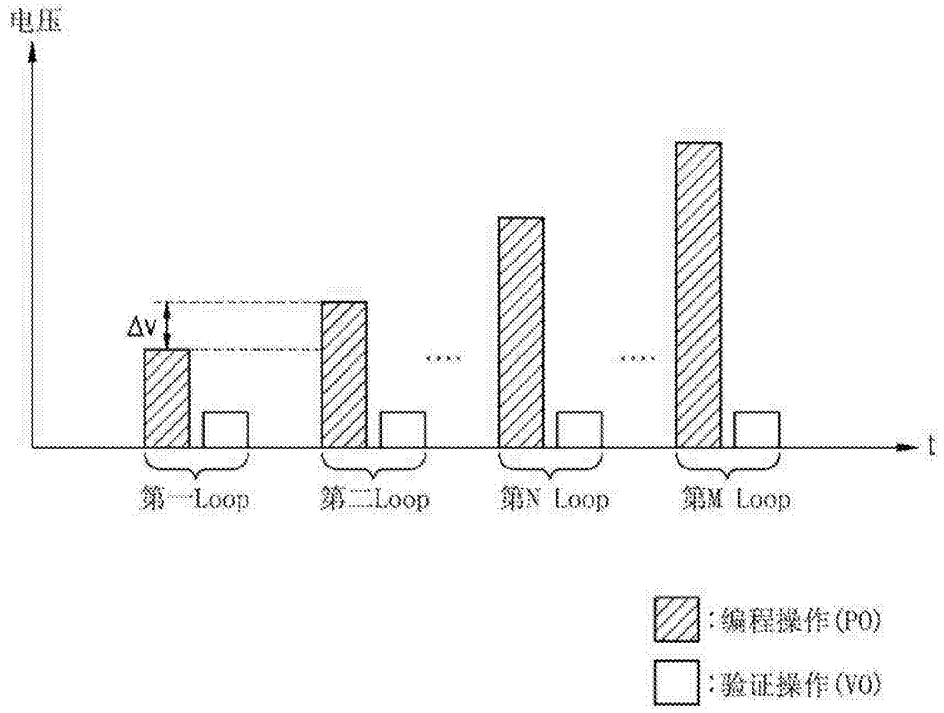


图6

Micron Ex. 1016, p. 137
Micron v. YMTC
IPR2024-00795

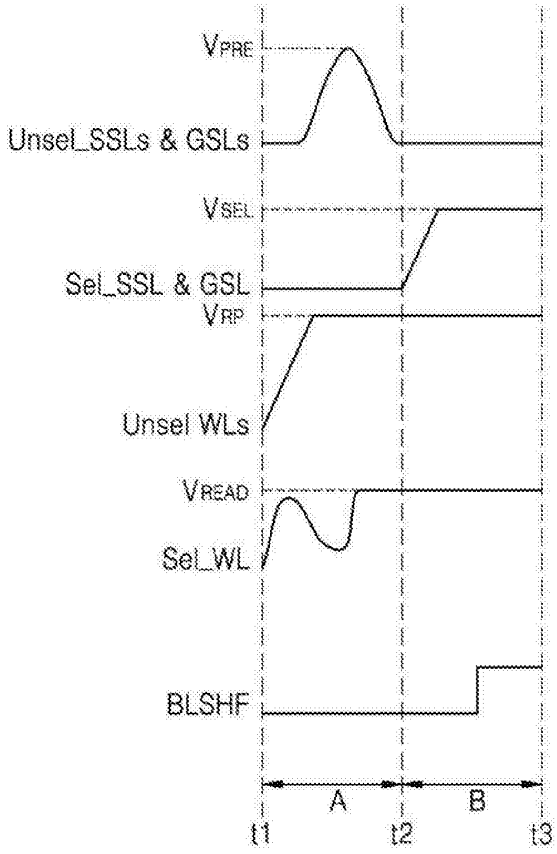


图7

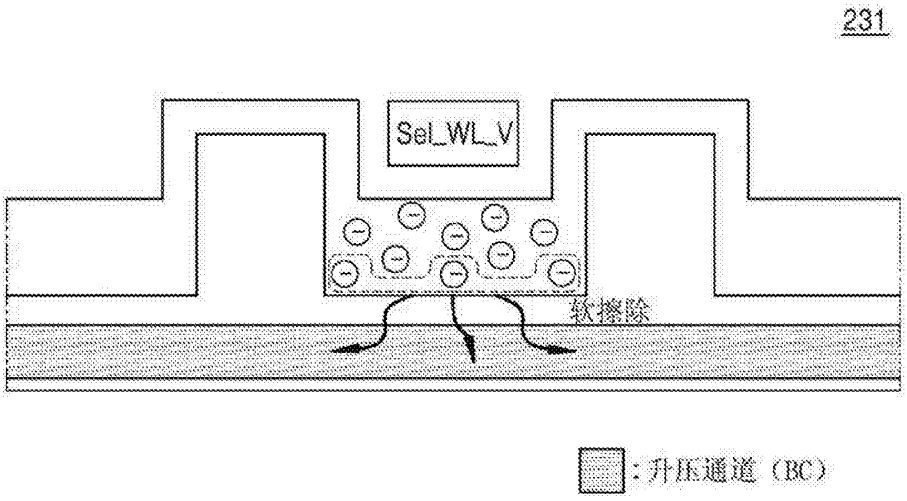


图8

Micron Ex. 1016, p. 138
Micron v. YMTC
IPR2024-00795

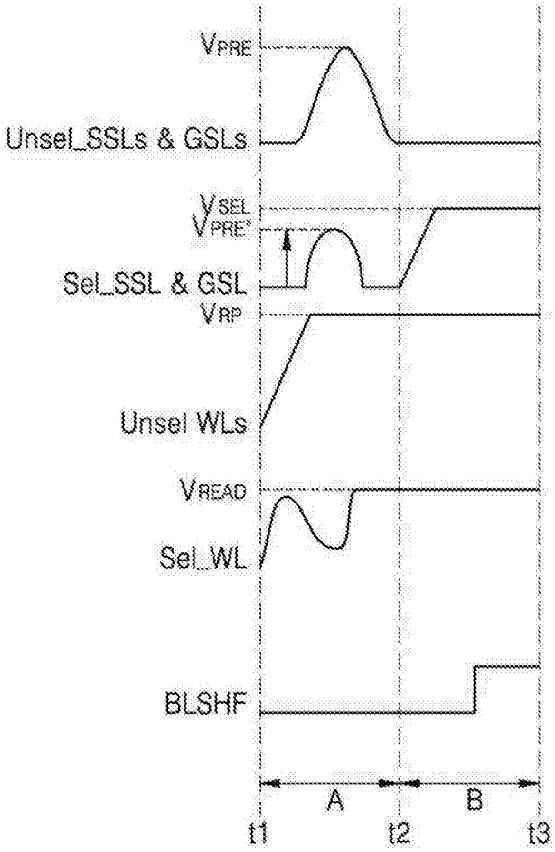


图9A

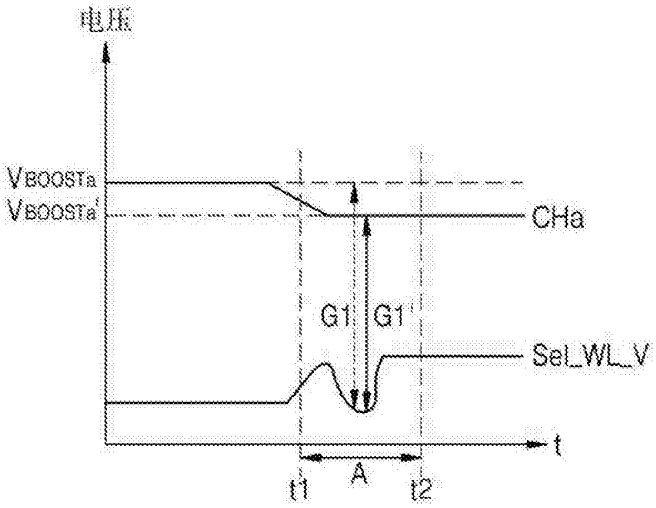


图9B

Micron Ex. 1016, p. 139
Micron v. YMTC
IPR2024-00795

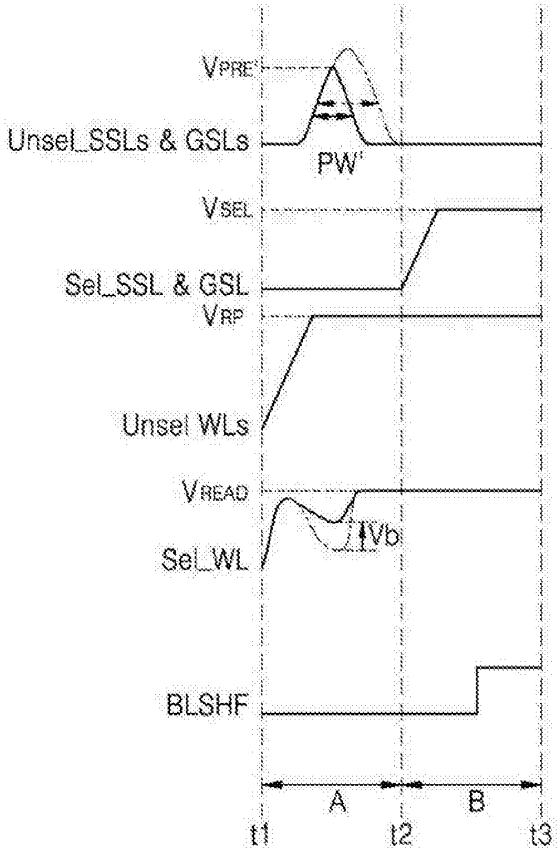


图10A

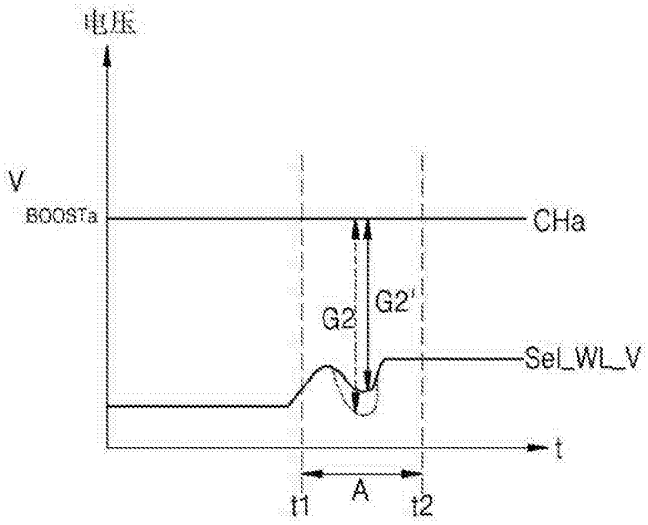


图10B

Micron Ex. 1016, p. 140
Micron v. YMTC
IPR2024-00795

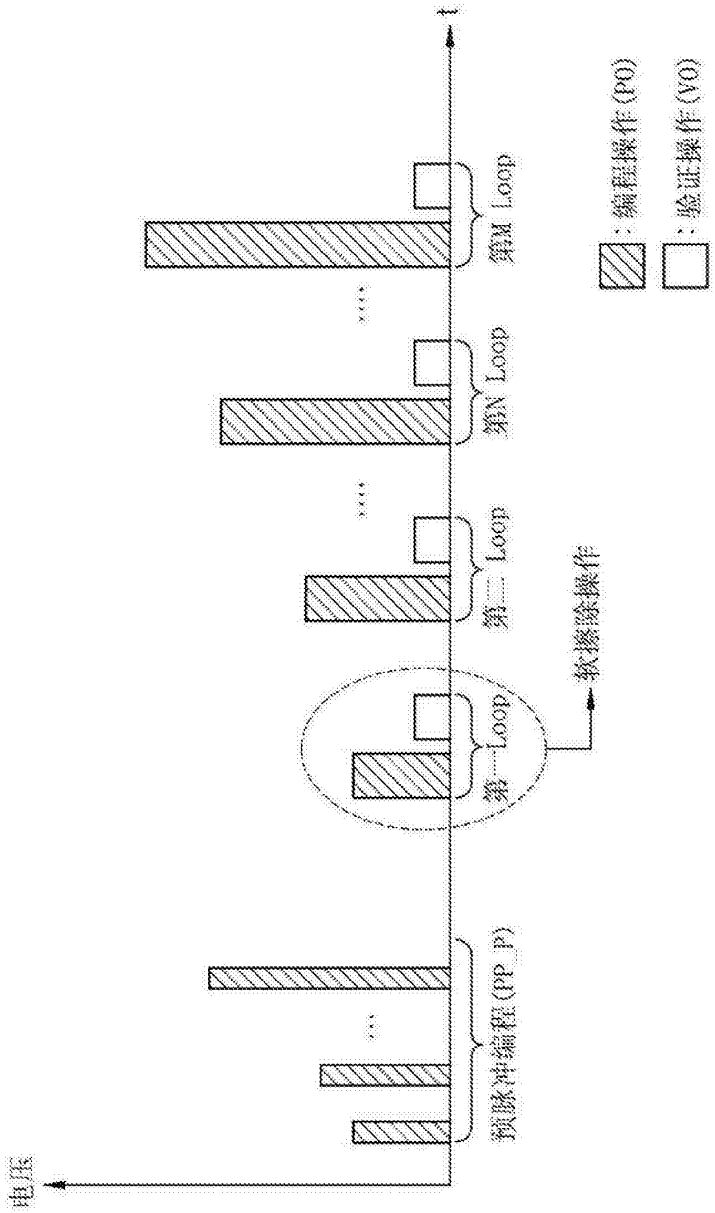


图11A

Micron Ex. 1016, p. 141
Micron v. YMTC
IPR2024-00795

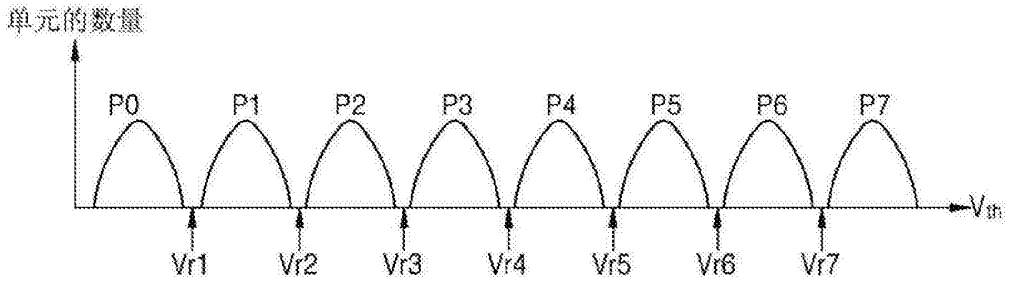


图11B

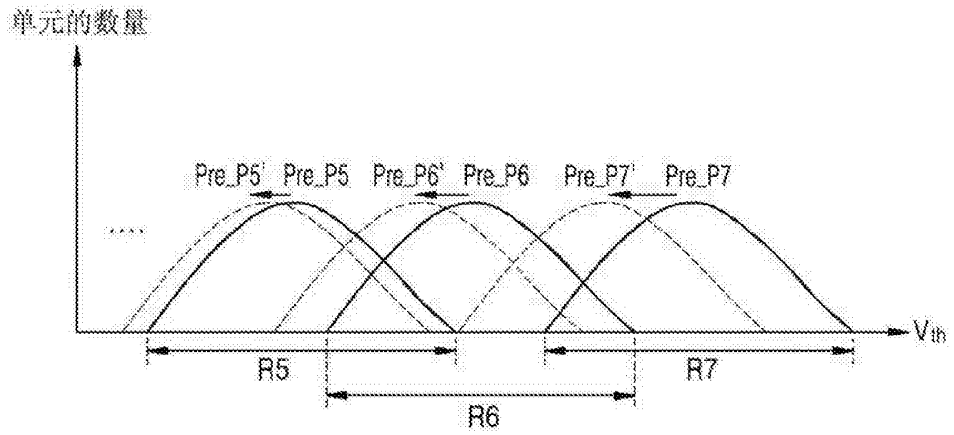


图11C

Micron Ex. 1016, p. 142
Micron v. YMTC
IPR2024-00795

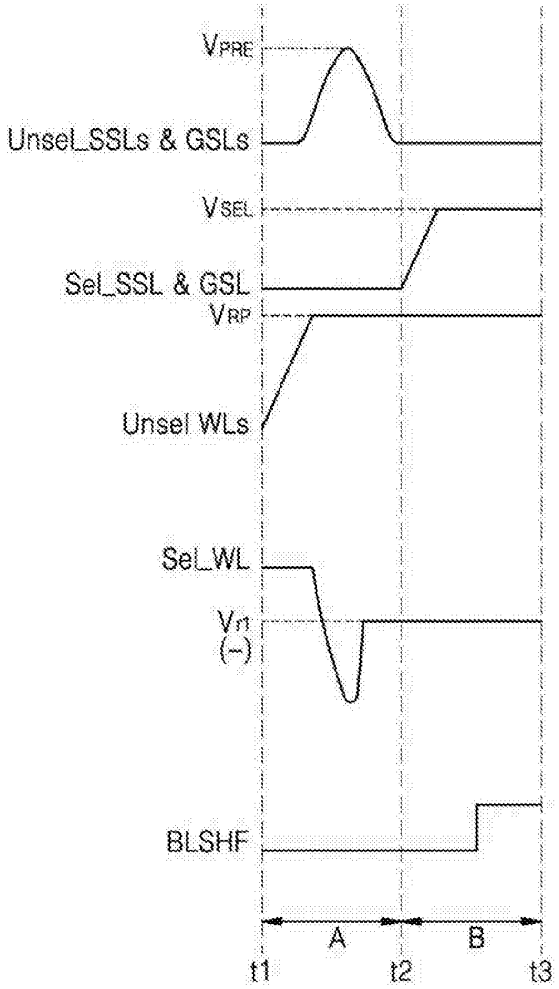


图11D

Micron Ex. 1016, p. 143
Micron v. YMTC
IPR2024-00795

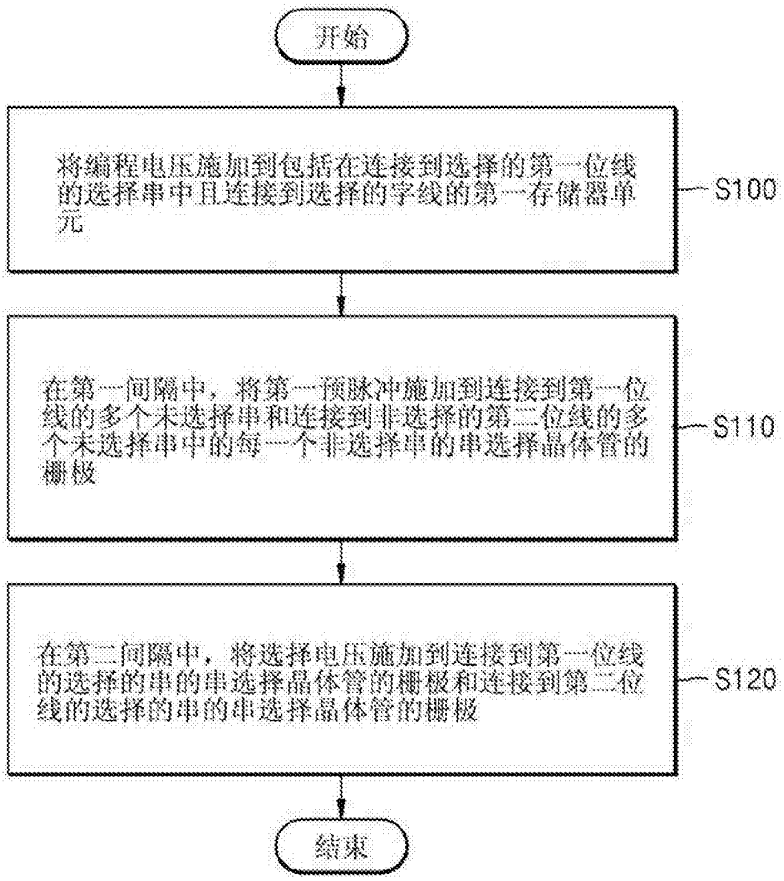


图12

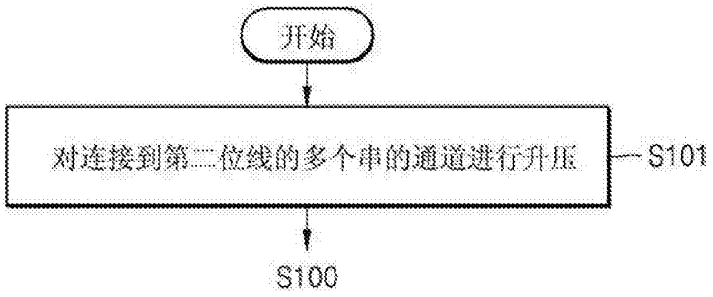


图13

Micron Ex. 1016, p. 144
Micron v. YMTC
IPR2024-00795

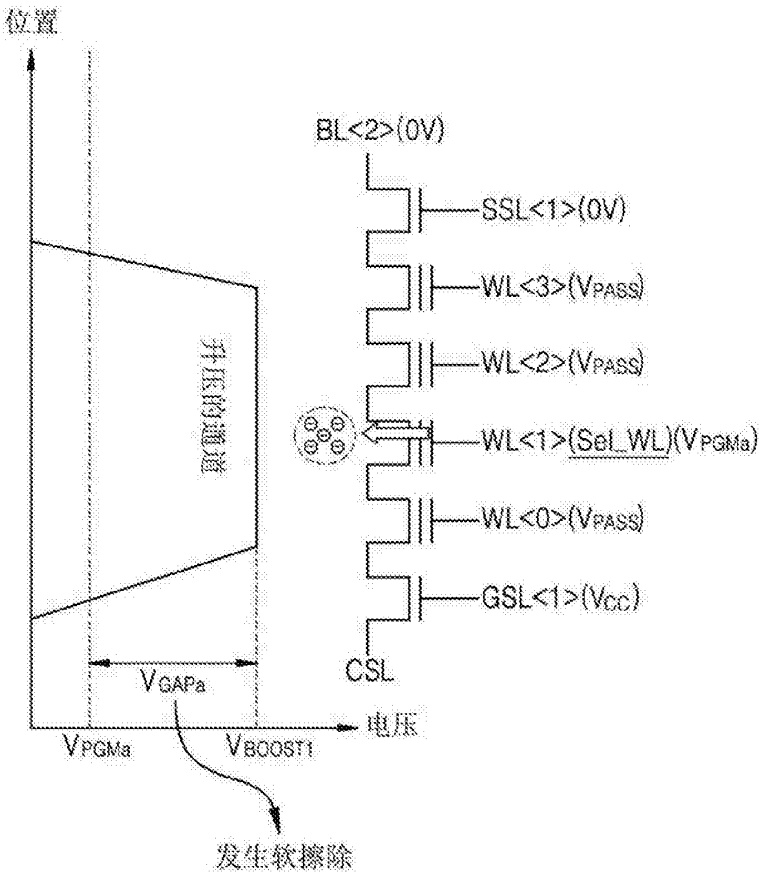


图14A

Micron Ex. 1016, p. 145
Micron v. YMTC
IPR2024-00795

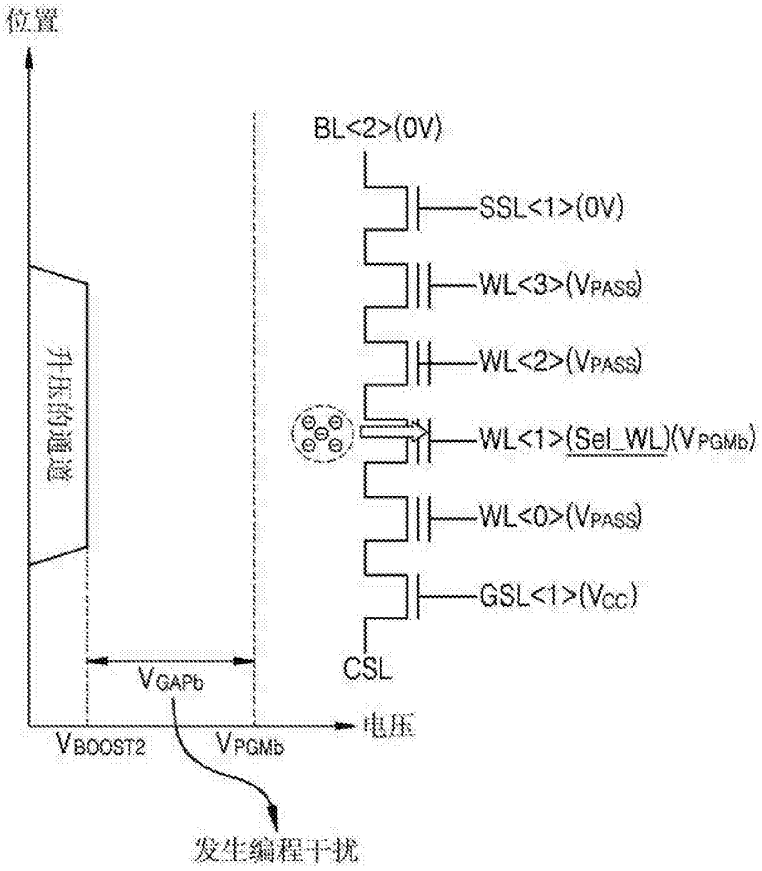


图14B

Micron Ex. 1016, p. 146
Micron v. YMTC
IPR2024-00795

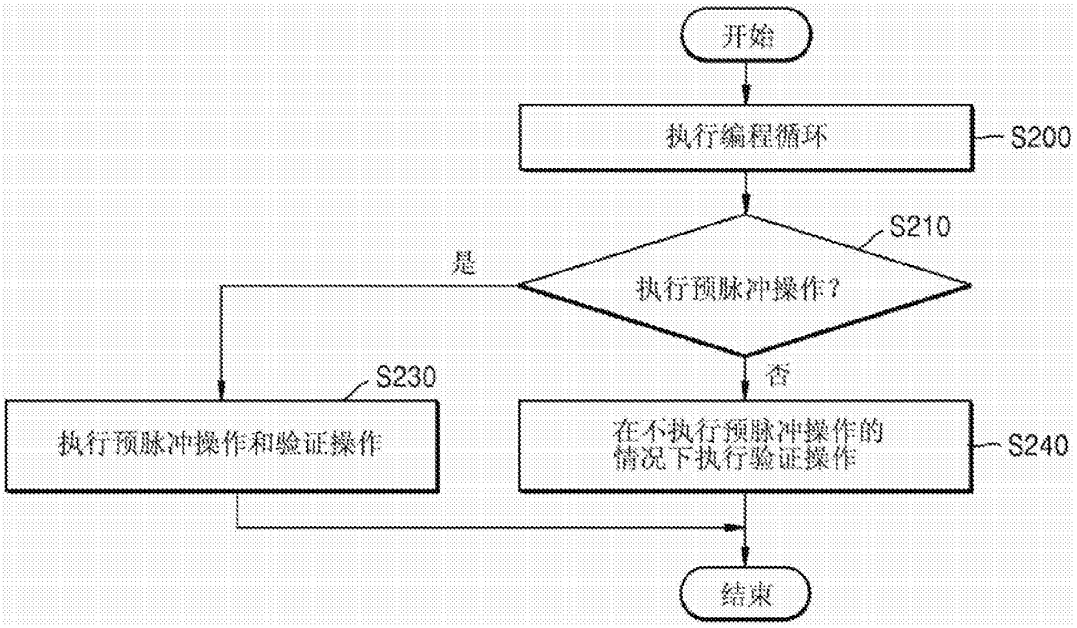


图15

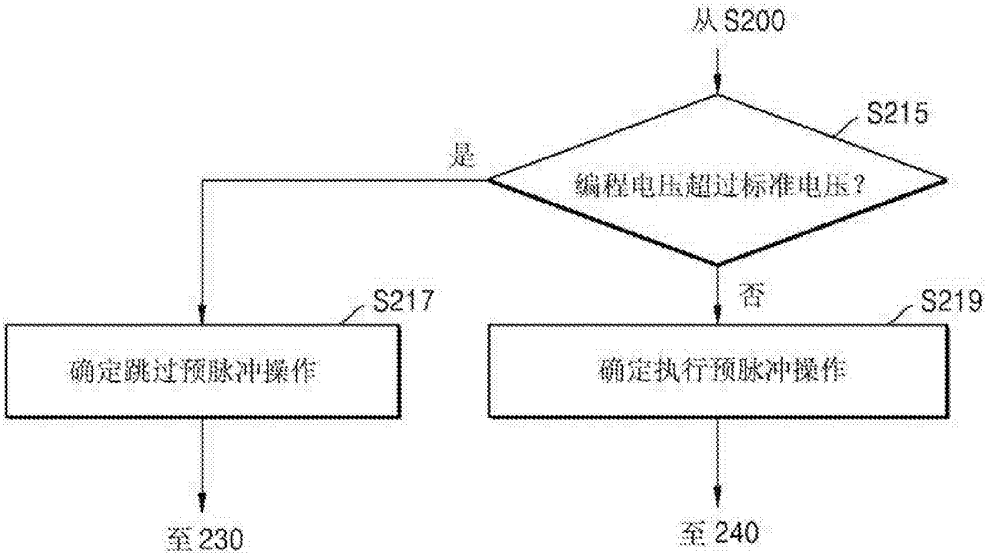


图16A

Micron Ex. 1016, p. 147
Micron v. YMTC
IPR2024-00795

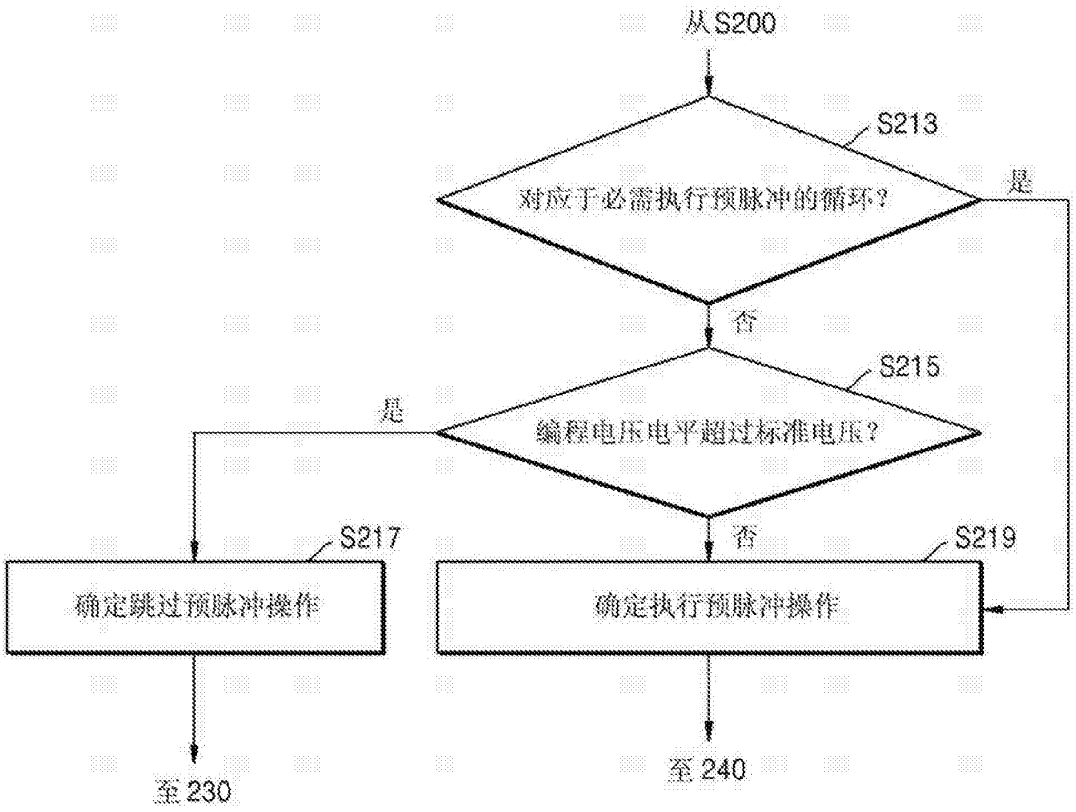


图16B

Micron Ex. 1016, p. 148
Micron v. YMTC
IPR2024-00795

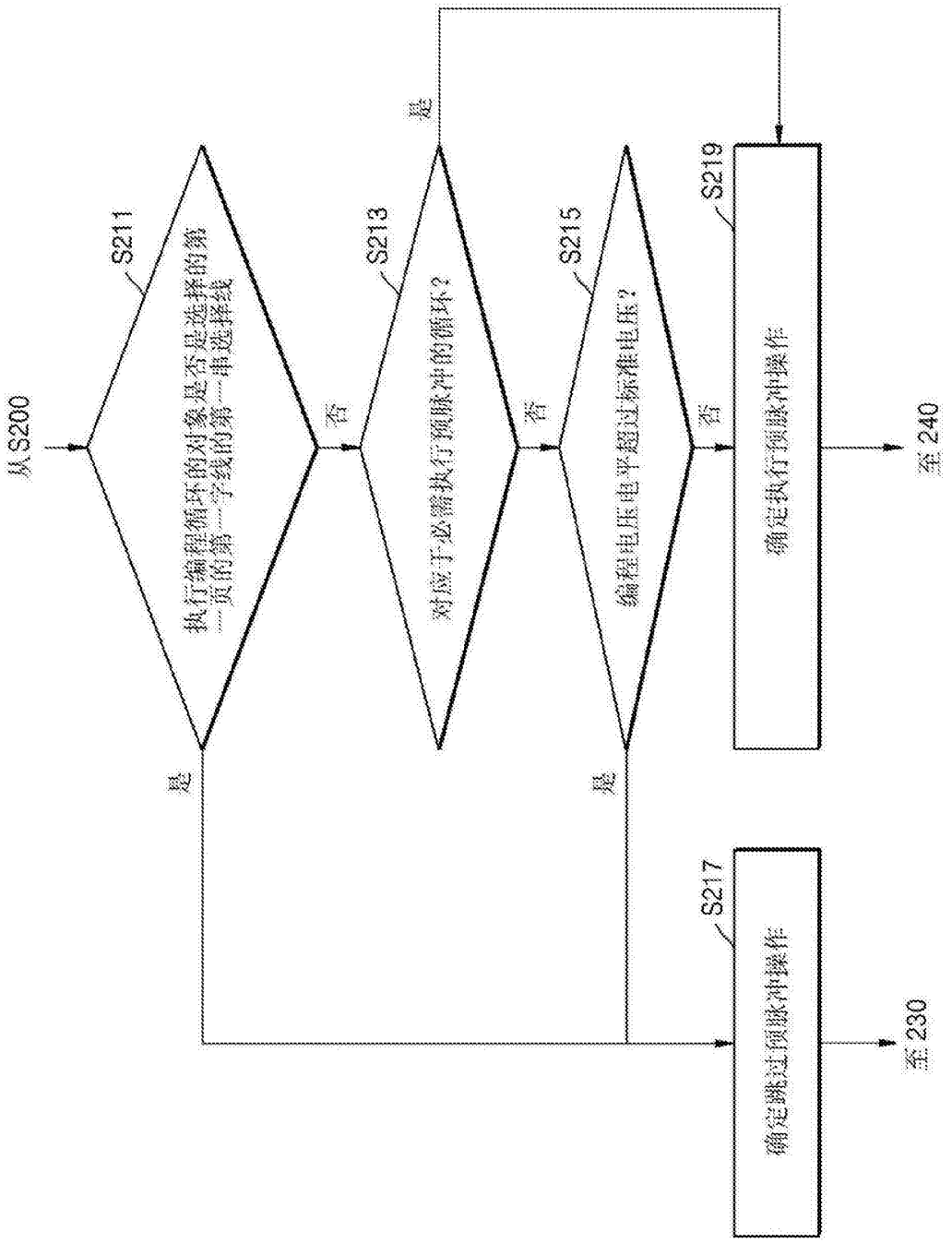


图16C

Micron Ex. 1016, p. 149
Micron v. YMTC
IPR2024-00795

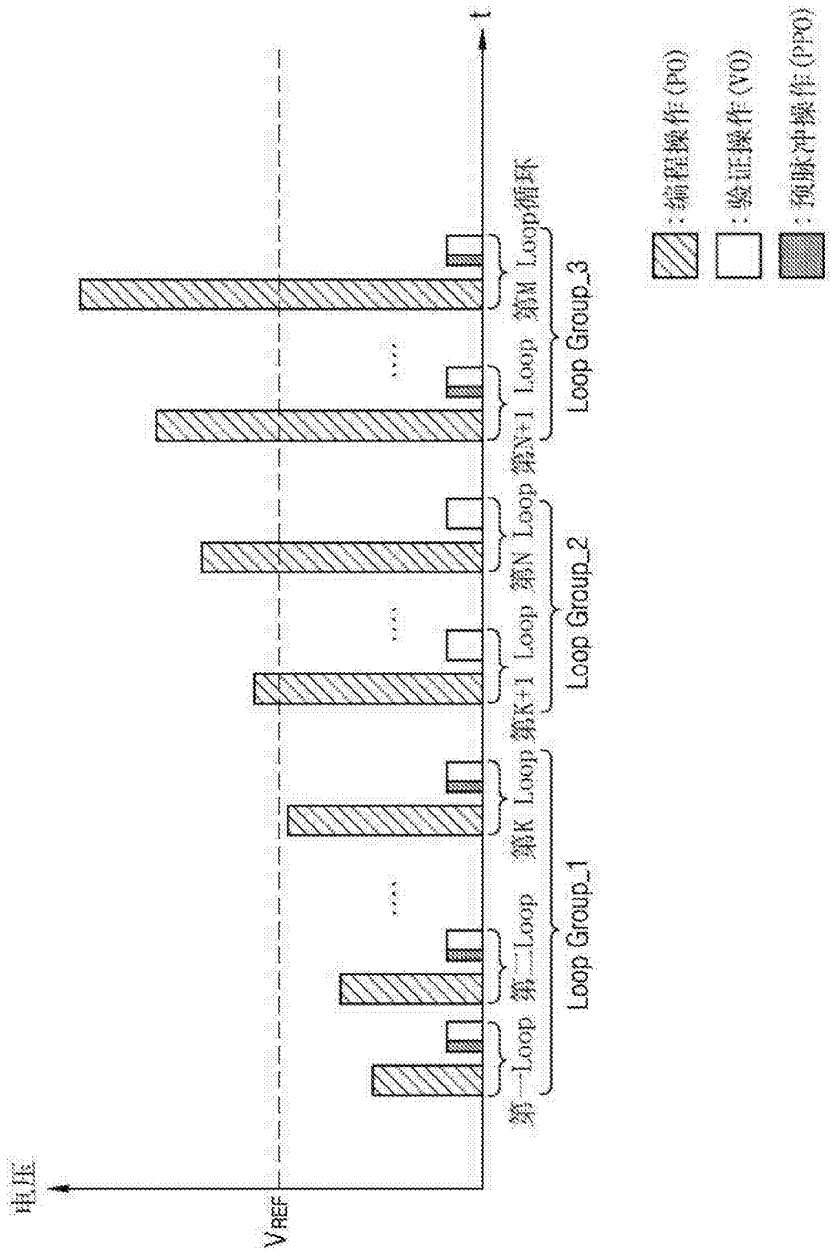


图17

Micron Ex. 1016, p. 150
Micron v. YMTC
IPR2024-00795

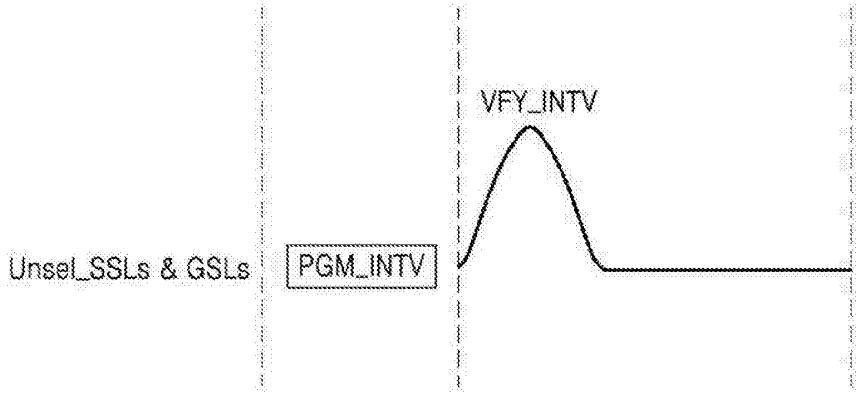


图18A

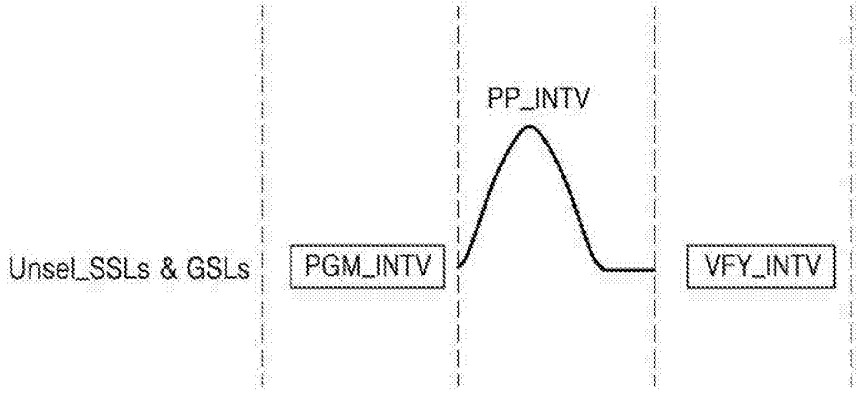


图18B

Micron Ex. 1016, p. 151
Micron v. YMTC
IPR2024-00795

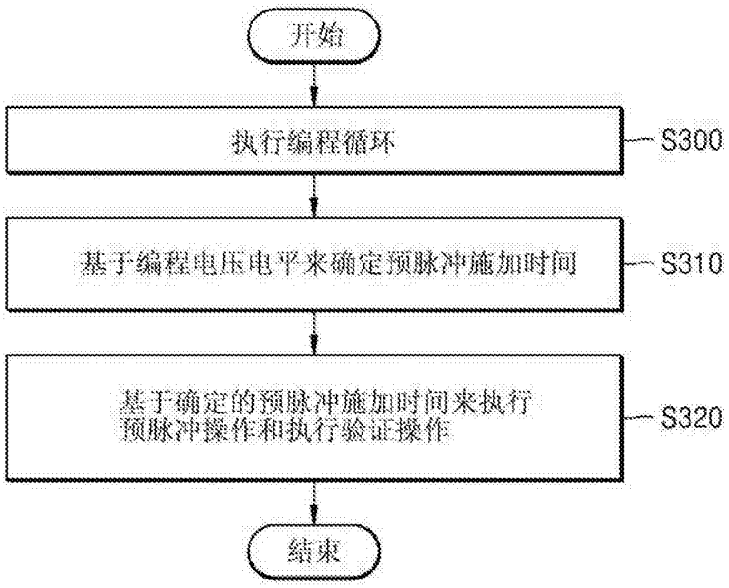


图19

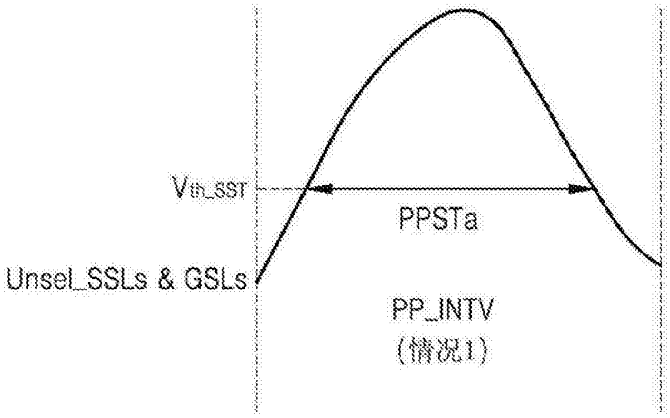


图20A

Micron Ex. 1016, p. 152
Micron v. YMTC
IPR2024-00795

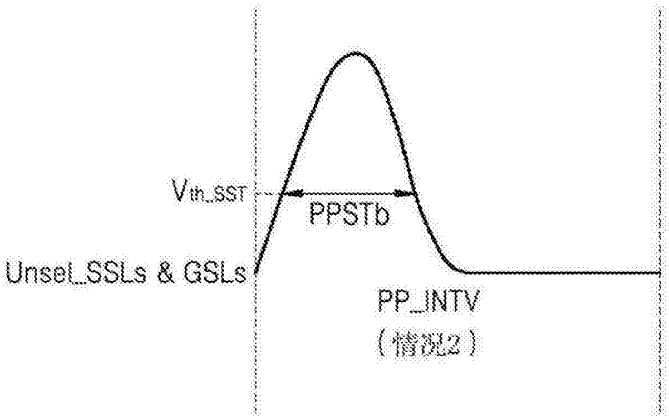


图20B

Table

PGM Vol_Lev (PVL)	Pre-Pulse Sup_Time (PPST)
Lev_1	T_1
Lev_2	T_2
Lev_3	T_3
⋮	⋮
Lev_H	T_H

图20C

Micron Ex. 1016, p. 153
Micron v. YMTC
IPR2024-00795

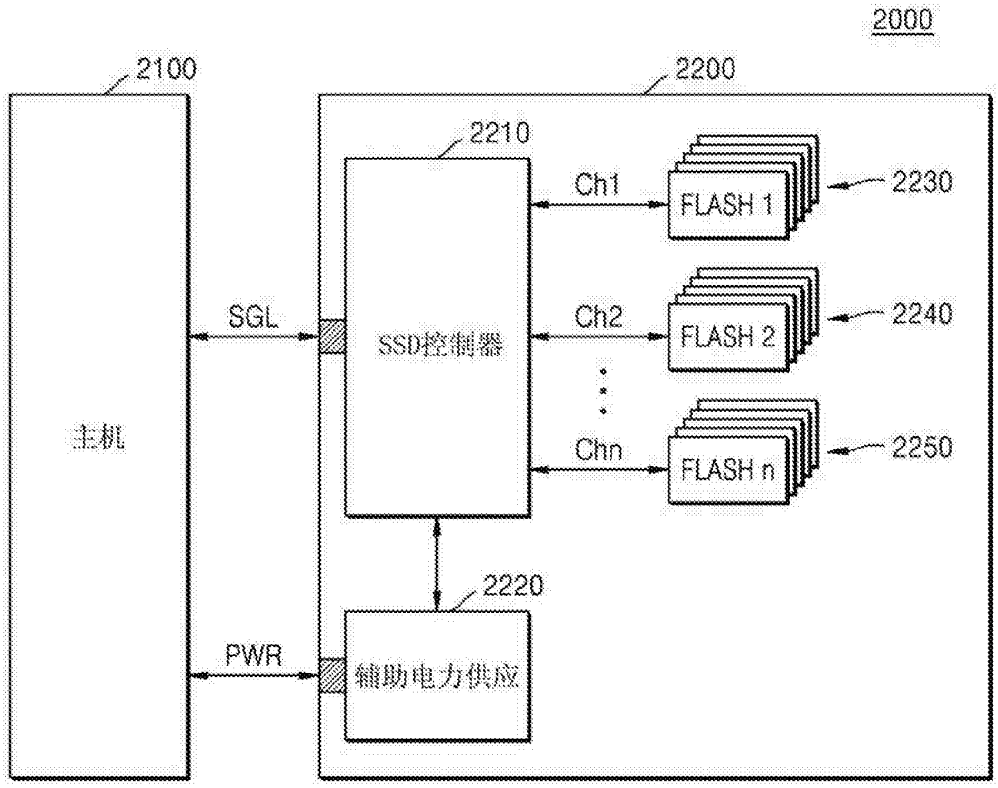


图21

Micron Ex. 1016, p. 154
Micron v. YMTC
IPR2024-00795

Electronic Acknowledgement Receipt

EFS ID:	47599959
Application Number:	17965527
International Application Number:	
Confirmation Number:	7400
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan Jia
Customer Number:	153988
Filer:	Zhiwei Zou/Anna O'Connor
Filer Authorized By:	Zhiwei Zou
Attorney Docket Number:	10018-01-0242-US-CON2
Receipt Date:	27-FEB-2023
Filing Date:	13-OCT-2022
Time Stamp:	22:29:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

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1	Information Disclosure Statement (IDS) Form (SB08)	10018-01-0242-US-CON2_IDS3-SB08.pdf	612089 5569a22c546da3f52e2927812e1891401098cc4f	no	4

Warnings:

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2	Foreign Reference	CN108389601A_Bibl.pdf	5588568 49b15742a4bfec8e436de6b8e7bc59f63a6c2458	no	42
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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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(Not for submission under 37 CFR 1.99)

Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	10018-01-0242-US-CON2

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	2	20080158991	A1	2008-07-03	Hemink et al.	

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	1	20110032797	KR	A	2011-03-30	HYNIX SEMICONDUCTOR INC [KR]		
	2	101627436	CN	A	2010-01-13	MOSAID TECHNOLOGIES INC		

Micron Ex. 1016, p. 157
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Micron Ex. 1016, p. 158
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-28
Name/Print	Zhiwei Zou	Registration Number	66,041

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Micron Ex. 1016, p. 159
Micron v. YMTC
IPR2024-00795

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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.

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.

Micron Ex. 1016, p. 160
Micron v. YMTC
IPR2024-00795

Espacenet

KR20110032797A METHOD OF PROGRAMMING A NON VOLATILE MEMORY DEVICE

Applicants: HYNIX SEMICONDUCTOR INC [KR]

Inventors: KIM DO YOUNG [KR]

Classifications:
IPC ***G11C16/10; G11C16/12; G11C16/24; G11C16/30;***

CPC **G11C16/08 (KR); G11C16/10 (KR); G11C16/24 (KR); G11C16/30 (KR); G11C16/3404 (KR);**

Priorities: KR20090090469A 2009-09-24

Application: KR20090090469A·2009-09-24

Publication: KR20110032797A·2011-03-30

Published as: KR20110032797A

METHOD OF PROGRAMMING A NON VOLATILE MEMORY DEVICE

Abstract

PURPOSE: A method of programming a non volatile memory device is provided to allow a precharge voltage to be evenly precharged in a bit line by applying different path voltages to each word line. CONSTITUTION: A non-volatile memory device comprises memory blocks. Memory blocks comprises a plurality of word lines. Non-selected word lines are divided into at least two word line groups. A voltage is set in at least two word line groups respectively. A voltage is applied in a channel precharge operation. The set voltage is applied to each group. The voltage of the drain select line is applied to a power supply voltage. A bit line is pre-charged.

Micron Ex. 1016, p. 161
Micron v. YMTC
IPR2024-00795

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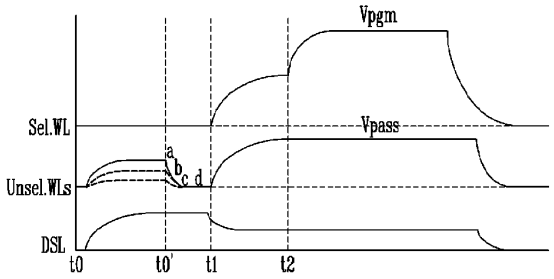
전체 청구항 수 : 총 9 항

(54) 불휘발성 메모리 소자의 프로그램 방법

(57) 요 약

본 발명은 복수개의 워드라인들을 포함하는 메모리 블록들이 포함되는 불휘발성 메모리 소자가 제공되는 단계; 상기 복수개의 워드라인들 중 프로그램 동작을 위해서 선택되지 않은 워드라인 들을 두개 이상의 워드라인 그룹으로 나누는 단계; 상기 두개 이상의 워드라인 그룹 각각에 채널 프리차지 동작시 인가하기 위한 전압을 설정하는 단계; 및 프로그램을 위해, 비트라인을 프리차지하는 동안 상기 설정된 전압을 각각의 그룹에 인가하고, 드레인 선택 라인의 전압을 전원전압으로 인가하여 상기 비트라인을 프리차지 하는 단계를 포함하는 불휘발성 메모리 소자의 프로그램 방법을 제공한다.

대 표 도 - 도4



Micron Ex. 1016, p. 162
Micron v. YMTC
IPR2024-00795

특허청구의 범위

청구항 1

복수개의 워드라인들을 포함하는 메모리 블록들이 포함되는 불휘발성 메모리 소자가 제공되는 단계;

상기 복수개의 워드라인들 중 프로그램 동작을 위해서 선택되지 않은 워드라인 들을 두개 이상의 워드라인 그룹으로 나누는 단계;

상기 두개 이상의 워드라인 그룹 각각에 채널 프리차지 동작시 인가하기 위한 전압을 설정하는 단계; 및

프로그램을 위해, 비트라인을 프리차지하는 동안 상기 설정된 전압을 각각의 그룹에 인가하고, 드레인 선택 라인의 전압을 전원전압으로 인가하여 상기 비트라인을 프리차지 하는 단계

를 포함하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 2

제 1항에 있어서,

상기 복수개의 워드라인들을 두개 이상의 워드라인 그룹으로 나눌 때,

상기 드레인 선택 라인과 소오스 선택 라인에 인접한 워드라인들을 하나 이상 빼고, 상기 워드라인 그룹에 포함되는 워드라인의 개수가 균등하게 나누는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 3

제 2항에 있어서,

상기 비트라인 프리차지시에,

상기 워드라인 그룹에서 제외된 상기 드레인 선택 라인 및 상기 소오스 선택라인에 인접한 워드라인들은 0V를 인가하는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 4

제 3항에 있어서,

상기 두개 이상의 워드라인 그룹에 설정되는 채널 프리차지시의 전압은, 드레인 선택 라인에 인접한 워드라인 그룹일수록 작은 전압 레벨로 설정되는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 5

제 1항에 있어서,

상기 비트라인을 프리차지한 후, 프로그램을 위해 선택된 비트라인을 프로그램할 데이터 상태에 따라서 디스차지하거나, 프리차지 상태로 유지시킨 후, 프로그램을 진행하는 단계를 포함하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 6

제 3항에 있어서,

상기 채널 프리차지시의 전압을 설정하는 것은,

상기 메모리 블록에 포함되는 워드라인의 개수에 따라 상기 채널 프리차지시에 인가할 수 있는 최고 전압레벨을 결정하는 단계; 및

상기 워드라인 그룹들에 대해 워드라인에 인가할 전압을 상기 드레인 선택 라인에서 멀수록 크게 설정하는 단계를 포함하는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 7

Micron Ex. 1016, p. 163
Micron v. YMTC
IPR2024-00795

제 6항에 있어서,

상기 워드라인 그룹의 워드라인에 인가할 전압은,

상기 최고 전압 레벨을 상기 워드라인 그룹의 개수로 나눈 제 1 값을 상기 드레인 선택 라인에 가장 가까운 워드라인 그룹에 인가하는 워드라인 전압으로 설정하고,

이후의 워드라인 그룹들에 대해 상기 드레인 선택 라인에서 멀어질수록 순차적으로 제 1 값씩 상승시켜 워드라인 전압을 설정하는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 8

제 1항에 있어서,

상기 비트라인을 프리차지할 때, 프로그램을 위해 선택되는 워드라인에는 워드라인 그룹에 상관없이 0V를 인가하는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

청구항 9

제 5항에 있어서,

상기 최고 전압 레벨은,

프로그램 금지 메모리 셀의 문턱전압이 프로그램 동작에 의해 변경될 수 있는 전압레벨과 상기 모든 워드라인들의 개수와 곱한 값으로 정하는 것을 특징으로 하는 불휘발성 메모리 소자의 프로그램 방법.

명 세 서

발명의 상세한 설명

기 술 분 야

[0001] 본 발명은 불휘발성 메모리 소자의 프로그램 방법에 관한 것이다.

배 경 기 술

[0002] 최근 들어 전기적으로 프로그램(program)과 소거(erase)가 가능하고, 일정 주기로 데이터를 재작성 해야 하는 리프레시(refresh) 기능이 필요 없는 불휘발성 메모리 소자에 대한 수요가 증가하고 있다.

[0003] 전기적으로 프로그램(program)과 소거(erase)가 가능하며, 전원(Power)이 공급되지 않는 상태에서도 데이터가 소거되지 않고 저장 가능한 불휘발성 메모리 소자의 수요가 증가하고 있다. 그리고 많은 수의 데이터(data)를 저장할 수 있는 대용량 메모리 소자의 개발을 위해서 메모리 셀의 고집적화 기술이 개발되고 있다. 불휘발성 메모리 소자는 복수개의 메모리 셀들이 직렬로 연결되어 한 개의 스트링(string)으로 구성되고, 복수개의 스트링들이 하나의 메모리 셀 어레이(memory cell array)를 포함한다.

[0004] 불휘발성 메모리 소자의 스트링은 비트라인과 소오스 라인 사이에 복수개의 메모리 셀들이 직렬로 연결되는 구조이다. 이러한 스트링 구조로 인해서 비트라인과 소오스 라인의 컨택트(Contact) 개수가 줄어들면서 메모리 셀의 크기를 작게하여 고용량의 메모리를 구현할 수 있다. 그러나 메모리 셀의 크기가 작아지면서 메모리 셀의 전류(Cell Current)가 매우 작기 때문에 액세스(Access) 속도가 느린 단점이 있다.

발명의 내용

해결 하고자하는 과제

[0005] 따라서 본 발명이 이루고자 하는 기술적 과제는 프로그램 동작시의 비트라인을 프리차지할 때, 워드라인별로 서로 다른 패스전압을 인가함으로써 비트라인에 프리차지 전압이 채널 전체에 고르게 프리차지되도록 하여 프로그램 금지 동작에 셀프 부스팅 레벨을 정상적으로 제어하여 디스터브를 줄일 수 있는 불휘발성 메모리 소자의 프로그램 방법을 제공하는데 있다.

과제 해결수단

Micron Ex. 1016, p. 164
Micron v. YMTC
IPR2024-00795

[0006] 본 발명의 특징에 따른 불휘발성 메모리 소자의 프로그램 방법은,

[0007] 복수개의 워드라인들을 포함하는 메모리 블록들이 포함되는 불휘발성 메모리 소자가 제공되는 단계; 상기 복수개의 워드라인들 중 프로그램 동작을 위해서 선택되지 않은 워드라인 들을 두개 이상의 워드라인 그룹으로 나누는 단계; 상기 두개 이상의 워드라인 그룹 각각에 채널 프리차지 동작시 인가하기 위한 전압을 설정하는 단계; 및 프로그램을 위해, 비트라인을 프리차지하는 동안 상기 설정된 전압을 각각의 그룹에 인가하고, 드레인 선택 라인의 전압을 전원전압으로 인가하여 상기 비트라인을 프리차지 하는 단계를 포함한다.

[0008] 상기 복수개의 워드라인들을 두개 이상의 워드라인 그룹으로 나눌 때, 상기 드레인 선택 라인과 소오스 선택 라인에 인접한 워드라인들을 하나 이상 빼고, 상기 워드라인 그룹에 포함되는 워드라인의 개수가 균등하게 나누는 것을 특징으로 한다.

[0009] 상기 비트라인 프리차지시에, 상기 워드라인 그룹에서 제외된 상기 드레인 선택 라인 및 상기 소오스 선택라인에 인접한 워드라인들은 0V를 인가하는 것을 특징으로 한다.

[0010] 상기 두개 이상의 워드라인 그룹에 설정되는 채널 프리차지시의 전압은, 드레인 선택 라인에 인접한 워드라인 그룹일수록 작은 전압 레벨로 설정되는 것을 특징으로 한다.

[0011] 상기 비트라인을 프리차지한 후, 프로그램을 위해 선택된 비트라인을 프로그램할 데이터 상태에 따라서 디스차지하거나, 프리차지 상태로 유지시킨 후, 프로그램을 진행하는 단계를 포함한다.

[0012] 상기 채널 프리차지시의 전압을 설정하는 것은, 상기 메모리 블록에 포함되는 워드라인의 개수에 따라 상기 채널 프리차지시에 인가할 수 있는 최고 전압레벨을 결정하는 단계; 및 상기 워드라인 그룹들에 대해 워드라인에 인가할 전압을 상기 드레인 선택 라인에서 멀수록 크게 설정하는 단계를 포함하는 것을 특징으로 한다.

[0013] 상기 워드라인 그룹의 워드라인에 인가할 전압은, 상기 최고 전압 레벨을 상기 워드라인 그룹의 개수로 나눈 제 1 값을 상기 드레인 선택 라인에 가장 가까운 워드라인 그룹에 인가하는 워드라인 전압으로 설정하고, 이후의 워드라인 그룹들에 대해 상기 드레인 선택 라인에서 멀어질수록 순차적으로 제 1 값씩 상승시켜 워드라인 전압을 설정하는 것을 특징으로 한다.

[0014] 상기 비트라인을 프리차지할 때, 프로그램을 위해 선택되는 워드라인에는 워드라인 그룹에 상관없이 0V를 인가하는 것을 특징으로 한다.

[0015] 상기 최고 전압 레벨은, 프로그램 금지 메모리 셀의 문턱전압이 프로그램 동작에 의해 변경될 수 있는 전압레벨과 상기 모든 워드라인들의 개수와 곱한 값으로 정하는 것을 특징으로 한다.

표 1

[0016] 이상에서 설명한 바와 같이, 본 발명에 따른 불휘발성 메모리 소자의 프로그램 방법은, 프로그램 동작에서 비트라인을 프리차지하는 동안 워드라인들에 패스전압을 다양하게 인가함으로써 셀 스트링 전체에 프리차지 전압이 고르게 전달되게 함으로써 프로그램 금지 셀 스트링의 부스팅 동작이 정상적으로 이루어지게 하여 디스터브를 줄일 수 있다.

발명의 실시를 위한 구체적인 내용

[0017] 이하, 첨부된 도면을 참조하여 본 발명의 바람직한 실시 예를 설명하기로 한다. 그러나 본 발명은 이하에서 개시되는 실시 예에 한정되는 것이 아니라 서로 다른 다양한 형태로 구현될 수 있으며, 단지 본실시 예는 본 발명의 개시가 완전하도록 하며 통상의 지식을 가진 자에게 발명의 범주를 완전하게 알려주기 위해 제공되는 것이다.

[0018] 도 1은 불휘발성 메모리 소자를 나타낸다.

[0019] 도 1을 참조하면, 불휘발성 메모리 소자(100)는 메모리 셀 어레이(110), 페이지 버퍼부(120), X 디코더(130), 전압 제공부(140) 및 제어부(150)를 포함한다.

[0020] 메모리 셀 어레이(110)는 복수개의 메모리 블록(BK)들을 포함한다.

[0021] 각각의 메모리 블록(BK)은 복수개의 셀 스트링들을 포함한다. 각각의 셀 스트링은 소오스 선택 트랜지스터(Source Select Transistor; SST)와 드레인 선택 트랜지스터(Drain Select Transistor; DST)의 사이에 제 1 내

Micron Ex. 1016, p. 165
Micron v. YMTC
IPR2024-00795

지 제 64 메모리 셀(C0 내지 C63)이 직렬로 연결된다.

[0022] 상기한 셀 스트링들이 드레인 선택 트랜지스터(DST)들의 게이트에는 드레인 선택 라인(Drain Select Line; DSL)이 연결되고, 소오스 선택 트랜지스터(SST)들이 게이트에는 소오스 선택 라인(Source Select Line; SSL)이 연결된다.

[0023] 제 1 내지 제 64 메모리 셀(C0 내지 C63)의 게이트에는 각각 제 1 내지 제 64 워드라인(WL0 내지 WL63)이 연결된다.

[0024] 그리고 소오스 선택 트랜지스터(SST)의 소오스단은 공통적으로 소오스 라인(Source Line; SL)에 연결되고, 드레인 선택 트랜지스터(DST)의 드레인단에는 비트라인(Bit Line; BL)이 각각 연결된다.

[0025] 페이지 버퍼부(120)는 하나 이상의 비트라인에 연결되는 페이지 버퍼들을 포함한다. 페이지 버퍼들은 비트라인과 워드라인에 의해서 선택되는 메모리 셀에 프로그램하기 위한 데이터를 임시 저장하고, 데이터 프로그램 동작을 수행한다.

[0026] 또한 페이지 버퍼는 데이터 독출 동작에서 워드라인과 비트라인에 의해서 선택되는 메모리 셀에 저장된 데이터를 독출 하여 저장한다.

[0027] X 디코더(130)는 제어부(150)의 제어신호에 따라서 메모리 블록(BK)들 중 하나를 인에이블시키고, 제 1 내지 제 64 워드라인(WL0 내지 WL63)과 드레인 선택 라인(DSL) 및 소오스 선택 라인(SSL)에 동작 전압을 제공하기 위한 글로벌 라인(GL)들에 연결한다.

[0028] 전압 제공부(140)는 동작 전압을 생성하여 글로벌 라인(GL)들에 제공한다.

[0029] 제어부(150)는 페이지 버퍼부(120), X 디코더(130) 및 전압 제공부(140)의 동작 제어를 위한 제어신호를 출력한다.

[0030] 제어부(150)는 프로그램 동작에서 채널 프리차지를 할 때 워드라인 그룹을 구분하여 전압을 제어함으로써 금지(inhibit) 시켜야 하는 셀 스트링 전체에 프리차지 전압을 전달할 수 있게 한다.

[0031] 도 2는 일실시예에 따른 프로그램 동작시의 워드라인 전압 인가를 설명하기 위한 타이밍도이다.

[0032] 도 2를 참조하면, 프로그램 동작을 위해서는 먼저 셀 스트링들을 프리차지한다. 이를 위해서 드레인 선택 라인(DSL)에 전원전압을 인가하고 비트라인에도 전원전압을 인가하여 셀 스트링의 채널을 프리차지한다.

[0033] 이때 모든 워드라인들은 0V를 인가하고 있다. 따라서 소거 상태인 메모리 셀은 턴온되고, 프로그램 상태인 메모리 셀은 턴 오프 된다. 따라서 채널에 고르게 프리차지 전압이 전달되지 못할 수 있다.

[0034] 따라서 프로그램 금지(inhibit)를 해야 하는 셀 스트링의 경우에는 채널의 프리차지 전압이 충분하지 않으면 채널 부스팅이 제대로 일어나지 않기 때문에 프로그램 금지가 되지 않고 프로그램이 될 수 있다.

[0035] 셀 스트링의 프리차지 전압은 드레인 선택 라인(DSL), 비트라인에 인가되는 전압, 드레인 선택 트랜지스터(DST)의 문턱전압, 펄스의 길이 등에 영향을 받는다.

[0036] 따라서 셀 스트링의 프리차지 전압을 조절하기 위해서 다양한 요인의 제어를 수행할 수 있다.

[0037] 도 3a 내지 도 3f는 셀 스트링의 프리차지 전압을 다양한 방법으로 제어한 경우의 효과를 측정한 도면이다.

[0038] 도 3a는 드레인 선택 라인(DSL)의 전압을 0V로 하고, 소오스 선택 라인(SSL)의 전압을 전원전압으로 인가한 상태에서, 소오스 라인(SL)을 통해서 전압을 입력하여 채널 프리차지를 하고, 프로그램을 진행한 경우의 메모리 셀의 문턱전압 변경 정도를 나타낸다.

[0039] 도 3b는 드레인 선택 라인(DSL)에 전원전압을 인가하고, 소오스 선택 라인(SSL)의 전압을 0V로 한 상태에서, 비트라인(BL)을 통해 전압을 입력하여 채널 트리차지를 하고, 프로그램을 진행한 경우의 메모리 셀의 문턱전압 변경 정도를 나타낸다.

[0040] 특히, 도 3a 및 도 3b는 메모리 블록(BK)의 워드라인이 제 1 내지 제 32 워드라인(WL0 내지 WL31)까지만 있는 경우에 측정한 경우이다.

[0041] 채널 프리차지를 위해 인가되는 소오스 라인 전압(SL) 또는 비트라인 전압(BL)이 2.4 V인 경우를 비교하면, 소오스 라인을 통해서 채널 프리차지를 한 경우에는 소오스 선택 라인에 가장 인접한 제 1 워드라인(WL0)에 연결

Micron Ex. 1016, p. 166
Micron v. YMTC
IPR2024-00795

된 메모리 셀의 문턱전압 변경이 가장 크다. 그리고 비트라인을 통해서 채널을 프리차지한 경우에는 제 32 워드라인(WL31)에 연결된 메모리 셀의 문턱전압 변경이 가장 크다.

[0042] 한편, 도 3b 내지 도 3e는 메모리 블록(BK)에 워드라인이 32개인 경우와 64개인 경우에 패스전압 윈도우(Pass Window)와, 4.5V로 패스전압을 인가했을 때의 프로그램 디스터브 정도를 나타낸다.

[0043] 도 3c는 32개의 워드라인들과 드레인 선택 라인(DSL) 및 소오스 선택 라인(SSL)을 포함하는 34개의 라인이 있는 메모리 블록의 경우이고, 도 3d는 64개의 워드라인들과 드레인 선택라인(DSL) 및 소오스 선택 라인(SSL)을 포함한 66개의 라인이 있는 메모리 블록의 경우이다.

[0044] 패스전압을 변경하면서 프로그램을 했을 때 제 1 워드라인(WL0)에 연결되는 메모리 셀의 문턱전압 변화를 비교하면, 패스전압이 높을수록 셀 스트링 채널의 프리차지 전압이 높아지는 것이다. 따라서 스트링 채널의 프리차지 전압이 높아질수록 디스터브가 줄어드는 것을 확인할 수 있다.

[0045] 도 3e는 34개와 66개 라인에 대해서 각각 패스전압을 4.5V 로 인가한 경우에 드레인 선택 라인(DSL) 전압에 따른 프로그램 디스터브를 측정한 것이다. 평균적으로 66라인의 경우가 34 라인보다 0.5V 정도 디스터브가 증가한 것을 확인할 수 있다.

[0046] 즉, 라인의 개수가 증가할수록 채널 프리차지의 감소와, 낮은 패스전압에서의 부스팅 레벨이 감소한다.

[0047] 그리고 도 3f는 라인의 개수가 증가함에 따라 프로그램 디스터브가 일어나는 정도를 나타낸다. 제 1 워드라인(WL0)에 연결된 메모리 셀의 디스터브 정도를 측정한 것으로 패스전압은 4.5V일 때이다.

[0048] 이상의 도 3a 내지 도 3f에 나타난 바와 같이, 채널의 프리차지 전압을 제어하는 것은 셀프 부스팅 레벨에 중요한 역할을 하여 셀의 디스터브를 제어한다.

[0049] 도 4는 본 발명의 실시 예에 따른 프로그램 동작의 워드라인 제어를 설명하기 위한 타이밍도이다.

[0050] 본 발명의 실시 예에서는 먼저 메모리 블록(BK)들의 제 3 내지 제 62 워드라인(WL2 내지 WL61)들을 여러 개의 그룹으로 나눈다. 제 1, 제 2, 제 63 및 제 64 워드라인(WL0, WL1, WL62, WL53)은 그룹화 하는 워드라인 들에서 제외한다. 그리고 0V를 인가한다.

표 1

[0051]

	6 그룹	전압	5그룹	전압	4그룹	전압	3그룹	전압	2그룹	전압
a	제 1 그룹	0.66	제 1 그룹	0.66	제 1 그룹	0.66	제 1 그룹	0.66	제 1 그룹	0.66
b	제 2 그룹	0.55	제 2 그룹	0.53	제 2 그룹	0.50	제 2 그룹	0.44	제 2 그룹	0.33
c	제 3 그룹	0.44	제 3 그룹	0.40	제 3 그룹	0.33	제 3 그룹	0.22		
d	제 4 그룹	0.33	제 4 그룹	0.26	제 4 그룹	0.17				
e	제 5 그룹	0.22	제 5 그룹	0.13						
f	제 6 그룹	0.11								

[0052] 표 1은 제 1 내지 제 64 워드라인(WL0 내지 WL63)을 포함하는 메모리 블록의 프로그램 동작에서의 채널 프리차지를 위해 워드라인 그룹을 나누고, 각각의 그룹에 패스전압으로 인가하는 전압을 나타낸다. 표 1에서는 6개의 그룹에서 2개의 그룹으로 나누는 경우에 각 그룹에 인가하는 전압 레벨을 나타낸 것으로 소오스 선택 라인(SSL)에 근접한 제 1 그룹에서 드레인 선택 라인(DSL)에 근접한 제 6 그룹으로 나눈다.

[0053] 워드라인 그룹을 나누는 조건으로는, 소오스 선택 라인(SSL)과 드레인 선택 라인(DSL)에 인접한 워드라인들 제외한 나머지 워드라인들을 동일한 개수를 갖도록 그룹을 나눈다. 이때 드레인 선택 라인(DSL)에 가까운 그룹으로부터 순차적으로 그룹 번호를 설정한다. 예를 들어 6개의 그룹으로 할 때 제 6 그룹의 그룹 번호는 '1'이고, 제 5 그룹의 그룹 번호는 '2'이다. 이러한 그룹 번호는 드레인 선택 라인(DSL)에서 멀어질수록 커지는 것으로, 채널 프리차지시에 전압을 인가하기 위해 결정되는 가중치에 해당한다. 즉 소오스 선택 라인(SSL)에 가까울수록 가중치를 크게 하고, 드레인 선택 라인(DSL)에 가까울수록 가중치를 작게한다.

[0054] 상기 워드라인 그룹은 최소한의 워드라인을 포함하도록 나눈다면, 각각의 워드라인마다 다른 패스전압을 인가하는 것도 가능하다. 이때는 각각의 워드라인마다 드레인 선택 라인 쪽에 적은 가중치를 두고, 소오스 선택 라인

Micron Ex. 1016, p. 167
Micron v. YMTC
IPR2024-00795

(SSL)쪽으로 큰 가중치를 줄 수 있다.

[0055] 이때 최고 전압 레벨은 메모리 블록 전체의 라인의 개수에 0.1을 곱한 값으로 정한다. '0.1'디스터브로 인해서 메모리 셀의 문턱전압이 변동되는 평균치를 실험을 통해서 구한 수치로써, 불휘발성 메모리 소자의 특성에 따라서 다르게 적용할 수 있다. 본 발명의 실시 예에 따른 즉 워드라인이 64개와 드레인 선택 라인(DSL) 및 소오스 선택 라인(SSL)을 포함한 66개의 라인이 있을 때는 0.66V가 최고 전압 레벨이 된다.

[0056] 그리고 기준 전압레벨은 최고 전압 레벨을 그룹의 개수로 나누어 설정한다. 그리고 기준 전압 레벨에 그룹번호를 곱한 값을 각 그룹에 인가하는 전압레벨로 결정한다.

[0057] 소오스 선택 라인(SSL)과 드레인 선택 라인(DSL)에 근접한 워드라인에는 0V를 인가하여 너무 높게 채널 부스팅이 일어날 때 발생되는 HCI(Hot Carrier Injection)을 방지하기 위해 0V를 인가한다.

[0058] 상기한 그룹을 나눈 상태에서 도 4에 나타난 타이밍도 처럼 전압 인가를 한다.

[0059] 즉, 선택된 워드라인(Sel WL)은 0V를 인가한 상태에서, 선택되지 않은 워드라인들(Unsel WL)들은 그룹별로 각각 설정된 전압을 인가한다. 이때 드레인 선택 라인(DSL)에는 전원전압을 인가한 후, 비트라인(BL)을 통해서 채널 프리차지 전압이 인가된다.

표 2

[0060]

워드라인 그룹		전압
제 1 그룹	WL-2~WL21	aV
제 2 그룹	WL22~WL41	bV
제 3 그룹	WL42~WL61	cV
	WL0, WL1, WL62, WL63	

[0061] 표 2는 워드라인 그룹을 3개로 한 경우에 각 그룹에 워드라인을 나타내고, 또한 도 4에서 제 1 시간(t0)에서 제 2 시간(t1) 사이에 인가하는 전압 레벨을 나타낸다.

[0062] aV는 bV 보다 크고, bV는 cV 보다 큰 전압이다. 전압설정은 앞서 언급한 바와 같이 설정된다.

[0063] 그리고 나머지 워드라인들, 즉 드레인 선택 라인(DSL)과 소오스 선택 라인(SSL)에 인접한 제 1, 제 2, 제 63 및 제 64 워드라인(WL0, WL1, WL62, WL63)에는 0V를 인가한다.

[0064] 상기한 방식으로 전압을 인가하면, 소오스 선택 라인(SSL)쪽에 인접한 워드라인에 전압을 드레인 선택 라인(DSL)에 인접한 워드라인보다 높은 전압을 인가하면 메모리 셀의 턴온 정도가 커진다. 따라서 소오스 선택 라인(SSL)까지 고르게 채널 프리차지 전압이 전달될 수 있다.

[0065] 셀 스트링의 채널 전체에 고르게 프리차지 전압이 전달되면, 이후에 프로그램 금지(inhibit)되는 셀 스트링의 부스팅 전압 레벨이 조절되어 디스터브를 줄일 수 있다.

[0066] 상기에서 설명한 본 발명의 기술적 사상은 바람직한 실시 예에서 구체적으로 기술되었으나, 상기한 실시 예는 그 설명을 위한 것이며 그 제한을 위한 것이 아님을 주의하여야 한다. 또한, 본 발명은 본 발명의 기술분야의 통상의 전문가라면 본 발명의 기술적 사상의 범위 내에서 다양한 실시예가 가능함을 이해할 수 있을 것이다.

도면의 간단한 설명

[0067] 도 1은 불휘발성 메모리 소자를 나타낸다.

[0068] 도 2는 일실시예에 따른 프로그램 동작시의 워드라인 전압 인가를 설명하기 위한 타이밍도이다.

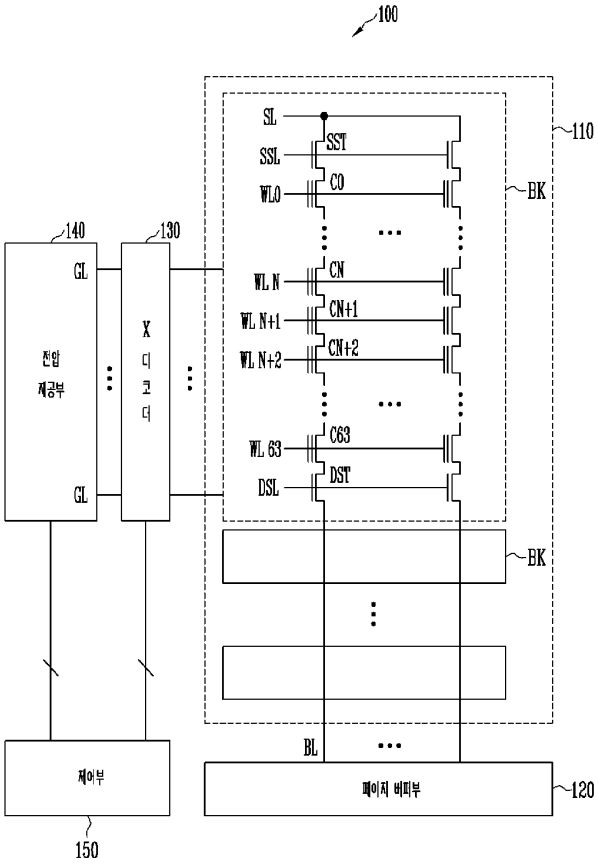
[0069] 도 3a 내지 도 3f는 셀 스트링의 프리차지 전압을 다양한 방법으로 제어한 경우의 효과를 측정한 도면이다.

[0070] 도 4는 본 발명의 실시 예에 따른 프로그램 동작의 워드라인 제어를 설명하기 위한 타이밍도이다.

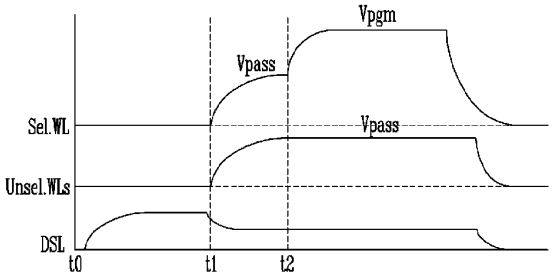
Micron Ex. 1016, p. 168
Micron v. YMTC
IPR2024-00795

도면

도면1

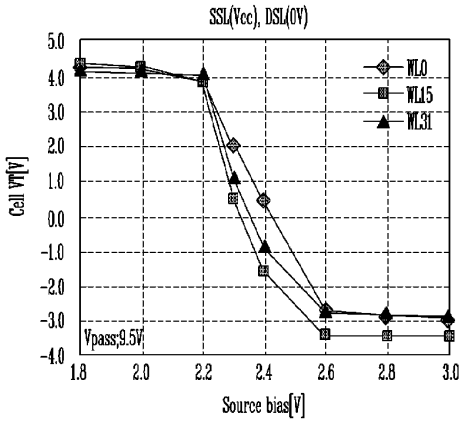


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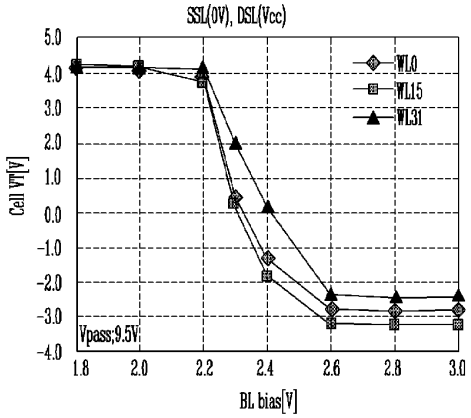


Micron Ex. 1016, p. 169
Micron v. YMTC
IPR2024-00795

도면3a

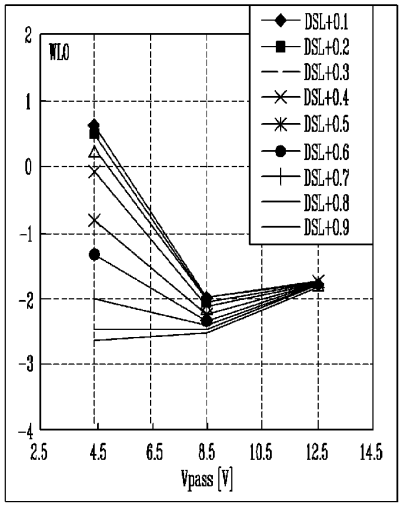


도면3b

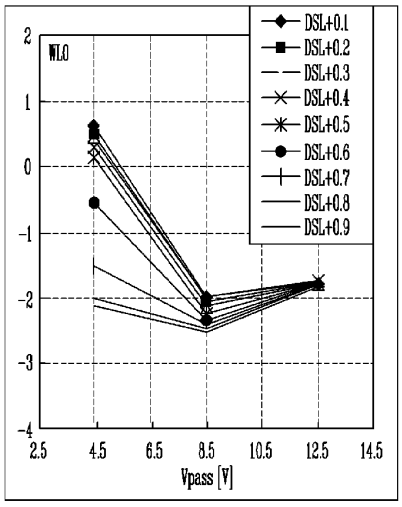


Micron Ex. 1016, p. 170
Micron v. YMTC
IPR2024-00795

도면3c

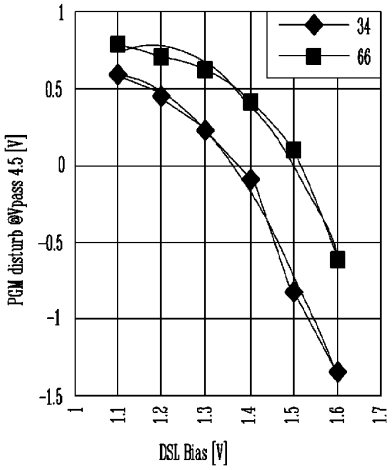


도면3d

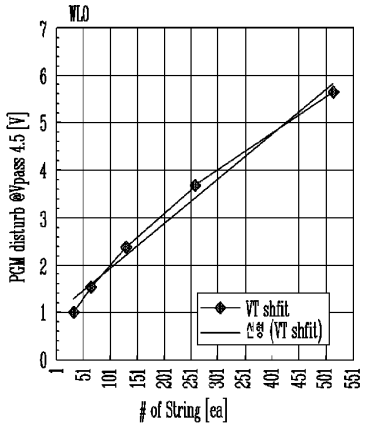


Micron Ex. 1016, p. 171
Micron v. YMTC
IPR2024-00795

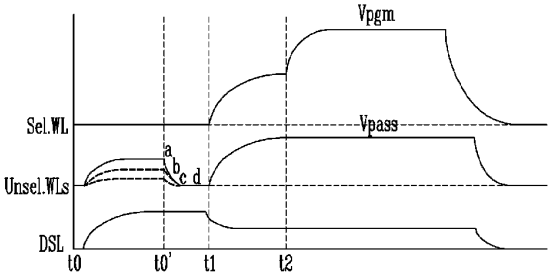
도면3e



도면3f



도면4



Micron Ex. 1016, p. 172
Micron v. YMTC
IPR2024-00795

Espacenet

CN101627436A Flash memory program inhibit scheme

Applicants: MOSAID TECHNOLOGIES INC

Inventors: JIN-KI KIM

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Flash memory program inhibit scheme

Abstract

A method for minimizing program disturb in Flash memories. To reduce program disturb in a NAND Flash memory cell string where no programming from the erased state is desired, a local boosted channel inhibit scheme is used. In the local boosted channel inhibit scheme, the selected memory cell in a NAND string where no programming is desired, is decoupled from the other cells in the NAND string. This allows the channel of the decoupled cell to be locally boosted to a voltage level sufficient for inhibiting F-N tunneling when the corresponding wordline is raised to a programming voltage. Due to the high boosting efficiency, the pass voltage applied to the gates of the remaining memory cells in the NAND string can be reduced relative to prior art schemes, thereby minimizing program disturb while allowing for random page programming.

Micron Ex. 1016, p. 173
Micron v. YMTC
IPR2024-00795

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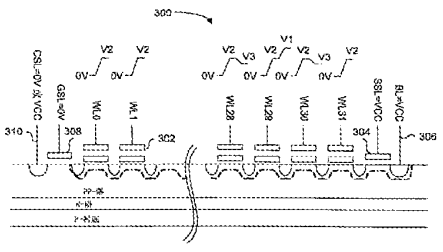
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权利要求书 4 页 说明书 19 页 附图 17 页

[54] 发明名称

闪烁存储器编程禁止方案

[57] 摘要

本发明涉及一种用于最小化闪烁存储器中编程干扰的方法。为了降低不期望从擦除状态进行编程的与非闪烁存储器单元串中的编程干扰，使用局部提升的沟道禁止方案。在该局部提升的沟道禁止方案中，不期望编程的与非串中的所选择的存储器单元和与非串中的其他单元去耦。这使得去耦的单元的沟道被局部提升到在对应字线上升到编程电压时足以禁止 F－N 隧穿的电压电平。由于高提升效率，应用到与非串中的剩余存储器单元的栅极的传递电压可以相对于现有技术方案下降，从而在允许随机页面编程时最小化编程干扰。



Micron Ex. 1016, p. 174
Micron v. YMTC
IPR2024-00795

1、一种用于最小化与非串中编程干扰的方法,所述与非串具有所选择的存储器单元、所述选择的存储器单元和位线之间的上部存储器单元、所述选择的存储器单元和电源线之间的下部存储器单元、以及用于耦合存储器单元到所述位线的串选择晶体管，所述方法包括:

a）将对应于编程禁止电压的电压电平从所述位线耦合到所述与非串;

b）在所述电压电平被耦合到所述与非串的沟道之后，预充电所述选择的存储器单元和所述上部存储器单元的沟道至初级提升的电压电平；以及

c）在所述沟道被预充电之后，局部提升所述选择的存储器单元沟道至次级提升的电压电平，所述次级提升的电压电平高于所述初级提升的电压电平。

2、根据权利要求 1 所述的用于最小化编程干扰的方法，其中，对应于编程禁止电压的所述电压电平在第一时间周期内被耦合到所述位线。

3、根据权利要求 2 所述的用于最小化编程干扰的方法，其中，在所述第一时间周期之后的第二时间周期内预充电所述沟道。

4、根据权利要求 3 所述的用于最小化编程干扰的方法，其中，在所述第二时间周期之后的第三时间周期内局部提升所述选择的存储器单元沟道。

5、根据权利要求 4 所述的用于最小化编程干扰的方法，其中，所述局部提升的步骤包括将连接到所述选择的存储器单元的所选择的字线驱至编程电压电平。

6、根据权利要求 5 所述的用于最小化编程干扰的方法，其中，所述耦合的步骤包括在所述第一时间周期内将所述串选择晶体管驱至第一电压电平，随后在第二时间周期中将所述串选择晶体管驱至去耦电压电平，所述去耦电压电平低于所述第一电压电平。

7、根据权利要求 5 所述的用于最小化编程干扰的方法，其中，所述预充电的步骤包括将所述选择的字线和连接到所述上部存储器单元的上部字线驱至第一传递电压电平。

8、根据权利要求 7 所述的用于最小化编程干扰的方法，其中，所述第一传递电压低于 10 伏特。

Micron Ex. 1016, p. 175
Micron v. YMTC
IPR2024-00795

9、根据权利要求 8 所述的用于最小化编程干扰的方法，其中，所述第一传递电压大约 7 伏特。

10、根据权利要求 7 所述的用于最小化编程干扰的方法，其中，所述第一传递电压具有用于有效地最小化所述上部存储器单元中的编程干扰并最大化所述初级提升的电压电平的值。

11、根据权利要求 7 所述的用于最小化编程干扰的方法，其中，所述局部提升的步骤包括电关闭与所述选择的存储器单元相邻的所述上部存储器单元。

12、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述驱动所述选择的字线的步骤包括：在与所述选择的存储器单元相邻的所述上部存储器单元被关闭之后，将所述选择的字线驱至所述编程电压电平。

13、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述电关闭的步骤包括将与所述上部存储器单元连接的上部字线从所述第一传递电压电平降低到去耦电压电平，而所述选择的字线被驱至所述编程电压电平。

14、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述电关闭的步骤包括将与所述上部存储器单元连接的上部字线从所述第一传递电压电平降低到去耦电压电平，并且在所述上部字线开始向所述去耦电压电平下降之后的一个预定延迟时间，将所述选择的字线驱至所述编程电压电平。

15、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述电关闭的步骤包括将除了与所述选择的字线相邻的上部字线之外的所述上部字线从所述第一传递电压电平上升到第二传递电压，而所述选择的字线被驱至所述编程电压电平，并且与所述选择的字线相邻的所述上部字线保持在所述第一传递电压电平。

16、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述预充电的步骤包括将连接到所述下部存储器单元的下部字线驱至第二传递电压，所述第二传递电压小于所述第一传递电压。

17、根据权利要求 16 所述的用于最小化编程干扰的方法，其中，所述局部提升的步骤包括将与所述选择的字线相邻的下部字线从所述第二传递电压降低到关闭电压电平，而所述选择的字线被驱至所述编程电压电

Micron Ex. 1016, p. 176
Micron v. YMTC
IPR2024-00795

平。

18、根据权利要求 11 所述的用于最小化编程干扰的方法，其中，所述预充电的步骤包括将连接到所述下部存储器单元的除了与所述选择的字线相邻的下部字线之外的下部字线驱至第二传递电压，在第一时间周期、第二时间周期和第三时间周期期间与所述选择的字线相邻的下部字线保持在关闭电压电平。

19、根据权利要求 16 所述的用于最小化编程干扰的方法，还包括以预定电压步幅反复增加所述编程电压电平，而保持所述第一传递电压电平和所述第二传递电压电平。

20、一种用于最小化闪烁存储器与非串中编程干扰的方法，所述与非串具有所选择的存储器单元、所述选择的存储器单元和位线之间的上部存储器单元、所述选择的存储器单元和电源线之间的下部存储器单元、以及用于耦合存储器单元到所述位线的串选择晶体管，所述方法包括:

a）在第一时间周期内驱动所述串选择晶体管用于耦合所述位线的数据电压到所述与非串;

b）在第二时间周期内使用传递电压电平来驱动所述上部存储器单元和所述选择的存储器单元;

c）在第三时间周期内驱动所述选择的存储器单元到编程电压电平;和

d）在所述第三时间周期内电关闭与所述选择的存储器单元相邻的所述上部存储器单元。

21、根据权利要求 20 所述的用于最小化编程干扰的方法，其中，所述驱动上部存储器单元的步骤包括在所述第二时间周期内以第二传递电压电平驱动除了和所述选择的存储器单元相邻的下部存储器单元之外的所述下部存储器单元，所述第二传递电压电平低于所述传递电压。

22、根据权利要求 21 所述的用于最小化编程干扰的方法，其中，所述下部存储器单元在所述第二时间周期内被驱至 0V。

23、根据权利要求 20 所述的用于最小化编程干扰的方法，其中，所述驱动上部存储器单元的步骤包括在所述第二时间周期内以第二传递电压电平驱动所述下部存储器单元，所述第二传递电压电平低于所述传递电压。

24、根据权利要求 23 所述的用于最小化编程干扰的方法，还包括:

Micron Ex. 1016, p. 177
Micron v. YMTC
IPR2024-00795

在所述第三时间周期内以关闭电压电平驱动和所述选择的存储器单元相邻的下部存储器单元。

25、根据权利要求 20 所述的用于最小化编程干扰的方法，其中，所述电关闭的步骤包括在所述第三时间周期内将与所述选择的存储器单元相邻的上部存储器单元从所述传递电压驱至去耦电压，而所述选择的存储器单元被驱至所述编程电压电平。

26、根据权利要求 25 所述的用于最小化编程干扰的方法，其中，在与所述选择的存储器单元相邻的所述上部存储器单元开始被驱至所述去耦电压之后的一个延迟时间，所述选择的存储器单元被驱至所述编程电压电平。

27、根据权利要求 20 所述的用于最小化编程干扰的方法，其中，所述电关闭的步骤包括在所述第三时间周期内将除了与所述选择的存储器单元相邻的上部存储器单元之外的所述上部存储器单元从所述传递电压驱至第二传递电压，所述第二传递电压大于所述传递电压。

28、根据权利要求 20 所述的用于最小化编程干扰的方法，还包括：以预定电压步幅反复增加所述编程电压电平，而保持所述传递电压电平和所述关闭电压电平。

Micron Ex. 1016, p. 178
Micron v. YMTC
IPR2024-00795

闪烁存储器编程禁止方案

技术领域

本发明总的涉及非易失性存储器，更具体地，本发明涉及非易失性闪烁存储器编程方案。

背景技术

多种类型的消费电子设备产品依赖于用于保持由微控制器执行代码的数据或者软件的一些形式的大容量存储设备。这样的消费电子设备是丰富的，并且包括诸如个人数字助理（PDA）、便携式音乐播放器、便携式多媒体播放器（PMP）和数字照相机的装置。在 PDA 中，需要大容量存储设备用于保存应用和数据，而便携式音乐播放器和数字照相机需要大量的大容量存储设备用于保持音乐文件数据和/或图像数据。用于这样的便携式电子设备的大容量存储设备的解决方案优选尺寸小、功耗最低并且具有高存储密度。因为诸如静态随机存取存储器（SRAM）和动态随机存取存储器（DRAM）的易失性存储器为了保持数据而需要不断地施加电力，所以将对存储器的选择限制到非易失性形式的存储器。如本领域内所公知的，便携式电子设备依赖于具有有限电源供应的电池。因此，优选电源移除之后仍保持数据的非易失性存储器。

虽然许多消费产品使用商用闪烁存储器，但消费者在诸如具有微处理功能的蜂窝电话和装置的产品中间接使用闪烁存储器。更具体地，通常在消费电子设备中存在的专用集成电路（ASIC）具有集成的闪烁存储器而能够使得固件升级。无需多言，由于闪烁存储器在尺寸、存储密度和速度方面的最佳折衷，使其成为用于消费电子设备的优选非易失性大容量存储的解决方案，所以闪烁存储器用途十分广泛。

图 1 是现有技术典型的闪烁存储器的总的框图。闪烁存储器 10 包括用于控制多种功能的闪烁电路的逻辑电路、用于保存地址和数据的寄存器、用于产生所需的编程和擦除电压的高电压电路和用于存取闪烁存储器阵列的核心存储器电路。闪烁存储器 10 的所示电路块的功能在本领域内应该是公知的。本领域内的普通技术人员将理解图 1 中所示的闪烁存储器 10 表示许

Micron Ex. 1016, p. 179
Micron v. YMTC
IPR2024-00795

多可能配置中的一个可能的闪烁存储器配置。

读操作是对存储在存储器阵列的特定存储位置（称为地址）的数据的相对直接存取。在对存储器阵列的特定块的写操作之前，该特定块首先必须通过高电压的施加而被擦除。写操作，更精确地称为编程操作，需要谨慎地施加高电压到所选择的存储位置，之后是编程验证操作以确保数据已经被正确编程。此外，由于使用了高电压，所以闪烁芯片必须被设计为相对容许对未选择的存储器单元的无意编程。

图 2a、2b 和 2c 是存储器单元阵列 28 中使用的与非（NAND）存储器单元串的示意图。图 2a 是两个与非存储器单元串的电路示意图。图 2b 是图 2a 所示的两个与非存储器单元串的芯片布局。图 2c 是图 2b 所示的一个与非存储器单元串沿着线 A-A’的横截面视图。每个与非存储器单元串包括 32 个串联的浮栅存储器单元 50(每个连接到各自的字线 WL0 到 WL31)、连接到位线 54 和第一浮栅存储器单元 50 之间的串选择晶体管 52 和连接到公共电源线（CSL）58 和最后一个浮栅存储器单元 50 之间的接地选择晶体管 56。串选择晶体管 52 的栅极接收串选择信号 SSL，而接地选择晶体管 56 的栅极接收接地选择信号 GSL。与非存储器单元串共用公共字线、串选择 SSL 和接地选择 GSL 信号线。本领域内公知所示的与非存储器串的结构和布置。

如前所述，根据本领域内的公知技术，首先擦除存储器阵列的与非存储器单元串。能够选择性地擦除与非存储器单元串的每一个块，从而可以同时擦除一个或者多个块。当成功擦除后，所有擦除的浮栅存储器单元 50 将具有负阈值电压。事实上，所有擦除的存储器单元 50 被设置为缺省逻辑状态，诸如例如逻辑“1”。编程的存储器单元 50 其阈值电压将被改变为正阈值电压，因此表示相反的“0”逻辑状态。

图 3 示出对于擦除的存储器单元和编程的存储器单元的阈值电压(Vt)分布图。由于处理和电压电源变化，擦除的和编程的阈值电压将分布在一个电压范围内。如图 3 所示，擦除的存储器单元将具有-3V 到-1V 的负阈值电压，而编程的存储器单元将具有 1V 到 3V 的正阈值电压。总的来说，通过施加高电压到单元的栅极同时保持其源极和漏极端子接地来编程该单元。高电场使得存储器单元沟道中的电子穿过栅极氧化物并且嵌入浮栅（公知为福勒-诺尔德海姆（F-N）隧道）中，从而增加了存储器单元的有效阈值电压。

Micron Ex. 1016, p. 180
Micron v. YMTC
IPR2024-00795

现在参见图 2a 到 2c 来简要讨论如何从与非存储器单元串读出数据。为了从一个存储器单元 50 读出数据，SSL 和 GSL 二者被设置为例如 5V 的读出电压（Vread，典型地高于 Vcc）来开启串选择晶体管 52 和接地选择晶体管 56。除了要被存取的字线之外的所有字线被设置为例如 5V 的读出电压（Vread），而要被存取的字线被设为 0V。因此，具有低于 5V 的阈值的所有存储器单元 50 被开启来耦合具有 0V 字线的所选择的存储器单元的源极和漏极到位线 54 和电源线 58。如果所选择的存储器单元处于擦除状态（具有负的阈值电压），其将开启，从而耦合位线 54 到电源线 58。另一方面，如果所选择的存储器单元处于编程状态（具有正的阈值电压），其将不开启，从而将位线 54 与电源线 58 隔离。随后通过读取放大器来检测电流的存在或者不存在。

如果擦除的和编程的阈值电压保持在他们各自的范围内，则前述读出方案将可靠地存取存储器单元数据。但是，所描述的情况是理想状态，并且在存储器单元被编程时擦除和编程的存储器单元的阈值电压可能移位。

编程典型地通过页面完成，意味着连接到同一字线的块中的所有的存储器单元 50 被选择在同时通过写数据（逻辑“0”）被编程。剩余的存储器单元因此在编程期间未被选择。由于在编程之前存储器单元开始于擦除状态（逻辑“1”），仅有将以逻辑“0”被编程的存储器单元经受必须的高电场以促进 F-N 隧穿。但是，由于存储器阵列的物理连接，沿着同一字线的所有的存储器单元接收同样的高电压编程电平。结果，有可能擦除的存储器单元将具有它们无意地被移位的阈值电压。这被称为编程干扰，其在闪烁存储器领域内公知。

因此，编程禁止方案被用于阻止无需从擦除状态改变的那些存储器单元被编程到逻辑“0”状态。目前存在可以使用的两种公知的编程禁止方案。第一种是基本禁止方案并且第二种是自提升禁止方案。表 1 概述了对于两种方案施加到图 2a 中的相关信号线的电压。假设连接到 WL27 的所有存储器单元 50 被擦除到逻辑“1”状态，并且 BL0=“0”和 BL1=“1”的数据被写到字线 WL27 存取的存储器单元 50。

表 1

	基本禁止	自提升禁止
BL0	0V（VSS）	0V（VSS）
BL1	VPI（例如 8V）	VCC（例如 2.5V）

Micron Ex. 1016, p. 181
Micron v. YMTC
IPR2024-00795

WL27	VPGM（例如 18V）	VPGM（例如 18V）
WL0-WL26，WL28-WL31	VPASS（例如 10V）	VPASS（例如 10V）
SSL	VPASS（例如 10V）	VCC（例如 2.5V），随后 0V
GSL	0V（VSS）	0V（VSS）

对于基本禁止方案，VPGM 被设置为足够高的编程电压来引起所选择的单元上以 0V 漏极电压的 F-N 隧穿。VPASS 被设置的足够高以使所选择的串中的未选择的单元晶体管呈现传导性而不考虑其编程状态，并且传递 VPI 到不期望编程的存储器单元。同时，VPASS 应该不够高来启动未选择的单元上的 F-N 隧穿。由于连接到 WL27 的存储器单元的沟道中的 VPGM 和 VPI 之间的电压差值现在很小，所以 VPI 是 BL1 上的禁止电压，其设置的足够高来禁止连接到 WL27 的所选择的单元上的 F-N 隧穿。

基本禁止方案存在一些问题。在编程操作期间由内部高电压发生器提供 VPI，并且需要大容量电荷泵来供应 VPI 到高电容位线。这导致功耗和芯片尺寸显著增加，而二者是很不期望的。连接到位线的页面缓冲器必须现在被配置用于高电压操作来提供 VPI 到位线。高电压晶体管大于一般的电压晶体管，其增加页面缓冲器尺寸并且相应地增加芯片尺寸。由于需要将高电容位线使用具有限制电流源的片上电压发生器充电到 VPI，则降低了编程速度。

自提升禁止方案解决了基本禁止方案的问题。随着 SSL 晶体管 52 开启并且 GSL 晶体管 56 关闭，0V 或者接地电压被施加到位线 BL0，而诸如 VCC 的高电压被施加到位线 BL1。0V 位线（如 BL0 中）将相关联的与非串的沟道接地。当编程电压 VPGM 被施加到所选择的单元的栅极，栅极和沟道之间的大的电位差导致电子 F-N 隧穿到浮栅上，从而编程该单元。在编程禁止的单元中，BL1 开始预充电相关的沟道到 VCC 电压。当 WL27 的电压上升到 VPGM 并且剩余的字线达到 VPASS，通过控制栅、浮栅、沟道和本体的串行容量被耦合，并且沟道电位被自动提升。

该提升发生在耦合的沟道电压上升到 Vcc-Vth（Vth 为 SSL 晶体管的阈值电压）时。在此时，SSL 晶体管 52 关闭并且沟道变成浮置节点。已经计算出浮沟道电压上升到大约栅极电压的 80%，其足够高到阻止 F-N 隧穿发生。

但是，编程干扰仍旧发生。特别是，如果 VPASS 被设置得过高，由于 VPASS 和 0V 沟道之间的电压的相对高的差值，使得耦合到 BL0 的擦除的单

Micron Ex. 1016, p. 182
Micron v. YMTC
IPR2024-00795

元可以被无意地软编程到逻辑“0”状态。另一方面，如果 VPASS 被设置的过低，连接到 WL27 并且耦合到 BL1 的擦除的存储器单元不可以接收足够的沟道提升来禁止 F-N 隧穿。

不幸的是，随着由于半导体制造技术的发展而不断地缩小，功率源 VCC 也降到一个较低的水平。这对于自提升禁止方案是不利的。这是由于与非单元串沟道在由 VPGM 和 VPASS 自提升之前被开始预充电到 SSL 晶体管 52 的 Vcc-Vth，并且提升的电压主要受预充电电压 Vcc-Vth 影响。此外，为了获得较高的封装密度，设计者增加每一与非串中的存储器单元的数量。因此，相对于具有 16 个存储器单元 50 的与非串，图 2a 到 2c 中示出的 32 个存储器单元的与非串经受两倍于 16 个存储器单元的与非串的许多的编程干扰周期。

因此，在编程操作期间编程的和擦除的存储器单元的阈值可以被无意移位。图 4 示出对于编程干扰的擦除的存储器单元和编程的存储器单元的阈值电压（Vt）的分布图。实线对应最初表示在图 3 中的阈值分布，而虚线示出由于编程干扰而移位的阈值分布。该移位可以是由于单元被干扰的积累数量的次数，或者是单个编程干扰事件。由于移位的阈值可以影响读出操作，所以这很成问题。对于读出操作如前所述，所选择的存储器单元 50 的栅极被驱至 0V，而未选择的存储器单元在其栅极接收读出电压 Vread，而未存取的存储器单元其栅极被驱至读出电压 Vread。如图 4 中所示，0V 电平不能启动阈值电压移位到 0V 之上的那些单元。此外，其阈值被移位至 Vread 电压之上的未选择的单元将保持关闭，从而将存取的存储器单元与其对应位线隔离。

用于最小化编程干扰的一个技术是用来降低 VPASS 的电压电平。这在闪烁存储器上引入操作限制，从而，与非串的存储器单元必须在顺序模式中编程，从离位线最远的存储器单元开始。在此方案中，要编程存储器单元（所选择的页面）和位线接触之间的与非串中的所有存储器单元必须处于擦除状态。因此较低的 VPASS 电压可以被用于未选择的单元来确保位线电压可以被耦合到与非串中的所选择的存储器单元。不幸的是，由于所选择的存储器单元和位线接触之间的编程的存储器单元（例如具有高于 VPASS 的 Vth）将阻止位线电压达到所选择的存储器单元，所以不能执行随机的页面编程操作。该随机页面编程禁止导致特定应用中的多种限制和性能降低。

Micron Ex. 1016, p. 183
Micron v. YMTC
IPR2024-00795

因此，期望提供一种编程禁止方案来最小化与非闪烁存储器单元中的编程干扰。更具体地，期望提供一种编程禁止方案，其中 VPASS 电压电平可以被降低用于最小化不期望编程的未选择的存储器单元中的编程干扰，同时最大化不期望编程的所选择的存储器单元的提升的沟道电压。

发明内容

本发明的目的是用来消除或者减轻先前闪烁存储器编程干扰禁止方案的至少一个缺陷。更具体地，本发明的目的是提供一种与非闪烁存储器编程干扰禁止方案来最小化随机编程操作期间的未选择的存储器单元的传递干扰。

在第一方面，本发明提供一种用于最小化与非串中编程干扰的方法。所述与非串包括所选择的存储器单元、所述选择的存储器单元和位线之间的上部存储器单元、所述选择的存储器单元和电源线之间的下部存储器单元、以及用于耦合存储器单元到所述位线的串选择晶体管。所述方法包括：耦合电压电平到所述与非串；预充电所述选择的存储器单元和所述上部存储器单元的沟道；并且局部提升所述选择的存储器单元沟道。所述电压电平对应于来自所述位线的编程禁止数据。在所述电压电平被耦合到所述与非串的沟道之后，所述选择的存储器单元和所述上部存储器单元的所述沟道被预充电到初级提升的电压电平。在所述沟道被预充电之后，所述选择的存储器单元沟道被局部提升到次级提升的电压电平，所述次级提升的电压电平高于所述初级提升的电压电平。

根据第一方面的实施例，对应于编程禁止数据的所述电压电平在第一时间周期内被耦合到所述位线，在所述第一时间周期之后的第二时间周期内预充电所述沟道，在所述第二时间周期之后的第三时间周期内局部提升所述选择的存储器单元沟道，并且局部提升的步骤包括将连接到所述选择的存储器单元的所选择的字线驱至编程电压电平。在本实施例的一方面，所述耦合的步骤可以包括在所述第一时间周期内将所述串选择晶体管驱至第一电压电平，随后在第二时间周期中将所述串选择晶体管驱至去耦电压电平。所述去耦电压电平可以低于所述第一电压电平。在本实施例的另一方面，所述预充电的步骤可以包括将所述选择的字线和连接到所述上部存储器单元的上部字线驱至第一传递电压电平。所述第一传递电压可以具有用于有效地最小化所述上部存储器单元中的编程干扰并最大化所述初

Micron Ex. 1016, p. 184
Micron v. YMTC
IPR2024-00795

级提升的电压电平的值。所述第一传递电压可以低于 10 伏特，但是也可以使用 7 伏特的传递电压。

在本实施例的又另一方面，其中，所述局部提升的步骤包括电关闭与所述选择的存储器单元相邻的所述上部存储器单元。所述电关闭的步骤可以包括将与所述选择的字线相邻的上部字线从所述第一传递电压电平降低到去耦电压电平，而所述选择的字线被驱至编程电压电平。可替代地，在与所述选择的存储器单元相邻的所述上部存储器单元被关闭之后，将所述选择的字线可以驱至编程电压电平。更具体地，在所述上部字线开始向所述去耦电压下降之后的一个延迟时间，所述选择的字线可以被驱至编程电压。可替代地，所述电关闭的步骤可以包括将除了与所述选择的字线相邻的上部字线之外的所述上部字线从所述第一传递电压电平上升到第二传递电压，而所述选择的字线被驱至所述编程电压电平，并且与所述选择的字线相邻的所述上部字线可以保持在所述第一传递电压电平。

在本实施例的又另一方面，所述预充电的步骤可以包括将连接到所述下部存储器单元的下部字线驱至第二传递电压，其中所述第二传递电压小于所述第一传递电压。所述局部提升的步骤可以包括将与所述选择的字线相邻的下部字线从所述第二传递电压降低到关闭电压电平，而所述选择的字线被驱至所述编程电压电平。可替代地，所述预充电的步骤可以包括将连接到所述下部存储器单元的除了与所述选择的字线相邻的下部字线之外的下部字线驱至第二传递电压，在第一时间周期、第二时间周期和第三时间周期期间与所述选择的字线相邻的下部字线保持在关闭电压电平。在所有之前的实施例中，编程电压电平可以以预定电压步幅被反复增加，而保持所述第一传递电压电平和所述第二传递电压电平。

在第二方面，本发明提供一种用于最小化闪烁存储器与非串中编程干扰的方法。所述与非串可以具有所选择的存储器单元、所述选择的存储器单元和位线之间的上部存储器单元、所述选择的存储器单元和电源线之间的下部存储器单元、以及用于耦合存储器单元到所述位线的串选择晶体管。所述方法包括：a）在第一时间周期内驱动所述串选择晶体管用于耦合所述位线的数据电压到所述与非串；b）在第二时间周期内以传递电压电平来驱动所述上部存储器单元和所述选择的存储器单元；c）在第三时间周期内驱动所述选择的存储器单元到编程电压电平；和 d）在所述第三时间周期内电关闭与所述选择的存储器单元相邻的所述上部存储器单元。

Micron Ex. 1016, p. 185
Micron v. YMTC
IPR2024-00795

根据第二方面的实施例，所述驱动上部存储器单元的步骤包括在所述第二时间周期内以第二传递电压电平驱动除了和所述选择的存储器单元相邻的下部存储器单元之外的所述下部存储器单元，其中所述第二传递电压电平低于所述传递电压。所述电关闭的步骤可以包括在所述第三时间周期内将与所述选择的存储器单元相邻的上部存储器单元从所述传递电压电平驱至去耦电压，而所述选择的存储器单元被驱至所述编程电压电平。在与所述选择的存储器单元相邻的所述上部存储器单元开始被驱至去耦电压之后的一个延迟时间，所述选择的存储器单元可以被驱至所述编程电压电平。可替代地，所述电关闭的步骤可以包括在所述第三时间周期内将除了与所述选择的存储器单元相邻的上部存储器单元之外的所述上部存储器单元从所述传递电压驱至第二传递电压，其中所述第二传递电压大于所述传递电压。编程电压电平可以以预定电压步幅被反复增加，而保持所述传递电压电平和所述关闭电压电平。

根据另一实施例，所述下部存储器单元可以在所述第二时间周期期间被驱至 0V，并且所述驱动上部存储器单元的步骤可以包括在所述第二时间周期内以第二传递电压电平驱动所述下部存储器单元，所述第二传递电压电平低于所述传递电压。和所述选择的存储器单元相邻的下部存储器单元可以在所述第三时间周期内以关闭电压电平驱动。

对本领域普通技术人员来说，通过结合附图阅读本发明具体实施例的下面描述，本发明的其他方面和特征将变得清楚。

附图说明

参考附图，将仅通过示例方式来描述本发明的实施例，其中：

图 1 是典型的闪烁存储器的框图；

图 2a 是两个与非存储器单元串的电路图；

图 2b 是图 2a 所示的两个与非存储器单元串的平面布局；

图 2c 是图 2b 所示的一个与非存储器单元串沿着线 A-A’ 的横截面图；

图 3 是擦除的存储器单元和编程的存储器单元的阈值电压（Vt）分布图；

图 4 是擦除的存储器单元和编程的存储器单元在编程干扰之后的阈值电压（Vt）分布图；

图 5 是根据本发明的实施例说明总的编程禁止方法的流程图；

图 6 是根据本发明的实施例说明总的编程禁止方法的实施例的流程图；

Micron Ex. 1016, p. 186
Micron v. YMTC
IPR2024-00795

图 7a 是根据本发明的实施例的编程禁止方法期间示出应用栅极电压的与非串的简化横截面视图;

图 7b 是进一步说明应用到图 7a 的与非串的电压时序的时序图;

图 8 是说明根据本发明的实施例的编程禁止时序的时序图;

图 9 是说明根据本发明的另一个实施例的编程禁止时序的时序图;

图 10 为说明图 7b 被修改的以最小化沟道泄漏的编程禁止时序的时序图;

图 11 是说明图 7b 被修改的以最大化局部次级提升的电压电平的编程禁止时序的时序图;

图 12 是说明根据本发明的另一个实施例的编程禁止时序的时序图;

图 13 是根据本发明的实施例的示出应用栅极电压的与非串的简化横截面图;

图 14 是进一步说明应用到图 13 的与非串的电压时序的时序图;

图 15 是根据本发明的实施例的示出应用栅极电压的与非串的简化横截面图;

图 16 是进一步说明应用到图 15 的与非串的电压时序的时序图。

具体实施方式

【0039】总的来说，本发明提供一种用于最小化闪烁存储器中编程干扰的方法和系统。为了降低与非闪烁存储器单元串中的编程干扰，期望没有自所擦除的状态的编程，使用了局部提升的沟道禁止方案。在局部提升的沟道禁止方案中，不期望编程的与非串中的所选择的存储器单元和与非串中的其他单元局部去耦。这允许所去耦的单元的沟道被局部提升到足以在对应字线上升到编程电压时禁止 F-N 隧穿的电压电平。由于高的提升效率，应用到与非串中的剩余的存储器单元的栅极的传递电压可以相对于现有技术方案下降，使得最小化编程干扰，而允许随机页面编程。

图 5 是说明根据本发明的实施例的总的编程禁止方法的流程图。应该理解当一个与非串的所选择的存储器单元被编程时，另一个与非串的所选择的存储器单元可以被禁止编程。在步骤 100 用编程禁止电压偏置位线，其对应逻辑“1”状态。随后在步骤 102，与非串的沟道被预充电到初级提升的电压电平。这可以通过驱动所有的字线到传递电压来实现。在步骤 104，当对应的字线被驱至编程电压时，所选择的存储器单元的沟道被局部提升到次级提

Micron Ex. 1016, p. 187
Micron v. YMTC
IPR2024-00795

升的电压电平。这可以通过控制与所选择的存储器单元直接相邻的存储器单元的字线电压使所选择的存储器单元与其余的与非串去耦或者隔离来实现。对于要禁止编程的与非串，其对应于局部提升阶段，其中，所选择的存储器单元的沟道被提升到足以禁止 F-N 隧穿的电平。时序在步骤 106 结束，其中所有的字线和诸如 SSL 的选择线被驱至 0V。

图 6 是说明图 5 所示的编程禁止方法的实施例的流程图。在本实施例中，上部字线是指所选择的存储器单元和位线之间的那些字线和存储器单元，而下部字线是指所选择的存储器单元和电源线之间的那些字线和存储器单元。图 6 所示的编程禁止方法在步骤 200 开始，其中使用禁止电压或者编程电压偏置位线。在这里讨论的例子中，假设位线被驱至 VCC 的禁止电压。在步骤 202，所选择的字线和上部字线被驱至第一传递电压。该第一传递电压足够高，可以开启对应于上部字线的每一个存储器单元，而无需考虑其编程的或者非编程的状态。与步骤 202 并行发生，在步骤 204，下部字线被驱至第二传递电压。根据本发明的实施例，第一传递电压和第二传递电压可以互相相同，或者第二传递电压可以小于第一传递电压。随后在步骤 206，所选择的字线被驱至编程电压，之后步骤 208 的隔离操作用于将所选择的存储器单元和与非串的未选择存储器单元去耦。如下所述，存在不同的技术用于隔离所选择的存储器单元。根据本发明的另一个实施例，可以关闭连接到下部字线的存储器单元，用于降低来自所选择的存储器单元的电荷泄漏。

图 7a 是与非串 300 的简化横截面图，类似于图 2b 中所示。与非串 300 包括：其栅极被连接在字线 WL0 至 WL31 的存储器单元 302；用于将与非串 300 耦合到位线 306 的串选择晶体管 304；用于将与非串 300 耦合到电源线 310 的接地选择晶体管 308。与非串 300 形成在 PP-阱，而该 PP-阱本身形成在 P-衬底的 N-阱中。与非串存储器单元晶体管的源极/漏极区是 n+扩散区。

图 7a 包括注解，用来示出根据本发明的实施例的应用到指定字线的相对电压电平。注意到在物理结构上与非串保持与现有技术相同。在图 7a 所示的例子中，假设连接到 WL29 的存储器单元被选择用于编程，并且要被编程的数据为逻辑“1”状态。由于擦除状态是逻辑“1”，所以禁止编程。图 7b 是进一步说明应用到图 7a 中的电压时序的时序图。

时间周期 T1 是初始状态，其中所有存储器单元 302 的栅极、信号 SSL 和信号 GSL 被偏置为 0V，而用于编程存储器单元和用于禁止编程存储器单元的位线电压被施加。CSL 可以被偏置为 0V 或者 VCC，但是在本例中可以优选

Micron Ex. 1016, p. 188
Micron v. YMTC
IPR2024-00795

偏置为 VCC 来最小化泄漏。在本例中，位线 306 被偏置为 VCC。在时间周期 T2，信号 SSL 被偏置为 VCC，用于耦合位线电压到与非串 300。在图 7a 所示的与非串 300 中，串选择晶体管 304 由于其连接到位线 306 的漏极端子和其栅极都被偏置为 VCC，所以串选择晶体管 304 电关闭。更具体地，串选择晶体管 304 一旦其源极上升到大约 VCC 减去晶体管的阈值电压，则串选择晶体管 304 将关闭。时间周期 T1 和 T2 对应于图 5 中的步骤 100。在时间周期 T3 期间，对应于图 5 中的步骤 102，所有的字线（上部、下部和所选择的字线）被驱至传递电压 V2，其中 V2 被选择大于 VCC。这将有效地提升与非串 300 的整个沟道到初级提升电压。在时间周期 T4 的开始，所选择的字线 WL29 上升到编程电压 V1，而相邻的字线 WL28 和 WL30 下降到去耦电压 V3。这分别对应于图 5 中的步骤 104 和 106。V1 的电压电平被设置大于 V2，并且 V3 的电压电平被设置低于 V1 和 V2。

将 WL28 和 WL30 的字线电压下降到 V3 的另一个优点是来补偿连接到 WL29 的控制栅极和耦合到 WL28 和 WL30 的浮栅之间的电容耦合。随着 WL29 被驱至 V1，电容耦合效应可以增加浮栅电压，从而增加与所选择的存储器单元直接相邻的存储器单元中的传递干扰的可能性。因此，字线电压下降到 V3 将降低浮栅电压。

在图 7a 所示的实施例中，应该根据以下标准选择 V1、V2 和 V3 的电压电平。V1 应该是足够高的电压电平来促进耦合到偏置为 0V 的位线的存储器单元中的 F-N 隧穿。V2 的电压电平应该被选择满足以下三个标准。第一，V2 应该足够高到确保未选择的单元的沟道被设置为导通的。第二，对于 WL28 和 WL30 在时间周期 T4 期间当电压 V2 下降到电压 V3 时，连接到 WL28 和 WL30 的存储器单元关闭并且在时间周期 T4 期间保持关闭。这是所获得的局部去耦效应。第三，当所选择的字线 WL29 从电压 V2 上升到编程电压 V1 时，所选择的单元的沟道可以被提升到期望的电压，也就是次级提升的电压电平。V3 的电压电平应该足够高到传递 0V 位线电压通过未选择的单元到达所选择的单元的漏极，而足够低到基本关闭与所选择的单元（连接到 WL29）直接相邻的存储器单元（连接到 WL28 和 WL30）的沟道。

本编程禁止方案的显著的优点在于 V2 的电压电平相对于现有技术的模拟 VPASS 的电压被降低，以最小化未选择的存储器单元中的编程干扰，而要足够高，以通过先前已经被编程为逻辑“0”状态的未选择的存储器单元在位线上传递 0V。

Micron Ex. 1016, p. 189
Micron v. YMTC
IPR2024-00795

既然电压 V1、V2 和 V3 的相对电平以及其应用时序已经根据本发明的一般实施例描述，以下是可以使用的示例值的描述。表 2 列出基于特定处理技术的图 7a 所示实施例的示例电压值。

表 2

参数	电压
VCC	2.5V
Vth_ss1（304 的阈值电压）	0.8V
γ（单元耦合率）	0.8
V1	18V
V2	7V
V3	5V
Vthc（最坏情况逻辑“0”编程的单元电压，阈值电压）	3V

使用这些值，可以计算对于与非串沟道 300 的初级提升电压电平和对于不期望编程的所选择的存储器单元的次级提升的电压电平。由于 VCC 的栅极电压和 VCC 的漏极电压（连接到位线 306），串选择晶体管 304 在其源极端子达到 VCC-Vth 时被电关闭。因此，VCC-Vth_ss1 是用于沟道提升的初始沟道电压 Vich（即，起始电压）。

根据以下公式（1）计算沟道的初级提升的电压电平（Vprimary）：

(1) $V_{primary} = V_{ich} + \gamma * (V_{unsel} - V_{thc} - V_{ich})$,

其中，Vunsel 是应用到未选择的存储器单元的栅极电压，并且 Vich=VCC-Vth_ss1。

根据以下公式（2）计算所选择的存储器单元的次级提升的电压电平 Vsecondary：

(2) $V_{secondary} = V_{ich} + \gamma * (V_{sel} - V_{thc} - V_{ich})$,

其中，Vsel 是应用到所选择的存储器单元的栅极电压，并且 Vich=VCC-Vth_ss1。

公式（2）中的 Vsecondary 可以由下面公式（3）替换表示：

(3) $V_{secondary} = V_{primary} + \gamma * (V_{sel} - V_{unsel})$，如果 $V_{unsel} > V_{thc} + V_{ich}$ 并且 $V_{sel} > V_{unsel}$ 。

图 7b 的时序图的描述跟随着表 2 的示例值的应用。将位线 306 设置为

Micron Ex. 1016, p. 190
Micron v. YMTC
IPR2024-00795

2.5V（VCC），在时间周期T2期间信号SSL上升到2.5V（VCC）将导致与非串300的沟道电压上升到大约1.7V的Vich。当所有的字线在时间周期T3期间上升到7V（V2）时，与非串300的沟道上升到初级提升的电压电平，即：

Vprimary = 1.7V + 0.8 * (7V - 3V - 1.7V) = 3.54V

在时间周期T4期间，所选择的字线上升到18V（V1），而两个相邻的未选择的字线WL28和WL30下降到5V（V3）。由于除了连接到WL28和WL30的存储器单元的未选择单元在T3期间保持3.54V的提升的沟道电压，连接到WL28和WL30的存储器单元随着所选择的单元的栅极上升到18V（V1）而电关闭。因此，所选择的单元的沟道和其余与非串300去耦，并且所选择的单元的沟道提升被局部化。局部化的沟道提升比现有技术沟道提升方案更有效，从而提供更高的提升的沟道电压。结果次级提升的电压电平近似为：

Vsecondary = 3.54V + 0.8 (V1-V2) = 12.34V

因此，该次级提升的电压电平足够高到禁止所选择的单元被编程。也就是，次级提升电压足够高使得所选择单元在18V的V1编程电压之下保持其擦除状态。在所描述的实施例中，次级提升的电压电平对编程电压V1的比率至少大约是70%。

由于相邻的存储器单元可以被关闭来将所选择的存储器单元和其余的与非串去耦，所以前述编程禁止时序应用于任意选择的具有相邻存储器单元的存储器单元。但是，与非串300包括连接到不具有第二相邻存储器单元的字线WL0和WL31的末端存储器单元。以下讨论每个末端存储器单元被禁止编程时的编程禁止时序。

图8是说明当连接到字线WL31的存储器单元被驱至编程电压V1时的编程禁止时序的时序图。与连接到WL31的存储器单元直接相邻的是连接到WL30的存储器单元，并且串选择晶体管304连接到信号SSL。在图7b的时序中，在时间周期T2期间位线306被偏置到VCC并且SSL上升到VCC。随着耦合的沟道电压上升到VCC-Vth_ss1，串选择晶体管304最终关闭。在时间周期T3期间，所有的字线上升到V2以将与非串300的沟道上升到初级提升的电压电平。字线WL31上升到V1并且在时间周期T4期间字线WL30下降到V3以关闭各自的存储器单元。由于串选择晶体管304已经被关闭，连接到WL31的存储器单元和与非串300去耦，并且其沟道被局部提升到次级提升的沟道电压电平。

图9是说明当连接到字线WL0的存储器单元被驱至编程电压V1时的编

Micron Ex. 1016, p. 191
Micron v. YMTC
IPR2024-00795

程禁止时序的时序图。与连接到 WL0 的存储器单元直接相邻的是连接到 WL1 的存储器单元，并且接地选择晶体管 308 连接到信号 GSL。在时间周期 T1 的初始状态下，GSL 被偏置为 0V，而位线 306 被偏置为 VCC。在时间周期 T2 期间 SSL 上升到 VCC，并且在时间周期 T3 期间所有的字线上升到 V2，以将与非串 300 的沟道上升到初级提升的电压电平。字线 WL0 上升到 V1 并且在时间周期 T4 期间字线 WL1 下降到 V3 以关闭各自的存储器单元。由于接地选择晶体管 308 已经被关闭，连接到 WL1 的存储器单元和与非串 300 去耦，并且其沟道被局部提升到次级提升的沟道电压电平。

如图 7b 到图 9 中所示，不期望编程的与非串中的所选择的存储器单元可以通过控制时序和应用到未选择存储器单元与所选择的晶体管的电压，来与其余的与非存储器单元去耦。

在图 7b 到图 9 中的时间周期 T3 期间，与非串 300 的沟道可以通过 WL31 和串选择晶体管 304 之间的电容性耦合来泄漏电荷到位线。这可以有效降低初级提升的电压电平。因此，根据本发明的实施例，信号 SSL 可以从 VCC 降低到泄漏最小电压 V4。例如，对于图 7a 中示出的与非串 300，V4 可以是 1V。通过将 SSL 下降到 V4，串选择晶体管 304 的沟道对于泄漏电荷到位线 306 变得更有阻抗性。V4 可以被选为足以传递位线上 0V 电平到要编程的所选择的存储器单元的电平。

图 10 为说明图 7b 被修改的以最小化沟道泄漏的编程禁止时序的的时序图。在时间周期 T1 的初始阶段，所有存储器单元 302 的栅极、信号 SSL 和信号 GSL 被偏置为 0V，而位线电压（VCC）被应用并且 CSL 被偏置为 VCC。在时间周期 T2，信号 SSL 被偏置为 VCC 用于耦合位线电压到与非串 300。在图 7a 中示出的与非串 300 中，因为串选择晶体管 304 的连接到位线 306 的漏极端子和其栅极都被偏置到 VCC，所以串选择晶体管 304 被关闭。更具体地，一旦串选择晶体管 304 的沟道上升到大约 VCC 减去晶体管的阈值电压，则串选择晶体管 304 将关闭。在时间周期 T3 期间，所有的字线被驱至传递电压 V2，用于将与非串 300 的全部沟道提升到初级提升的电压。但是，为了最小化至位线 306 的初级提升的电压的泄漏，随着字线被驱至 V2，SSL 下降到电压 V4。在时间周期 T4 的开始，所选择的字线 WL29 被升到编程电压 V1，而相邻字线 WL28 和 WL30 被下降到去耦电压 V3。可以在图 8 和图 9 中所示的具有等同效应的编程禁止时序中使用下降到泄漏最小化电压 V4 的 SSL 电压。

根据本发明的另一个实施例，所选择的不期望编程的存储器单元的局部

Micron Ex. 1016, p. 192
Micron v. YMTC
IPR2024-00795

次级提升的电压电平可以进一步增加。在图 7a 到图 10 中示出的之前编程禁止时序实施例中，所有的字线在时间周期 T3 期间被驱至 V2 传递电压，之后，仅有所选择的字线从 V2 被驱至编程电压 V1。当 V2 和 V1 之间的差值被最大化时，可以最大化局部次级提升的电压电平。因此，根据本发明的实施例，对于所选择的字线，V2 的电压电平相对于之前示出的编程禁止时序被降低。

图 11 是说明图 7b 被修改的以最大化被禁止编程的所选择的晶体管的沟道中的局部次级提升的电压电平的编程禁止时序的时序图。在所示时间周期 T3 期间，除了所选择的字线 WL29，所有的字线被驱至 V2 传递电压，WL29 被驱至较低的 V5 电压。紧接着在时间周期 T4 中，WL29 被驱至编程电压 V1。对于图 7a 所示的与非串 300，例如，V5 可以被设置为 5V 的电压电平。注意，选择 V5 足以高使得在时间周期 T3 期间确保所选择的单元的沟道的导通。因此，由于 V5 和 V1 之间的差值大于 V2 和 V1 之间的差值，所以在所选择的存储器单元中可以获得更高的局部次级提升的电压电平。这称为高差值局部提升方案。

随后的关系表达总结了在本发明之前所述实施例中使用的电压电平的相对限制条件。

(1) $V3 < V2 < V1$

(2) $0V < V4 < V3$

(3) $0V < V5 < V2$

实际值依赖于存储器单元和晶体管几何构型以及使用的工艺。V1 是足以导致 F-N 隧穿的编程电压。V2 是传递电压，i）足够高用于使存储器单元传导；ii）足够高使得下降到 V3 将与其连接的存储器单元关闭；iii）足够高使得增加到 V1 将所选择的存储器沟道局部提升到期望的次级提升电压电平。V2 可以大于 VCC。V3 足够高到传递 0V 位线电压，并且应该至少和编程的存储器单元的最坏情况的阈值电压一样高。例如，在表 1 中，如果 Vthc 为 3 伏特，则 V3 应该至少为 3 伏特。

在图 7b 到图 11 中已经示出根据本发明的实施例的不同的编程禁止时序。实施例已经被示出在编程操作期间用于降低泄漏或者用于增加次级提升的电压电平。这些实施例可以被组合在一起来获取每一个单个方案已经提供的所有的益处。如在图 12 的时序图中所示，SSL 信号可以在时间周期 T3 期间被降低到泄漏最小化电压 V4，而所选择的字线 WL29 在时间周期 T3 期间可被设置为降低的传递电压 V5。

Micron Ex. 1016, p. 193
Micron v. YMTC
IPR2024-00795

在之前描述的实施例中，SSL 信号可以被降低到泄漏最小化电压 V4，以最小化至位线 306 的电荷泄漏，从而在将所选择的存储器单元沟道局部提升到次级提升的电压电平之前最大化提升的沟道电压。在局部提升期间，一些电荷可以从所选择的存储器单元的沟道通过其两个直接相邻的存储器单元泄漏。这是由将相邻单元的字线从 V2 下降到 V3 造成的，其降低了他们各自存储器单元的沟道电压。因此，当仍旧关闭时，一些电荷将泄漏到连接到下部字线的其他存储器单元。

根据本发明的降低电荷泄漏实施例，下部字线使用不同于上部字线的电压驱动，用于降低从所选择的存储器单元的局部提升的沟道产生的电荷泄漏。在图 13 中示出此方案的一个实施例。

图 13 示出图 7a 中所示的同样的与非串 300，并且包括注解，用来示出应用到指定字线的相对电压电平。应用到所选择的字线 WL29 和上部字线 WL30 与 WL31 的电压可以与之前所示并描述的图 7a 的实施例相同。在本实施例中，下部字线 WL0-WL28 被驱至传递电压 V6，并且直接相邻的字线 WL28 随后下驱至低电压电平。例如，低电压可以是 0V、0.1V、0.2V。

图 14 是根据当前所述实施例说明编程禁止时序的时序图。在时间周期 T1 和 T2 期间的时序与之前描述的图 7b 中相同。在时间周期 T3，上部字线 WL30-WL31 以及所选择的字线被驱至第一传递电压 V2。下部字线 WL0-WL28 被驱至第二传递电压 V6。在另一个实施例中，第二传递电压 V6 低于第一传递电压 V2，但是高于编程的存储器单元的阈值。因为电荷在遍及与非存储器单元串的整个沟道中被分布或者共享，所以仍旧产生初级提升的电压。在时间周期 T4 的开始，所选择的字线 WL29 上升到编程电压 V1，而上部相邻字线 WL30 被降到去耦电压 V3。另一方面，下部相邻字线 WL28 被降到关闭电压 0V。现在开始讨论前述时序和电压电平的效应。

如果连接到 WL28 的存储器晶体管已经使用正阈值被编程，则当 WL28 降至诸如 0V 的正阈值之下时存储器晶体管关闭。另一方面，如果存储器单元仍被擦除（负阈值），则甚至 0V 的关闭电压可以开启存储器单元。但是，由于第二传递电压 V6 应用到下部字线，下部存储器单元的沟道被提升到较低的初级提升的电压。因此，连接到 WL28 的存储器单元的源极端子（漏极端子连接到所选择的存储器单元）为正，从而关闭存储器单元。通过关闭从所选择的晶体管的提升的沟道到下部存储器单元的泄漏路径，进一步提高局部提升效率。本领域内的普通技术人员可以理解关闭电压不限于 0V，并且可以

Micron Ex. 1016, p. 194
Micron v. YMTC
IPR2024-00795

使用任意低电压，其有效地最小化通过连接到 WL28 的存储器单元的电荷泄漏。

根据可替代实施例，在时间周期 T4 的开始，串选择信号 SSL 可以被降到 V4，如以 SSL 轨迹中的虚线示出，并且在时间周期 T3 期间，WL28 可以被设置为保持在关闭电压，如以 WL28 轨迹中的虚线示出。保持相邻下部字线（诸如所述实施例中的 WL28）在关闭电压的优点包括电压消耗和耦合电容的下降。由于字线驱动器不需要对字线进行升压和降压，所以降低了电压消耗。当减小字线间距来提高存储器阵列封装密度时，相邻字线之间的电容性耦合将随着字线的升压和降压而变得更加显著。由于相邻下部字线在时间周期 T3 和 T4 之间不改变，所以降低了电容性耦合。第二传递电压 V6 可以是低电压，诸如用于闪烁读出操作的读出电压电平，并且低于 V3。

图 15 是本发明的另一个实施例，结合了之前实施例中的一些特征。图 15 示出图 13 中所示的同样的与非串 300，并且包括标号以示出应用到指定字线的相对电压电平。更具体地，本例子使用了图 13 的电荷泄漏降低方案，图 11 的多种高差值局部提升方案和新的去耦方案。在新的去耦方案中，使用之前所建立的电压来控制与非串 300 的第一和第二上部相邻存储器单元，用来将所选择的存储器单元和与非串 300 去耦。

图 16 是根据当前描述实施例说明编程禁止时序的时序图。图 16 示出 WL29 的相对时序变化，以及 WL29 的可替代传递电压，这些将在下面描述。时间周期 T1 和 T2 期间的时序和之前描述的图 13 中相同。在时间周期 T3，所有的上部字线（本例中的 WL30 和 WL31）和所选择的字线 WL29 被驱至去耦电压 V3。事实上，在时间周期 T3 中使用 V3 作为第一传递电压。其间，下部字线被驱至第二传递电压 V6，包括相邻下部字线 WL28 保持在默认关闭电压电平（例如 0V）。因此，此时与非串 300 的沟道实际上被局限在连接到 WL29-WL31 的存储器单元，其被提升到初级提升的电压。

在时间周期 T4 的开始，所选择的字线 WL29 上升到编程电压 V1，而上部相邻字线 WL31 保持在 V3。大约在同一时间，除了上部相邻字线 WL31 之外的所有上部字线被上驱至第一传递电压 V2。在此实施例中，当 WL29 上升到 V1 并且 WL31 上升到 V2 时，连接到 WL30 的存储器单元被电关闭，并且在时间周期 T4，WL28 下降到关闭电压。在可替代实施例中，在时间周期 T4 的开始，串选择信号 SSL 可以被降到 V4，如以 SSL 轨迹中的虚线示出。以下关系表达式概述了图 13 到图 16 的实施例中使用的电压电平的相对限制条件。

Micron Ex. 1016, p. 195
Micron v. YMTC
IPR2024-00795

(1) V3 < V2 < V1

(2) 0V < V4 < V3

(3) 0V < V6 ≤V3

因此，由于低电压电平应用到下部存储器单元的栅极，所以事实上不存在下部存储器单元所经受的传递干扰。

在图 16 中，在时间周期 T3 期间，WL29 可以被初始设置为 V3 来增加 V3 和 V1 之间的电压差值，并且来提供类似于图 11 的实施例可获取的高差值局部提升。可替代地，通过在时间周期 T3 期间保持 WL29 在 0V 并且随后在时间周期 T4 期间直接驱动 WL29 到 V1 可以最大化局部提升。这通过虚线 400 示出。注意到连接到 WL29 的存储器单元是具有负阈值电压的擦除的单元。

之前所示时序图意于示出对于指定电压应用到所选择的和未选择的字线的一般时序关系。但是，将所选择的字线从第一传递电压（或者 0V）驱动到编程电压（V1）和直接相邻字线的控制之间的相对时序可以如下进一步得到改善。例如，参见图 10，所选择的字线 WL29 可以被驱至 V1，同时相邻字线 WL28 和 WL30 下降到 V3。换句话说，所选择的存储器单元在应用 V1 编程电压时与其余的与非存储器单元去耦。在 WL29 转变到 V1 的开始部分期间，在这些相邻存储器单元被电压 V3 完全关闭之前，由于 WL29 提升引起的一些电荷将通过相邻存储器单元泄漏。

为了在时间周期 T4 期间最大化所选择的存储器单元的局部提升效率，在所选择的存储器单元与其他存储器单元去耦之后不久所选择的字线可以被驱至 V1。例如在图 16 的实施例中，WL29 可以保持在 V3，直到 WL28 达到 0V 之后，如轨迹 402 中所示出。更具体地如图 16 中所示，在 WL28 开始下降到 0V 之后的一个延迟时间 td 之后 WL29 可以被驱至 V1。延迟时间 td 可以是任意预设值。对于在时间周期 T3 期间 WL29 保持在 0V 的实施例， WL29 可以保持在 0V，直到延迟时间 td 之后 WL28 达到 0V 之后，如轨迹 404 中所示出。本领域内的普通技术人员会理解所选择的字线和其他的字线之间的相对时序可按需求配置，来最小化电荷泄漏或者最大化局部沟道提升。

在之前的实施例中，V2 是优化用于最小化未选择存储器单元中的编程干扰并且用于最大化初级提升的沟道电平的值。本领域内的普通技术人员会理解实际的 V2 值将依赖于存储器单元的不同的设计和制造参数，并且

Micron Ex. 1016, p. 196
Micron v. YMTC
IPR2024-00795

因此可以通过仿真或者建模来确定。

本发明的所述实施例可以使用于标准分级编程方案。根据本发明的实施例，所选择的存储器单元编程电压 V1 将是应用到所选择的存储器单元的栅极的初始编程电压。从而，V1 的电压电平以预定的电压幅度反复增加，而应用到其他字线的传递电压和去耦电压保持在同样的电压电平。通过在递增编程步骤期间调整这些电压电平，相对于现有技术的编程方案，能够降低芯片尺寸和功率消耗。

在所述实施例中，应用到相邻下部字线（即，WL28）的关闭电压可以是 0V，或者基于对于存储器单元的所选择的设计和制造参数，以及由于应用 V6 传递电压导致的提升的沟道电压而选择的任意低电压。

可以通过字线驱动器电路和诸如译码器的相关的字线逻辑电路来控制字线和控制线（SSL 和 GSL）电压和应用时序。本领域内的普通技术人员会理解公知的多电压电平字线驱动器电路可以很容易被修改来提供在所说明的编程禁止时序实施例中使用的电压电平。对于任意的所选择的字线，译码逻辑可以确保直接相邻的字线（或者控制线）以所公开的方式被控制用于将所选择的存储器单元和与非串去耦。

因此，上面提及的字线/控制线控制方案有效地用于从擦除状态对所选择的存储器单元进行编程，而禁止对保持在擦除状态的所选择的存储器单元的编程。由于相对于现有技术编程禁止方案使用了较低的传递电压，所以未选择的存储器单元的编程干扰被最小化。由于所选择的存储器单元可以和与非串中的其他存储器单元去耦并隔离，因此，其沟道可以被有效地提升到用于禁止 F-N 隧穿的电平，并且可以执行随机页面编程。

对于任意基于与非串的闪烁存储器，可以实施编程禁止方案的前述实施例。本领域内的普通技术人员会理解方案中所使用的具体电压电平对于特定的工艺和与非单元设计是特有的。图 7b 到图 16 中所示的电压电平转变意于提供总的事件的时序，并不意于提供信号之间的具体的时序关系。本领域内的普通技术人员会意识到在不脱离本发明范围的情况下信号之间可以出现较小时序差。

本发明的上述实施例仅意于示例。本领域普通技术人员在不脱离本发明范围的情况下对于特定实施例可以做出替代、修改和改变，并且本发明范围仅由所附权利要求书限定。

Micron Ex. 1016, p. 197
Micron v. YMTC
IPR2024-00795

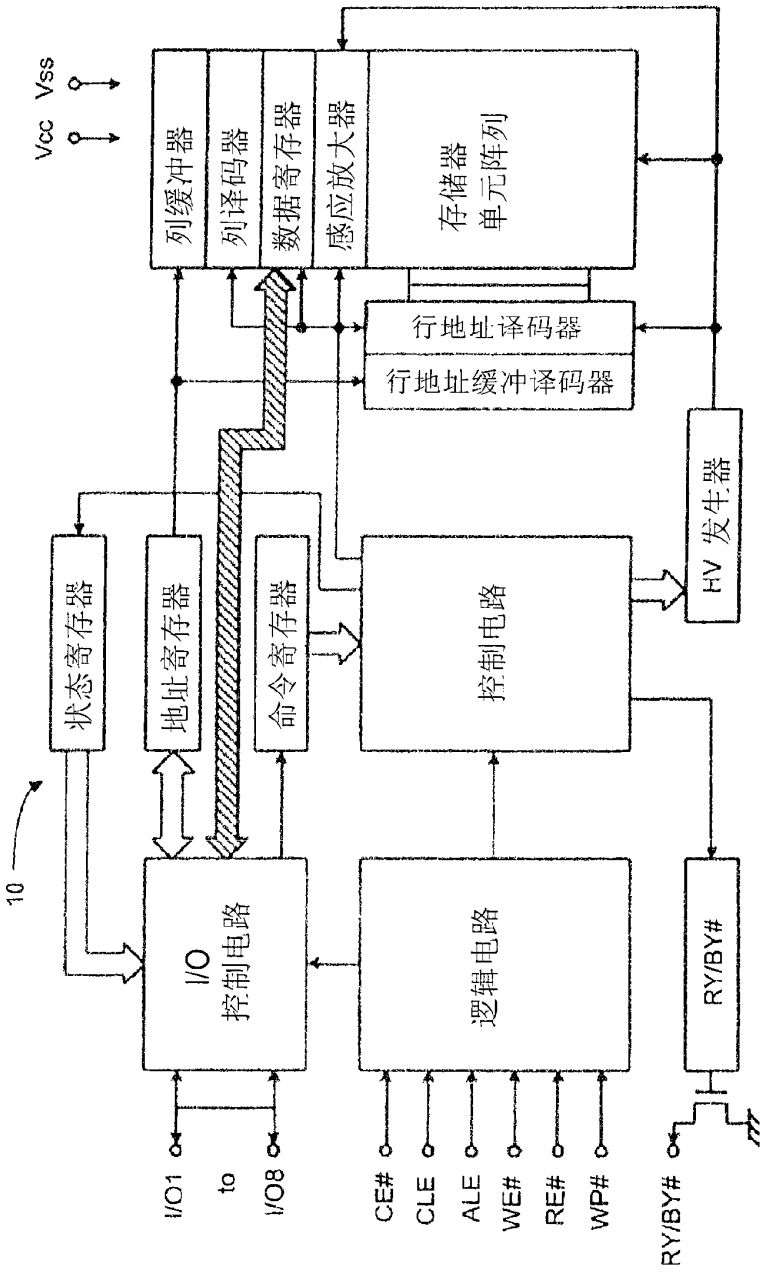


图1

Micron Ex. 1016, p. 198
Micron v. YMTC
IPR2024-00795

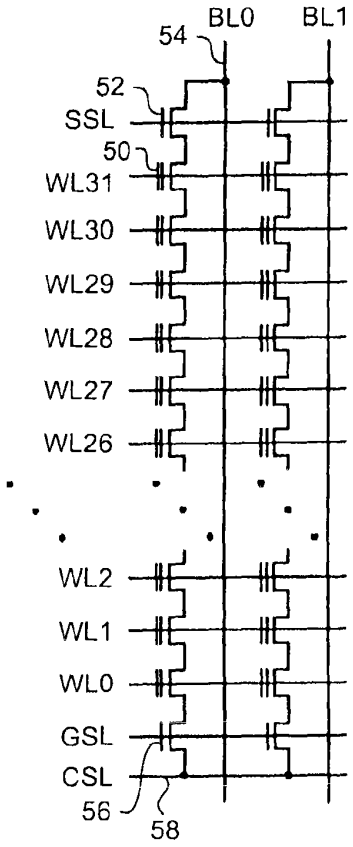


图2a

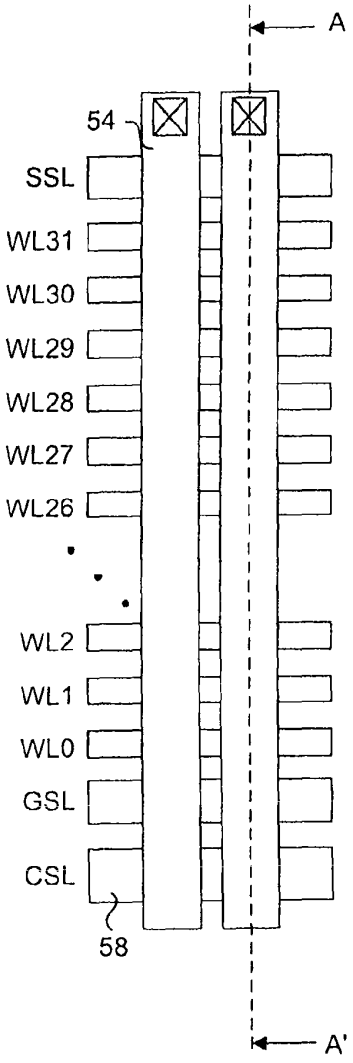


图2b

Micron Ex. 1016, p. 199
Micron v. YMTC
IPR2024-00795

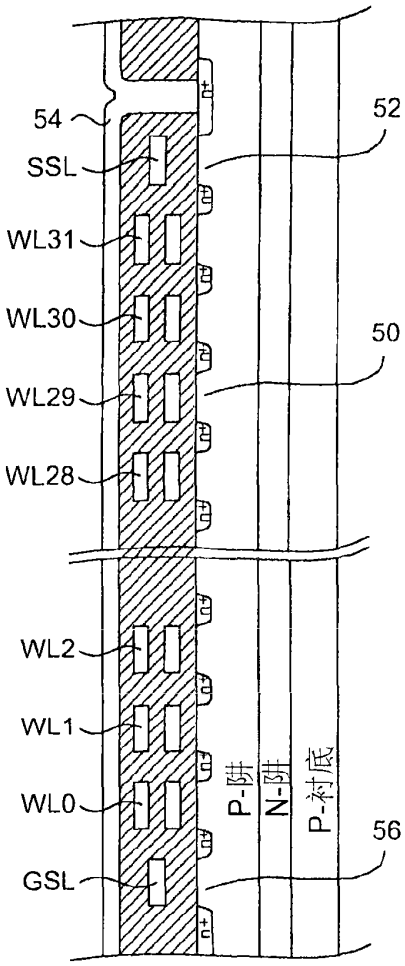


图2c

Micron Ex. 1016, p. 200
Micron v. YMTC
IPR2024-00795

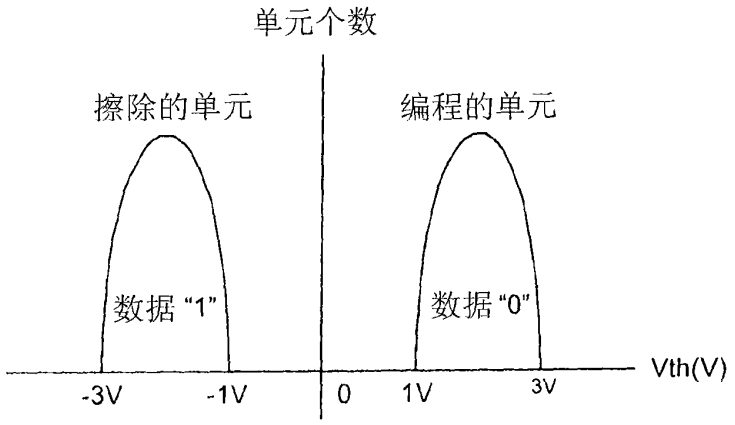


图3

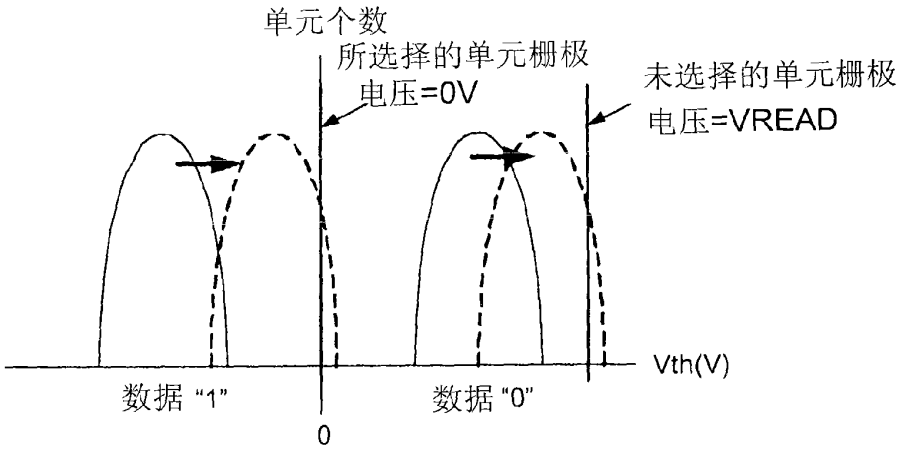


图4

Micron Ex. 1016, p. 201
Micron v. YMTC
IPR2024-00795

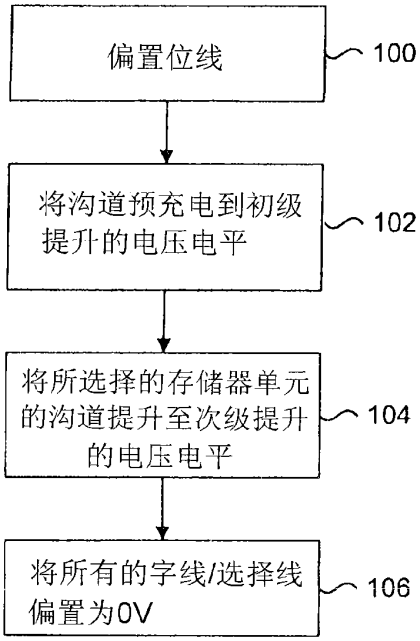


图5

Micron Ex. 1016, p. 202
Micron v. YMTC
IPR2024-00795

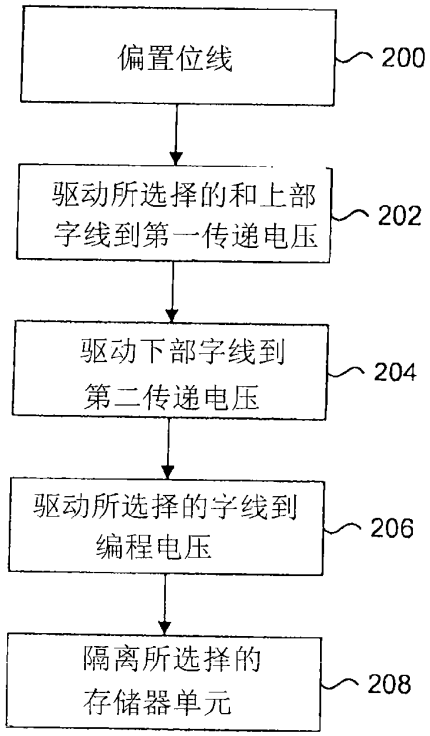


图6

Micron Ex. 1016, p. 203
Micron v. YMTC
IPR2024-00795

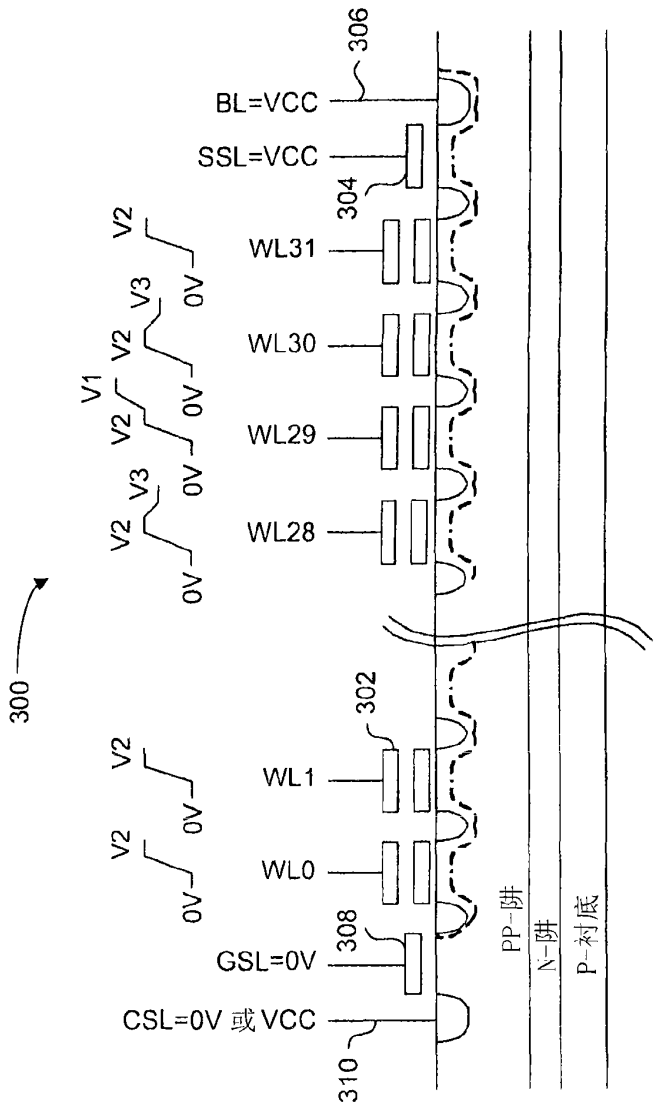


图7a

Micron Ex. 1016, p. 204
Micron v. YMTC
IPR2024-00795

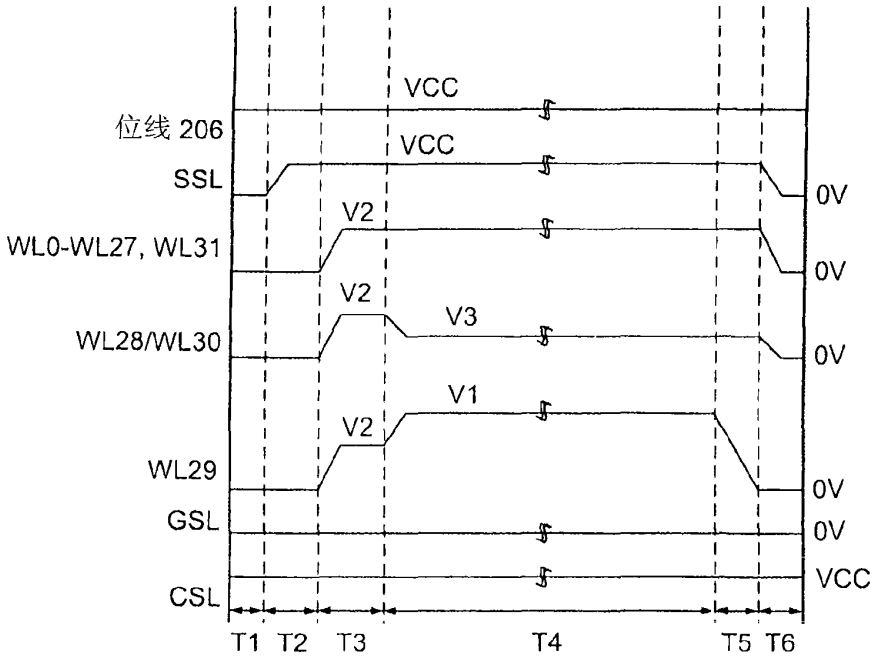


图7b

Micron Ex. 1016, p. 205
Micron v. YMTC
IPR2024-00795

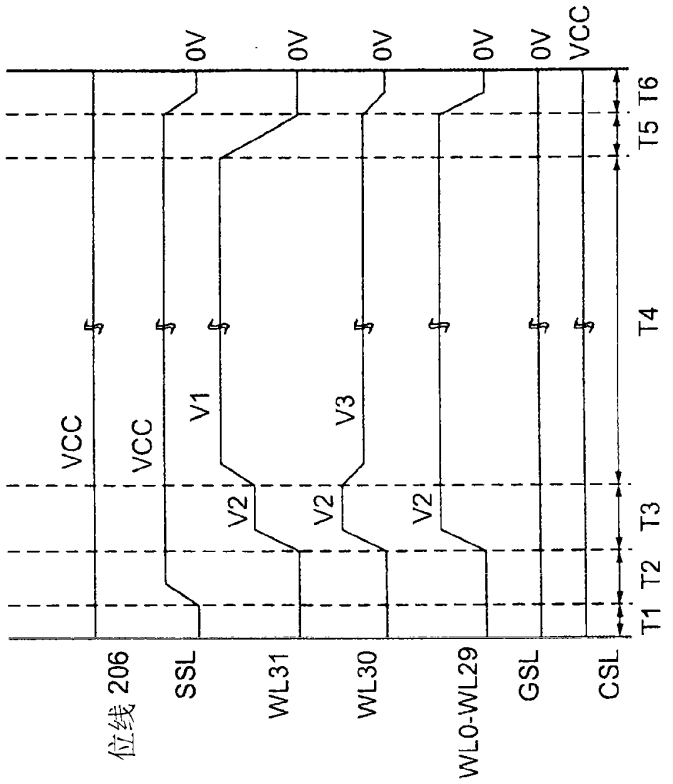


图 8

Micron Ex. 1016, p. 206
Micron v. YMTC
IPR2024-00795

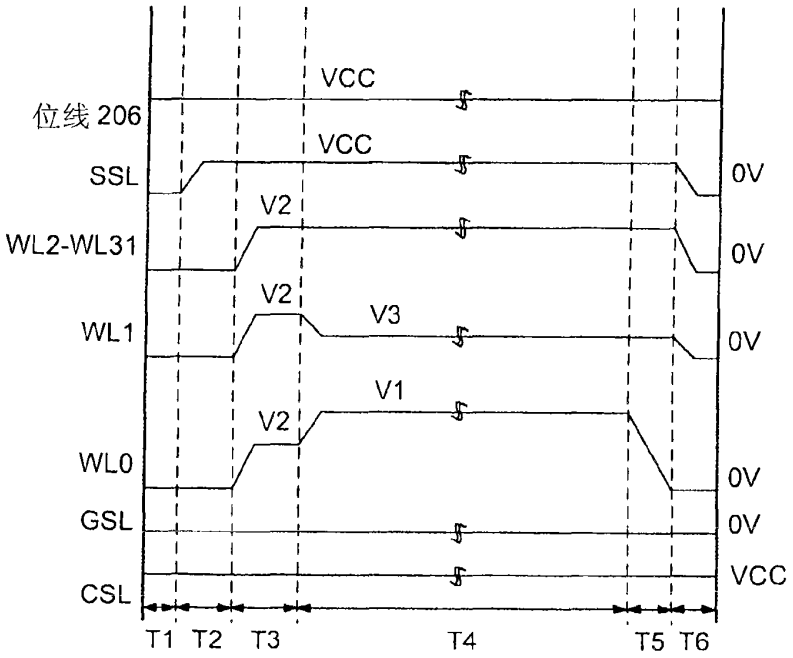


图9

Micron Ex. 1016, p. 207
Micron v. YMTC
IPR2024-00795

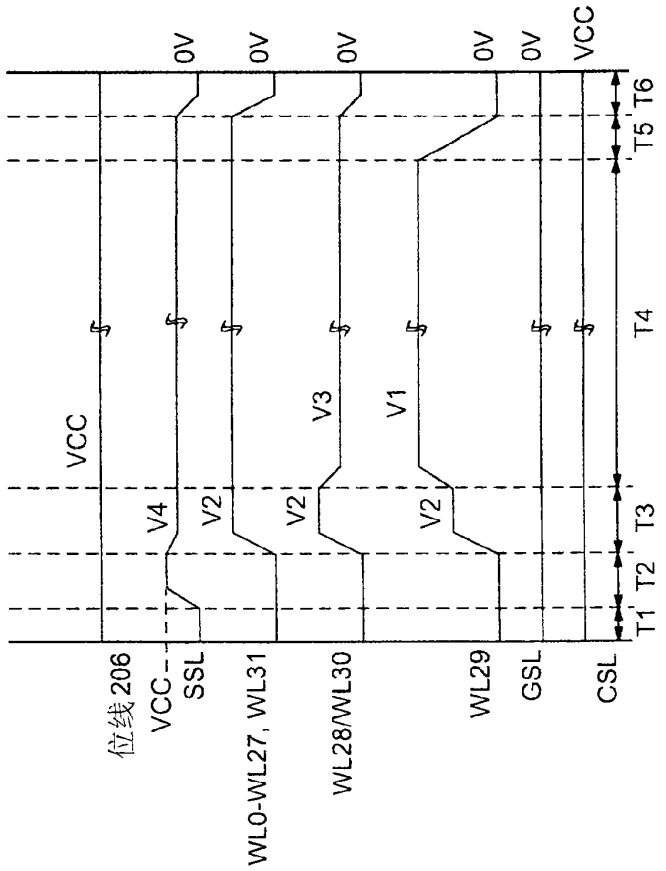


图10

Micron Ex. 1016, p. 208
Micron v. YMTC
IPR2024-00795

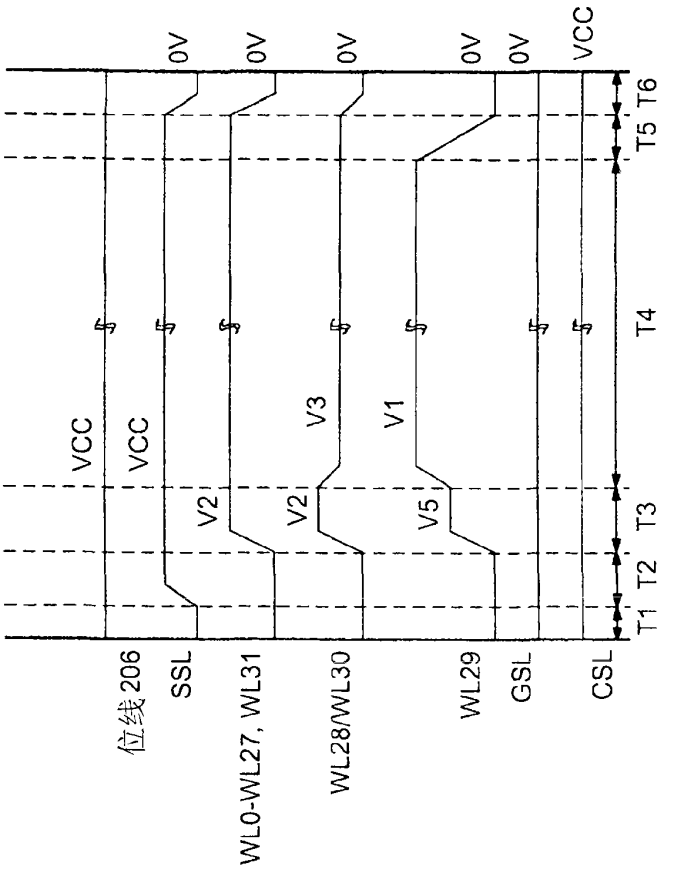


图11

Micron Ex. 1016, p. 209
Micron v. YMTC
IPR2024-00795

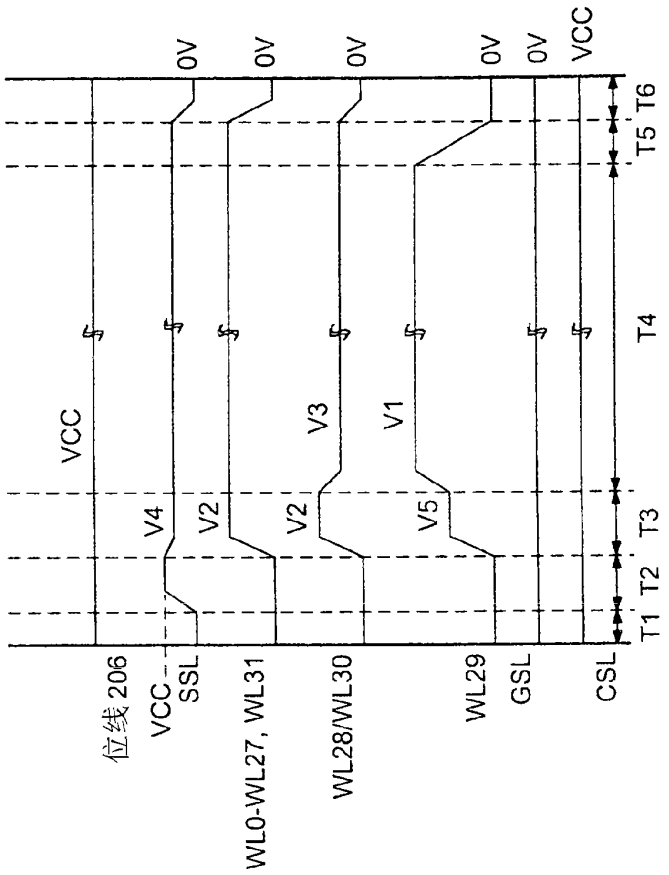


图12

Micron Ex. 1016, p. 210
Micron v. YMTC
IPR2024-00795

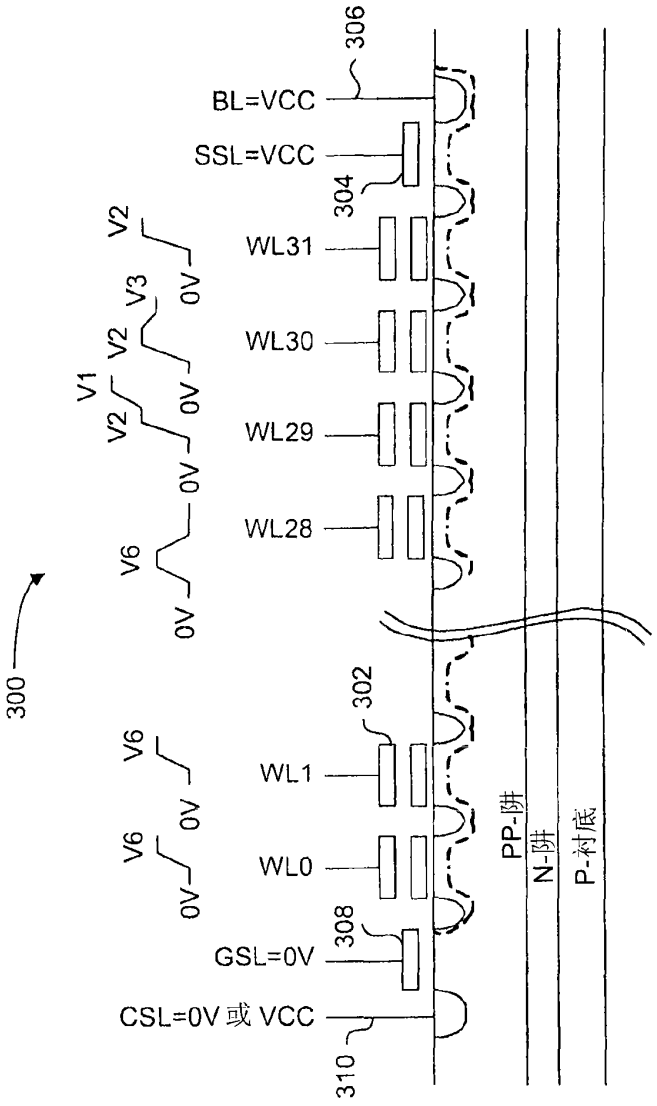


图13

Micron Ex. 1016, p. 211
Micron v. YMTC
IPR2024-00795

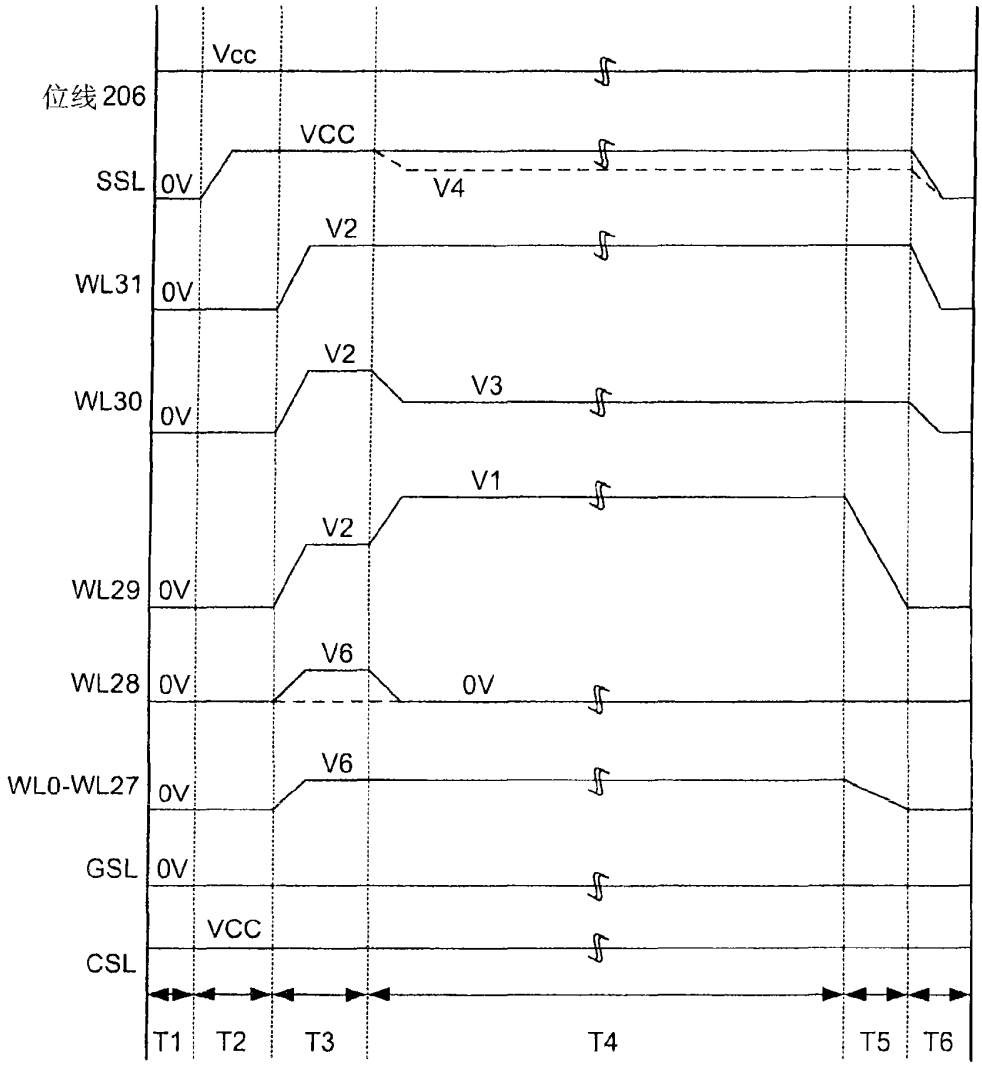


图14

Micron Ex. 1016, p. 212
Micron v. YMTC
IPR2024-00795

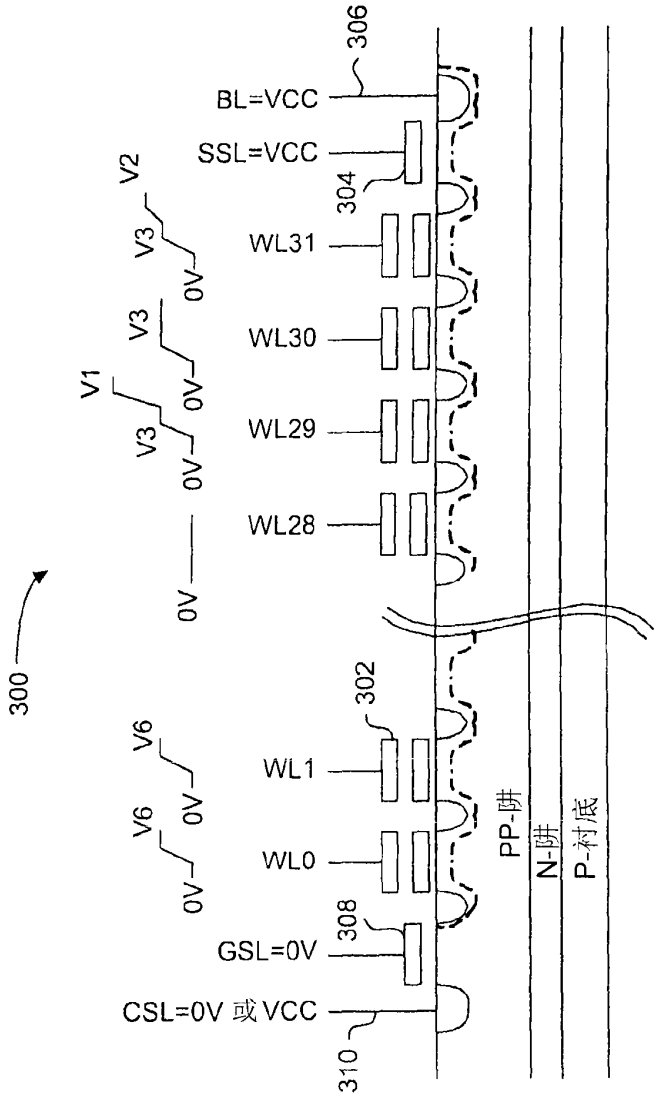


图15

Micron Ex. 1016, p. 213
Micron v. YMTC
IPR2024-00795

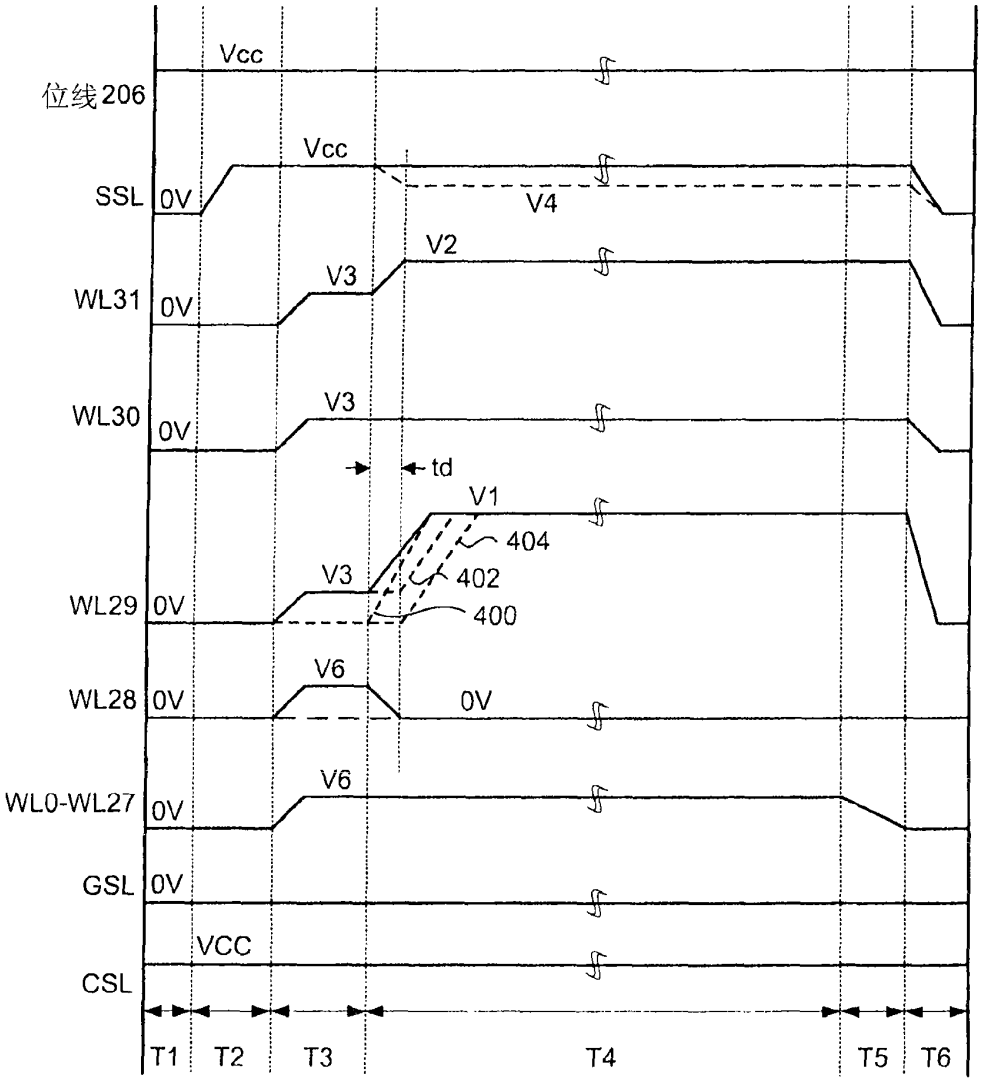


图16

Micron Ex. 1016, p. 214
Micron v. YMTC
IPR2024-00795

Electronic Acknowledgement Receipt

EFS ID:	47604706
Application Number:	17965527
International Application Number:	
Confirmation Number:	7400
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan Jia
Customer Number:	153988
Filer:	Zhiwei Zou/Anna O'Connor
Filer Authorized By:	Zhiwei Zou
Attorney Docket Number:	10018-01-0242-US-CON2
Receipt Date:	28-FEB-2023
Filing Date:	13-OCT-2022
Time Stamp:	14:36:49
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	10018-01-0242-US-CON2_IDS4-SB08.pdf	612209 bf5f45702bb2bb306a5ffe3620b55974598d6295	no	4

Warnings:

Micron Ex. 1016, p. 215
Micron v. YMTC
IPR2024-00795

Information:					
2	Foreign Reference	KR20110032797A_Bibl.pdf	1112310 a1bc4893433d5c5c72cfd9496c58f198adac97f1	no	12
Warnings:					
Information:					
3	Foreign Reference	CN101627436A_Bibl.pdf	6087480 4dc388e0c362ae33b9ff152c9a884add5f981f50	no	42
Warnings:					
Information:					
			Total Files Size (in bytes):	7811999	

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.

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

153988 7590 04/28/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

EXAMINER
NGUYEN, VIET Q

ART UNIT	PAPER NUMBER
2827	

NOTIFICATION DATE	DELIVERY MODE
04/28/2023	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):

USPTO@dockettrak.com
eofficeaction@appcoll.com
uspto@bayes.law

Micron Ex. 1016, p. 217
Micron v. YMTC
IPR2024-00795

Office Action Summary	Application No. 17/965,527	Applicant(s) Jia et al.	
	Examiner VIET Q NGUYEN	Art Unit 2827	AIA (FITF) Status Yes

-- 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 Application on 10/13/2022.

☐ 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) 1-20 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) 1,4,10,13-14 and 16 is/are rejected.

8) ☑ Claim(s) 2-3,5-9,11-12,15 and 17-20 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 or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 10/13/22 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 10/13/22; 2/13/23; 2/27/23; 2/28/23.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

Micron Ex. 1016, p. 218
Micron v. YMTC
IPR2024-00795

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

1. Claims **1-20** are present for examination.

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 conflicting claims 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); *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 nonstatutory

double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The filing of a terminal disclaimer by itself is not a complete reply to a nonstatutory double patenting (NSDP) rejection. A complete reply requires that the terminal disclaimer be accompanied by a reply requesting reconsideration of the prior Office action. Even where the NSDP rejection is provisional the reply must be complete. See MPEP § 804, subsection I.B.1. For a reply to a non-final Office action, see 37 CFR 1.111(a). For a reply to final Office action, see 37 CFR 1.113(c). A request for reconsideration while not provided for in 37 CFR 1.113(c) may be filed after final for consideration. See MPEP §§ 706.07(e) and 714.13.

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit www.uspto.gov/patent/patents-forms. The actual filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) 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 www.uspto.gov/ patents/apply/applying-online/eterminal-disclaimer

2. Claims **1, 4, 10, 13-14 & 16** are rejected on the ground of nonstatutory double patenting as being unpatentable over claims **1, 2, 4, 8 & 10-11**, respectively, of U.S. Patent No. **11,501,822 (same assignee/inventor).** Although the claims at issue are not identical, they are not patentably distinct from each other because the following comparisons:

Claim 1 (application) is broader than **claim 1 (patent),** and so it obviously read over claim 1 (of patent) because the control circuit of claim 1 (application) is also configured to perform the same three identical steps of the control circuit (patent) such as, for example, applying a first word line pre-pulse signal to a first group of word lines during precharge period, applying a second word line pre-pulse signal to a second group of word lines during precharge period, and applying a third word line pre-pulse signal to a third group of word lines during precharge period, and wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre- pulse signal is greater than that of the second word line pre-pulse signal.

Similarly, method **claim 16 (application)** is broader and obviously read over method **claim 11 (of patent)** because the method of claim 16 (application) is configured to perform the three identical steps of the method claim 11 (patent) such as, for example, applying a first word line pre-pulse signal to a first group of word lines during precharge period, applying a second word line pre-pulse signal to a second group of

word lines during precharge period, and applying a third word line pre-pulse signal to a third group of word lines during precharge period, and wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre- pulse signal is greater than that of the second word line pre-pulse signal.

Claim 4 (application) includes identical language from **claim 2 (patent).**

Claim 10 (application) includes identical language from **claim 4 (patent).**

Claim **13 (application)** includes identical language from **claim 8 (patent).**

Claim **14 (application)** includes identical language from **claim 10 (patent).**

3. Claims **1, 14 & 16** are rejected on the ground of nonstatutory double patenting as being unpatentable over claims **1, 9, & 3**, respectively, of U.S. Patent No. **11,081,164 (same assignee/inventor).** Although the claims at issue are not identical, they are not patentably distinct from each other because the following comparisons:

Claim 1 (application) is broader than **claim 1 (patent),** and so it obviously read over claim 1 (of patent) because the control circuit of claim 1 (application) is also configured to perform the same three identical steps of the control circuit (patent) such as, for example, applying a first word line pre-pulse signal to a first group of word lines during precharge period, applying a second word line pre-pulse signal to a second group of word lines during precharge period, and applying a third word line pre-pulse signal to a third group of word lines during precharge period, and wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line

pre-pulse signal, and a voltage level of the third word line pre- pulse signal is greater than that of the second word line pre-pulse signal.

Similarly, method **claim 16 (application)** is broader and obviously read over method **claim 9 (of patent)** because the method of claim 16 (application) is configured to perform the three identical steps of the method claim 9 (patent) such as, for example, applying a first word line pre-pulse signal to a first group of word lines during precharge period, applying a second word line pre-pulse signal to a second group of word lines during precharge period, and applying a third word line pre-pulse signal to a third group of word lines during precharge period, and wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre- pulse signal is greater than that of the second word line pre-pulse signal.

Claim **14 (application)** includes identical language from **claim 3 (patent).**

4. Other claims are objected as being dependent upon the rejected claims above but tentatively contain allowable subject matter over the prior arts of record for other recited features not seen elsewhere at this time.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to VIET Q NGUYEN whose telephone number is (571)272-1788. The examiner can normally be reached M-F 7:30-3PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/VIET Q NGUYEN/
Primary Examiner, Art Unit 2827

Notice of References Cited	Application/Control No. 17/965,527	Applicant(s)/Patent Under Reexamination Jia et al.	
	Examiner VIET Q NGUYEN	Art Unit 2827	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-11501822-B2	11-2022	Jia; Jianquan	G11C11/4074	1/1
*	B	US-11081164-B2	08-2021	Jia; Jianquan	G11C11/419	1/1
*	C	US-11205471-B2	12-2021	Choi; Yonghyuk	G11C11/5642	1/1
*	D	US-10998049-B1	05-2021	Wei; Wenzhe	G11C16/10	1/1
*	E	US-11024371-B2	06-2021	Cui; Ying	G11C16/08	1/1
*	F	US-10957408-B1	03-2021	Jia; Jianquan	G11C16/0483	1/1
*	G	US-11017838-B2	05-2021	Kang; Hee-Woong	G11C11/4085	1/1
*	H	US-10153029-B2	12-2018	Kwak; Dong-Hun	G11C8/12	1/1
*	I	US-10777254-B2	09-2020	Kwak; Dong-Hun	G11C16/08	1/1
*	J	US-9620232-B2	04-2017	Nam; Sang-Wan	G11C16/34	1/1
*	K	US-9142313-B2	09-2015	Shim; Sang-Won	G11C16/26	1/1
*	L	US-10157674-B2	12-2018	Kim; Doo-hyun	G11C16/14	1/1
*	M	US-9837164-B2	12-2017	Yun; Sung-Won	G11C16/3431	1/1

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC 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.

Micron Ex. 1016, p. 225
Micron v. YMTC
IPR2024-00795

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	Art Unit
	VIET Q NGUYEN	2827

CPC - Searched*		
Symbol	**Date**	**Examiner**
G11C 11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn

CPC Combination Sets - Searched*		
Symbol	**Date**	**Examiner**

US Classification - Searched*			
Class	**Subclass**	**Date**	**Examiner**

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	**Date**	**Examiner**
G11C 11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn
PE2E with similarity	04/25/2023	vn
Check with parent cases for DP :CON 16/709944 and 17/353727	04/25/2023	vn

Interference Search			
US Class/CPC Symbol	**US Subclass/CPC Group**	**Date**	**Examiner**
G11C	11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn

/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827	

Micron Ex. 1016, p. 226
Micron v. YMTC
IPR2024-00795

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	Art Unit
	VIET Q NGUYEN	2827

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/25/2023								
	1	✓								
	2	O								
	3	O								
	4	✓								
	5	O								
	6	O								
	7	O								
	8	O								
	9	O								
	10	✓								
	11	O								
	12	O								
	13	✓								
	14	✓								
	15	O								
	16	✓								
	17	O								
	18	O								
	19	O								
	20	O								

Micron Ex. 1016, p. 227
Micron v. YMTC
IPR2024-00795

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD 2827
Examiner Name	TBD V. Nguyen
Attorney Docket Number	10018-01-0242-US-CON2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050018489	A1	2005-01-27	Hosono	
	2	20080158991	A1	2008-07-03	Hemink et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	20110032797	KR	A	2011-03-30	HYNIX SEMICONDUCTOR INC [KR]		
	2	101627436	CN	A	2010-01-13	MOSAID TECHNOLOGIES INC		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 228
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

If you wish to add additional Foreign Patent Document citation information please click the Add button [Add]

NON-PATENT LITERATURE DOCUMENTS [Remove]

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button [Add]

EXAMINER SIGNATURE

Examiner Signature	/VIET Q NGUYEN/	Date Considered	04/25/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 229
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-28
Name/Print	Zhiwei Zou	Registration Number	66,041

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Micron Ex. 1016, p. 230
Micron v. YMTC
IPR2024-00795

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.

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Micron Ex. 1016, p. 231
Micron v. YMTC
IPR2024-00795

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD 2827
Examiner Name	TBD V. Nguyen
Attorney Docket Number	10018-01-0242-US-CON2

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20180053554	A1	2018-02-22	NAM et al.	
	2	20180082731	A1	2018-03-22	LEE	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2015176620	JP	A	2015-10-05	TOSHIBA CORP		

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Micron Ex. 1016, p. 232
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

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Examiner Signature	/VIET Q NGUYEN/	Date Considered	04/25/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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Micron Ex. 1016, p. 233
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-13
Name/Print	Zhiwei Zou	Registration Number	66,041

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Micron Ex. 1016, p. 234
Micron v. YMTC
IPR2024-00795

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Micron Ex. 1016, p. 235
Micron v. YMTC
IPR2024-00795

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	17/965527
Filing Date	10/13/22
First Named Inventor	Jianquan JIA
Art Unit	TBD 2827
Examiner Name	TBD V. Nguyen
Attorney Docket Number	10018-01-0242-US-CON2

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	9460805	B1	2016-10-04	Pang et al.	
	2	10283202	B1	2019-05-07	Chen et al.	
	3	10770157	B1	2020-09-08	Chen et al.	
	4	7577026	B2	2009-08-18	Dong et al.	
	5	9396800	B2	2016-07-19	Shim et al.	
	6	11081164	B2	2021-08-03	Jia et al.	
	7	11205471	B2	2021-12-21	Choi et al.	
	8	10998049	B1	2021-05-04	Wei et al.	

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Micron Ex. 1016, p. 236
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

	9	11024371	B2	2021-06-01	Cui et al.	
	10	10957408	B1	2021-03-23	Jia et al.	
	11	11017838	B2	2021-05-25	Kang et al.	
	12	10153029	B2	2018-12-11	Kwak et al.	
	13	10777254	B2	2020-09-15	Kwak et al.	
	14	9620232	B2	2017-04-11	Nam	
	15	9142313	B2	2015-09-22	Shim et al.	
	16	10157674	B2	2018-12-18	Kim et al.	
	17	9349471	B2	2016-05-24	Yun	
	18	9837164	B2	2017-12-05	Yun	

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	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
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	1	20200353312	A1	2020-11-12	Smith	
	2	20110194351	A1	2011-08-11	KIM et al.	
	3	20190147955	A1	2019-05-16	Chen	
	4	20190108883	A1	2019-04-11	Yu	
	5	20190156901	A1	2019-05-23	Chen	
	6	20200006379	A1	2020-01-02	NISHIKAWA et al.	

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	1	110289034	CN	A	2019-09-27		Abstract	
	2	109935256	CN	A	2019-06-25	TOSHIBA MEMORY CORP		

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	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

	3	113053431	A	CN	2021-06-29	SAMSUNG ELECTRONICS CO LTD		

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Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
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Examiner Signature	/VIET Q NGUYEN/	Date Considered	04/25/2023

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Micron Ex. 1016, p. 239
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

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See attached certification statement.

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SIGNATURE

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Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2022-10-13
Name/Print	Zhiwei Zou	Registration Number	66,041

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Micron Ex. 1016, p. 240
Micron v. YMTC
IPR2024-00795

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Micron Ex. 1016, p. 241
Micron v. YMTC
IPR2024-00795

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	150364	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 01:41 PM
L2	12886	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 01:47 PM
L3	159	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 02:59 PM
L4	211	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2021/12/26 02:59 PM

Micron Ex. 1016, p. 242
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L5	180	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:00 PM
L6	109	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:04 PM
L7	46	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN,	OR	ON	ON	2021/12/26 03:05 PM

Micron Ex. 1016, p. 243
Micron v. YMTC
IPR2024-00795

			WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L8	9	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:10 PM
L9	25	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L10	12	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L11	21	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2021/12/26 03:11 PM

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L12	11	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L13	19	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L14	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2021/12/26 03:11 PM

Micron Ex. 1016, p. 245
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L15	12	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L16	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:12 PM
L17	57	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:12 PM
L18	154097	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 246
Micron v. YMTC
IPR2024-00795

		G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L19	12886	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L20	173	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L21	230	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 247
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L22	196	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L23	115	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L24	49	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L25	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 248
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L26	27	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L27	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L28	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 249
Micron v. YMTC
IPR2024-00795

L29	11	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L30	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L31	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L32	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 250
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L33	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L34	58	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L35	140	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:43 PM
L36	56	L35 AND (cell$1 WITH	(US-PGPUB; USPAT;	OR	ON	ON	2022/04/14

Micron Ex. 1016, p. 251
Micron v. YMTC
IPR2024-00795

		string$1 WITH gate$1)	USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:44 PM
L37	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L38	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L39	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 252
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L40	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L41	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L42	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L43	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 253
Micron v. YMTC
IPR2024-00795

			AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L44	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L45	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L46	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 254
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L47	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L48	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L49	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L50	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 255
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L51	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L52	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L53	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 256
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L54	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L55	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L56	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L57	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 257
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L58	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L59	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L60	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 258
Micron v. YMTC
IPR2024-00795

			WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L61	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L62	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L63	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L64	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/06/30 02:31 PM

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L65	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L66	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L67	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 260
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L68	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L69	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L70	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L71	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 261
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L72	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L73	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L74	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 262
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L75	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L76	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L77	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L78	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 263
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L79	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L80	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L81	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 264
Micron v. YMTC
IPR2024-00795

L82	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L83	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L84	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L85	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 265
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L86	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L87	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L88	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L89	59	"10157674"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/01

Micron Ex. 1016, p. 266
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:02 PM
L90	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L91	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L92	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 267
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L93	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L94	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L95	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L96	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 268
Micron v. YMTC
IPR2024-00795

			AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L97	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L98	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L99	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 269
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L100	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L101	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L102	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L103	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 270
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L104	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L105	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L106	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 271
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L107	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L108	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L109	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L110	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/01 03:02 PM

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L111	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L112	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L113	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 273
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L114	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L115	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L116	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L117	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/01 03:02 PM

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L118	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L119	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L120	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 275
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L121	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L122	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L123	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L124	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 276
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L125	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L126	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L127	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 277
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L128	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L129	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L130	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L131	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 278
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L132	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L133	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L134	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 279
Micron v. YMTC
IPR2024-00795

L135	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L136	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L137	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L138	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 280
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L139	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L140	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L141	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L142	59	"10157674"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/01

Micron Ex. 1016, p. 281
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:02 PM
L143	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L144	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L145	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 282
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L146	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L147	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L148	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L149	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 283
Micron v. YMTC
IPR2024-00795

			AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L150	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L151	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L152	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 284
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L153	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L154	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L155	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L156	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 285
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L157	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L158	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L159	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 286
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L160	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L161	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L162	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L163	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 287
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L164	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L165	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L166	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 288
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L167	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L168	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L169	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L170	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L171	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L172	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L173	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 290
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L174	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L175	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L176	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L177	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 291
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L178	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L179	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L180	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 292
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L181	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L182	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L183	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L184	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 293
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L185	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L186	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L187	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 294
Micron v. YMTC
IPR2024-00795

L188	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L189	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L190	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L191	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 295
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L192	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L193	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L194	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L195	13	"10777254"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/07

Micron Ex. 1016, p. 296
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:47 AM
L196	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L197	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L198	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 297
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L199	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L200	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L201	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L202	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 298
Micron v. YMTC
IPR2024-00795

			AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L203	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L204	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L205	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 299
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L206	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L207	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L208	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L209	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 300
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L210	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L211	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L212	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 301
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L213	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L214	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L215	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L216	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L217	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L218	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L219	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 303
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L220	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L221	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L222	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L223	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 304
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L224	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L225	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L226	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 305
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L227	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L228	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L229	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L230	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 306
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L231	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L232	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L233	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 307
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L234	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L235	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L236	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L237	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 308
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L238	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L239	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L240	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 309
Micron v. YMTC
IPR2024-00795

L241	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L242	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L243	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L244	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 310
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L245	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L246	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L247	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L248	13	"10777254"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/07

Micron Ex. 1016, p. 311
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:47 AM
L249	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L250	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L251	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 312
Micron v. YMTC
IPR2024-00795

			PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L252	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L253	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L254	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L255	180	(wordline OR word-line OR (word adj1 line))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 313
Micron v. YMTC
IPR2024-00795

		near5 pre-pulse$1	AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L256	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L257	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L258	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 314
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L259	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L260	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L261	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L262	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L263	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L264	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L265	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 316
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L266	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L267	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L268	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L269	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 317
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L270	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L271	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L272	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 318
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L273	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L274	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L275	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L276	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 319
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L277	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L278	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L279	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 320
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L280	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L281	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L282	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L283	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 321
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L284	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L285	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L286	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 322
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L287	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L288	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	41398	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:41 PM
N2	7560614	YANGTZE MEMORY TECHNOLOGIES CO., LTD.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:43 PM
N3	530242	Jia, Jianquan; Cui, Ying; You, Kaikai	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:43 PM
N4	6894	365/230.06.ccls.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:47 PM

Micron Ex. 1016, p. 323
Micron v. YMTC
IPR2024-00795

N5	50	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:54 PM
N6	75	(wordline OR word-line OR (word adj1 line)) near9 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:54 PM
N7	77	(wordline OR word-line OR (word adj1 line)) near12 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:55 PM
N8	78	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:55 PM
N9	68	(N1 OR N4) AND (N2 OR N3) AND N8	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:56 PM
N10	52	N9 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:57 PM
N11	6	"11056196"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:58 PM
N12	3	"11205471"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:59 PM
N13	3	"11043279"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 02:01 PM

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	17965527
Filing Date	2022-10-13
First Named Inventor	Jianquan JIA
Art Unit	TBD 2827
Examiner Name	TBD V. Nguyen
Attorney Docket Number	10018-01-0242-US-CON2

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20150221387	A1	2015-08-06	NAM	
	2	20180137925	A1	2018-05-17	NAM et al.	
	3	20180053554	A1	2018-02-22	NAM et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	108389601	CN	A	2018-08-10	SAMSUNG ELECTRONICS CO LTD		

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 325
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

If you wish to add additional Foreign Patent Document citation information please click the Add button [Add]

NON-PATENT LITERATURE DOCUMENTS [Remove]

Examiner Initials*	Cite No	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, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1		

If you wish to add additional non-patent literature document citation information please click the Add button [Add]

EXAMINER SIGNATURE

Examiner Signature	/VIET Q NGUYEN/	Date Considered	04/25/2023

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 326
Micron v. YMTC
IPR2024-00795

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	17965527
	Filing Date	2022-10-13
	First Named Inventor	Jianquan JIA
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	10018-01-0242-US-CON2

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Zhiwei Zou/	Date (YYYY-MM-DD)	2023-02-27
Name/Print	Zhiwei Zou	Registration Number	66,041

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 327
Micron v. YMTC
IPR2024-00795

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 record s.

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.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /V.Q.N/

Micron Ex. 1016, p. 328
Micron v. YMTC
IPR2024-00795

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 17/965,527	Filing Date 10/13/2022	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)			
FOR	NUMBER FILED	NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $480 =	
☐ APPLICATION SIZE FEE (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).				
☐ 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	07/21/2023	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 $100 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0		x $480 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ 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		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ 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.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/AMANDA CHRISTINE LEMUS/
*** 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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor: Jianquan Jia	Confirmation No.: 7400
Applicant: YANGTZE MEMORY TECHNOLOGIES CO. LTD.	Art Unit: 2827
Application No.: 17/965,527	Examiner: NGUYEN, VIET Q
Filing Date: October 13, 2022	Atty. Docket: 10018-01-0242-US-CON2

Title: **NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD**

Amendment and Reply Under 37 C.F.R. § 1.111

Mail Stop Amendment

Commissioner for Patents

PO Box 1450

Alexandria, VA 22313-1450

Commissioner:

In reply to the Office Action dated April 28, 2023, Applicant submits the following Remarks:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected on page 3 of this paper.

Remarks begin on page 7 of this paper.

It is not believed that extensions of time are required beyond those that may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any additional fees required to continue prosecution or appeal of this application (including issue fee, fees for net addition of claims or forwarding to appeal) are hereby authorized to be charged to our Deposit Account No. 60-2227.

Micron Ex. 1016, p. 330
Micron v. YMTC
IPR2024-00795

Amendment to the Specification

Please amend paragraph [0001] of the specification as following:

[0001] This application is a continuation of U.S. Application No. 17/353,727, filed on June 21, 2021, issued as U.S. Patent No. 11,501,822, which is a continuation of U.S. Application No. 16/709,944, filed on December 11, 2019, issued as U.S. Patent No. 11,081,164, which is a continuation of International Application No. PCT/CN2019/112409, filed on October 22, 2019, all of which are incorporated herein by reference in their entireties.

Micron Ex. 1016, p. 331
Micron v. YMTC
IPR2024-00795

Amendment to the Claims

1. (Original) A non-volatile memory device, comprising:

a plurality of word lines; and

a control circuit configured to:

apply a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines,

apply a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period, and

apply a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period,

wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

2. (Original) The non-volatile memory device of claim 1, wherein the control circuit is further configured to:

apply a select pre-pulse signal of the plurality of word line pre-pulse signals to a selected word line of the plurality of word lines during the pre-charge period, wherein the select pre-pulse signal is different from the second word line pre-pulse signal.

3. (Original) The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are at a same side of the selected word line.

4. (Original) The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are disposed in an order of distance from the selected word line.

5. (Original) The non-volatile memory device of claim 2, wherein the first group of the plurality of word lines are disposed adjacent to the selected word line, the second group of

Micron Ex. 1016, p. 332
Micron v. YMTC
IPR2024-00795

the plurality of word lines are disposed between the first group of the plurality of word lines and a top select gate line, and the third group of the plurality of word lines are disposed between the second group of the plurality of word lines and the top select gate line, wherein the selected word line are between the top select gate line and a bottom select gate line.

6. (Currently Amended) The non-volatile memory device of claim 1, wherein voltages of at least two ~~group~~ groups of the plurality of word lines change during a first period of the pre-charge period, wherein the first period of the pre-charge period is adjacent to a programming period in which a voltage Vpass is applied to the plurality of word lines.

7. (Currently Amended) The non-volatile memory device of claim 1, wherein voltages of at least two ~~group~~ groups of the plurality of word lines are zero volts during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line.

8. (Currently Amended) The non-volatile memory device of claim 1, wherein voltages of at least two ~~group~~ groups of the plurality of word lines decrease during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line.

9. (Original) The non-volatile memory device of claim 1, wherein voltage levels of the plurality of word line pre-pulse signals are positive, negative, or zero volts.

10. (Original) The non-volatile memory device of claim 5, wherein the control circuit is configured to apply a bit line pre-pulse signal to a bit line during the pre-charge period.

11. (Original) The non-volatile memory device of claim 10, further comprising: a first memory string connected to the top select gate line and being an unselected memory string, and the bit line is an unselected bit line.

12. (Original) The non-volatile memory device of claim 2, wherein the control circuit is

Micron Ex. 1016, p. 333
Micron v. YMTC
IPR2024-00795

configured to apply a top dummy word line pre-pulse signal to a top dummy word line of the plurality of word lines during the pre-charge period, wherein the selected word line is between the top dummy word line and a bottom select gate line.

13. (Original) The non-volatile memory device of claim 12, wherein a voltage level of the top dummy word line pre-pulse signal is greater than that of the third word line pre-pulse signal.

14. (Original) The non-volatile memory device of claim 1, wherein a charge duration of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a charge duration of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

15. (Original) The non-volatile memory device of claim 1, wherein voltage levels of the first word line pre-pulse signal, the second word line pre-pulse signal, and the third word line pre-pulse signal are negative, wherein an absolute value of a voltage level of the first word line pre-pulse signal is greater than that of the second word line pre-pulse signal, and an absolute value of a voltage level of the second word line pre-pulse signal is greater than that of the third word line pre-pulse signal.

16. (Original) A control method of non-volatile memory device, wherein the non-volatile memory device comprises a plurality of word lines, the control method comprises:

applying a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines;

applying a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period; and

applying a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period,

wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal.

Micron Ex. 1016, p. 334
Micron v. YMTC
IPR2024-00795

17. (Original) The control method of claim 16, further comprising:

applying a select pre-pulse signal of the plurality of word line pre-pulse signals to a selected word line of the plurality of word lines during the pre-charge period, wherein the select pre-pulse signal is different from the second word line pre-pulse signal.

18. (Original) The control method of claim 17, wherein the first group of the plurality of word lines, the second group of the plurality of word lines, and the third group of the plurality of word lines are at a same side of the selected word line and are disposed in an order of distance from the selected word line.

19. (Currently Amended) The control method of claim 16, wherein voltages of at least two ~~group~~ groups of the plurality of word lines change during a first period of the pre-charge period, wherein the first period of the pre-charge period is adjacent to a programming period in which a voltage Vpass is applied to the plurality of word lines.

20. (Currently Amended) The control method of claim 16, wherein voltages of at least two ~~group~~ groups of the plurality of word lines are zero volts during a period after the pre-charge period and before a voltage Vpass being applied to word lines disposed between a selected word line and a top select gate line, or voltages of the at least two groups of the plurality of word lines decrease during the period after the pre-charge period and before the voltage Vpass being applied to the word lines disposed between the selected word line and the top select gate line.

Micron Ex. 1016, p. 335
Micron v. YMTC
IPR2024-00795

REMARKS

Reconsideration of this Application is respectfully requested.

The cross-reference section of the specification is hereby amended to add corresponding patent numbers. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Claims 6-8 and 19-20 are hereby amended to correct typos. No new matter is introduced.

Throughout the arguments, Applicant reminds the Examiner that the claims are given their broadest reasonable meaning in view of the specification, and any paraphrasing of the claim features is not to be interpreted as reading any features into, or characterizing of, the claims.

Based on the above amendment and the following remarks, Applicant respectfully requests that the Examiner reconsider all outstanding rejections and that they be withdrawn.

Double Patenting

Claims 1, 4, 10, 13-14, and 16 are rejected on the ground of non-statutory double patenting as being unpatentable over claims 1, 2, 4, 8, and 10-11, respectively, of U.S. Patent No. 11,501,822.

Claims 1, 14, and 16 are rejected on the ground of non-statutory double patenting as being unpatentable over claims 1, 9, and 3, respectively, of U.S. Patent No. 11,081,164.

Without acquiescing to the propriety of the rejection and to expedite the prosecution, Applicant respectfully files a terminal disclaimer to obviate the non-statutory double patenting rejections.

Accordingly, Applicant respectfully requests withdrawal of the double patenting rejection.

Micron Ex. 1016, p. 336
Micron v. YMTC
IPR2024-00795

Conclusion

All of the stated grounds of rejections have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. Applicant believes that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

BAYES PLLC

/Zhiwei Zou/

Zhiwei Zou
Attorney for Applicant
Registration No. 66,041

Date: July 21, 2023

8260 Greensboro Drive, Suite 625
McLean, VA 22102
(703) 995-9887

Micron Ex. 1016, p. 337
Micron v. YMTC
IPR2024-00795

Electronic Acknowledgement Receipt

EFS ID:	48331705
Application Number:	17965527
International Application Number:	
Confirmation Number:	7400
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan Jia
Customer Number:	153988
Filer:	Zhiwei Zou/Anna O'Connor
Filer Authorized By:	Zhiwei Zou
Attorney Docket Number:	10018-01-0242-US-CON2
Receipt Date:	21-JUL-2023
Filing Date:	13-OCT-2022
Time Stamp:	17:36:03
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)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		2019-00232-YMTC-PCT-US-CON1-CON1_ResponsetoNFOAdated_04282023.pdf	143041 05a719c30b6dd10f1c69d28f76783e686d776be9	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Request for Reconsideration-After Non-Final Rejection	1	1
	Specification	2	2
	Claims	3	6
	Applicant Arguments/Remarks Made in an Amendment	7	8
Warnings:			
Information:			
	Total Files Size (in bytes):	143041	

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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.

Doc Code: DIST.E.FILE **Document Description: Electronic Terminal Disclaimer - Filed**	PTO/SB/26 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT**
Application Number	17965527
Filing Date	13-Oct-2022
First Named Inventor	Jianquan Jia
Attorney Docket Number	10018-01-0242-US-CON2
Title of Invention	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

☒ Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action

☒ This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.

Owner	Percent Interest
YANGTZE MEMORY TECHNOLOGIES CO. LTD.	100%

The owner(s) with percent interest listed above 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 number(s)

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as the term of said prior patent is presently shortened by any terminal disclaimer. The owner 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 owner 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.

◉ Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request. ○ I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.	
Applicant claims the following fee status: ○ Small Entity ○ Micro Entity ◉ Regular Undiscounted I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application Registration Number 66041 ○ A sole inventor ○ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ○ A joint inventor; all of whom are signing this request	
Signature	/Zhiwei Zou/
Name	Zhiwei Zou

*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).
Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

Electronic Patent Application Fee Transmittal

Application Number:	17965527
Filing Date:	13-Oct-2022
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan Jia
Filer:	Zhiwei Zou/Anna O'Connor
Attorney Docket Number:	10018-01-0242-US-CON2

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
STATUTORY OR TERMINAL DISCLAIMER	1814	1	170	170
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**170**

Doc Code: DISQ.E.FILE
Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 17965527

Filing Date: 13-Oct-2022

Applicant/Patent under Reexamination: Jia

Electronic Terminal Disclaimer filed on July 21, 2023

☒ APPROVED

This patent is subject to a terminal disclaimer

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

Electronic Acknowledgement Receipt

EFS ID:	48331745
Application Number:	17965527
International Application Number:	
Confirmation Number:	7400
Title of Invention:	NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD
First Named Inventor/Applicant Name:	Jianquan Jia
Customer Number:	153988
Filer:	Zhiwei Zou/Anna O'Connor
Filer Authorized By:	Zhiwei Zou
Attorney Docket Number:	10018-01-0242-US-CON2
Receipt Date:	21-JUL-2023
Filing Date:	13-OCT-2022
Time Stamp:	17:40:24
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$170
RAM confirmation Number	E20237KH40225112
Deposit Account	602227
Authorized User	Anna O'Connor
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Terminal Disclaimer-Filed (Electronic)	eTerminal-Disclaimer.pdf	41237 9ea3a6db124fdbc2bd7269373c828accb7716358	no	2
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	37958 4f1ec86bda04c741aab0b0ccf112cb57ca01b066	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	79195		

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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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NOTICE OF ALLOWANCE AND FEE(S) DUE

153988 7590 08/24/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

EXAMINER	
NGUYEN, VIET Q	
ART UNIT	PAPER NUMBER
2827	

DATE MAILED: 08/24/2023

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

TITLE OF INVENTION: NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	11/24/2023

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 40% the amount of undiscounted fees, and micro entity fees are 20% the amount of undiscounted 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. 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: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PTOL-85 (Rev. 02/11)

Micron Ex. 1016, p. 347
Micron v. YMTC
IPR2024-00795

PART B - FEE(S) TRANSMITTAL

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

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CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

153988 7590 08/24/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

TITLE OF INVENTION: NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	11/24/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, VIET Q	2827	365-230060

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/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or 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 _____
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). 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. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via Patent Center or EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

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.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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.

❑ Applicant changing to regular undiscounted fee 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. _____

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Micron Ex. 1016, p. 348
Micron v. YMTC
IPR2024-00795

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.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

153988 7590 08/24/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

EXAMINER	
NGUYEN, VIET Q	
ART UNIT	PAPER NUMBER
2827	

DATE MAILED: 08/24/2023

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.

PTOL-85 (Rev. 02/11)

Micron Ex. 1016, p. 349
Micron v. YMTC
IPR2024-00795

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 30 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.

Notice of Allowability	Application No. 17/965,527	Applicant(s) Jia et al.	
	Examiner VIET Q NGUYEN	Art Unit 2827	AIA (FITF) Status Yes

-- 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 TD & amendment on 7/21/23.
   ☐ 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 1-20 . 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** or send an inquiry to **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. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/VIET Q NGUYEN/
Primary Examiner, Art Unit 2827

Micron Ex. 1016, p. 351
Micron v. YMTC
IPR2024-00795

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Reasons for Allowance

1. The following is an examiner's statement of reasons for allowance:

The prior arts fail to disclose control method for a non-volatile memory device comprising the steps of:

apply a first word line pre-pulse signal of a plurality of word line pre-pulse signals to a first group of the plurality of word lines,

apply a second word line pre-pulse signal of the plurality of word line pre-pulse signals to a second group of the plurality of word lines during a pre-charge period, and apply a third word line pre-pulse signal of the plurality of word lines pre-pulse signals to a third group of the plurality of word lines during the pre-charge period,

wherein a voltage level of the second word line pre-pulse signal is greater than that of the first word line pre-pulse signal, and a voltage level of the third word line pre-pulse signal is greater than that of the second word line pre-pulse signal (claims 1 & 16).

The dependent claims are allowable for inheriting recited method above and/recite additional novel features, which are neither shown nor seen elsewhere at this time.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to VIET Q NGUYEN whose telephone number is (571)272-1788. The examiner can normally be reached M-F 7:30-3PM EST.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: https://patentcenter.uspto.gov. Visit https://www.uspto.gov/patents/apply/patent-center for more information about Patent Center and https://www.uspto.gov/patents/docx for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197

(toll-free). If you would like assistance from a USPTO Customer Service

Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/VIET Q NGUYEN/
Primary Examiner, Art Unit 2827

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	Art Unit
	VIET Q NGUYEN	2827

CPC - Searched*		
Symbol	Date	Examiner
G11C 11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
365	230.06	4/25/23	vn

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
G11C 11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn
PE2E with similarity	04/25/2023	vn
Check with parent cases for DP :CON 16/709944 and 17/353727	04/25/2023	vn
PE2E Updated	08/21/2023	vn

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
G11C	11/4085, 11/4074, 11/4094, 11/4099, 11/419	04/25/2023	vn

/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827	/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827

Micron Ex. 1016, p. 355
Micron v. YMTC
IPR2024-00795

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	**Art Unit**
	VIET Q NGUYEN	2827

CPC						
Symbol					**Type**	**Version**
G11C	/	11	/	4085	F	2013-01-01
G11C	/	11	/	4074	I	2013-01-01
G11C	/	11	/	4094	I	2013-01-01
G11C	/	11	/	4099	I	2013-01-01
G11C	/	11	/	419	I	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827	21 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20230821

Micron Ex. 1016, p. 356
Micron v. YMTC
IPR2024-00795

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	**Art Unit**
	VIET Q NGUYEN	2827

INTERNATIONAL CLASSIFICATION					
CLAIMED					
G11C	/	8	/	00	
NON-CLAIMED					
	/		/		

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
365	230.06

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827	21 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20230821

Micron Ex. 1016, p. 357
Micron v. YMTC
IPR2024-00795

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	**Art Unit**
	VIET Q NGUYEN	2827

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	10	10	19	19										
2	2	11	11	20	20										
3	3	12	12												
4	4	13	13												
5	5	14	14												
6	6	15	15												
7	7	16	16												
8	8	17	17												
9	9	18	18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/VIET Q NGUYEN/ Primary Examiner, Art Unit 2827	21 August 2023	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

U.S. Patent and Trademark Office — Part of Paper No.: 20230821

Micron Ex. 1016, p. 358
Micron v. YMTC
IPR2024-00795

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	17/965,527	Jia et al.
	Examiner	**Art Unit**
	VIET Q NGUYEN	2827

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☑ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/25/2023	08/21/2023							
1	1	✓	=							
2	2	O	=							
3	3	O	=							
4	4	✓	=							
5	5	O	=							
6	6	O	=							
7	7	O	=							
8	8	O	=							
9	9	O	=							
10	10	✓	=							
11	11	O	=							
12	12	O	=							
13	13	✓	=							
14	14	✓	=							
15	15	O	=							
16	16	✓	=							
17	17	O	=							
18	18	O	=							
19	19	O	=							
20	20	O	=							

Micron Ex. 1016, p. 359
Micron v. YMTC
IPR2024-00795

PE2E SEARCH - Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
L1	150364	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 01:41 PM
L2	12886	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 01:47 PM
L3	159	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 02:59 PM
L4	211	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2021/12/26 02:59 PM

Micron Ex. 1016, p. 360
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L5	180	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:00 PM
L6	109	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:04 PM
L7	46	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN,	OR	ON	ON	2021/12/26 03:05 PM

Micron Ex. 1016, p. 361
Micron v. YMTC
IPR2024-00795

			WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L8	9	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:10 PM
L9	25	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L10	12	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L11	21	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2021/12/26 03:11 PM

Micron Ex. 1016, p. 362
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L12	11	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L13	19	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L14	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2021/12/26 03:11 PM

Micron Ex. 1016, p. 363
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L15	12	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:11 PM
L16	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:12 PM
L17	57	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2021/12/26 03:12 PM
L18	154097	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 364
Micron v. YMTC
IPR2024-00795

		G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L19	12886	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L20	173	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L21	230	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 365
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L22	196	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L23	115	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L24	49	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L25	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/04/14 03:42 PM

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L26	27	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L27	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L28	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 367
Micron v. YMTC
IPR2024-00795

L29	11	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L30	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L31	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L32	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/04/14 03:42 PM

Micron Ex. 1016, p. 368
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L33	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L34	58	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:42 PM
L35	140	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/04/14 03:43 PM
L36	56	L35 AND (cell$1 WITH	(US-PGPUB; USPAT;	OR	ON	ON	2022/04/14

Micron Ex. 1016, p. 369
Micron v. YMTC
IPR2024-00795

		string$1 WITH gate$1)	USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:44 PM
L37	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L38	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L39	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 370
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L40	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L41	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L42	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L43	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 371
Micron v. YMTC
IPR2024-00795

			AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L44	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L45	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L46	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 372
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L47	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L48	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L49	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L50	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 373
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L51	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L52	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L53	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 374
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L54	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L55	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L56	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L57	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/06/30 02:31 PM

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L58	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L59	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L60	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 376
Micron v. YMTC
IPR2024-00795

			WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L61	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L62	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L63	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L64	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 377
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L65	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L66	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L67	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 378
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L68	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L69	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L70	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L71	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/06/30 02:31 PM

Micron Ex. 1016, p. 379
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L72	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/06/30 02:31 PM
L73	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L74	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 380
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L75	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L76	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L77	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L78	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 381
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L79	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L80	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L81	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 382
Micron v. YMTC
IPR2024-00795

L82	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L83	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L84	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L85	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 383
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L86	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L87	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L88	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L89	59	"10157674"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/01

Micron Ex. 1016, p. 384
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:02 PM
L90	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L91	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L92	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 385
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L93	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L94	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L95	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L96	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 386
Micron v. YMTC
IPR2024-00795

			AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L97	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L98	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L99	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 387
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L100	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L101	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L102	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L103	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 388
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L104	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L105	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L106	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 389
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L107	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L108	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L109	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L110	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 390
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L111	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L112	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L113	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 391
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L114	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L115	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L116	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L117	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 392
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L118	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L119	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L120	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 393
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L121	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L122	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L123	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L124	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 394
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L125	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L126	157984	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L127	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 395
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L128	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L129	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L130	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L131	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 396
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L132	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L133	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L134	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 397
Micron v. YMTC
IPR2024-00795

L135	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L136	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L137	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L138	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/01 03:02 PM

Micron Ex. 1016, p. 398
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L139	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L140	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L141	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L142	59	"10157674"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/01

Micron Ex. 1016, p. 399
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				03:02 PM
L143	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L144	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/01 03:02 PM
L145	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 400
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L146	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L147	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L148	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L149	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 401
Micron v. YMTC
IPR2024-00795

			AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L150	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L151	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L152	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 402
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L153	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L154	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L155	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L156	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 403
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L157	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L158	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L159	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 404
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L160	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L161	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L162	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L163	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 405
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L164	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L165	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L166	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 406
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L167	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L168	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L169	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L170	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 407
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L171	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L172	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L173	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 408
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L174	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L175	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L176	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L177	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L178	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L179	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L180	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 410
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L181	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L182	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L183	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L184	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 411
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L185	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L186	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L187	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 412
Micron v. YMTC
IPR2024-00795

L188	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L189	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L190	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L191	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 413
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L192	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L193	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L194	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L195	13	"10777254"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/07

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:47 AM
L196	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L197	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L198	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 415
Micron v. YMTC
IPR2024-00795

			NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L199	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L200	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L201	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L202	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 416
Micron v. YMTC
IPR2024-00795

			AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L203	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L204	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L205	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 417
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L206	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L207	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L208	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L209	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 418
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L210	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L211	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L212	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 419
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L213	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L214	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L215	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L216	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L217	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L218	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L219	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 421
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L220	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L221	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L222	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L223	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 422
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L224	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L225	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L226	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 423
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L227	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L228	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L229	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L230	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 424
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L231	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L232	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L233	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 425
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L234	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L235	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L236	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L237	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 426
Micron v. YMTC
IPR2024-00795

			IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L238	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L239	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L240	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 427
Micron v. YMTC
IPR2024-00795

L241	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L242	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L243	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L244	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 428
Micron v. YMTC
IPR2024-00795

			NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L245	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L246	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L247	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L248	13	"10777254"	(US-PGPUB; USPAT;	OR	ON	ON	2022/07/07

Micron Ex. 1016, p. 429
Micron v. YMTC
IPR2024-00795

			USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				11:47 AM
L249	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L250	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L251	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 430
Micron v. YMTC
IPR2024-00795

			PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L252	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L253	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L254	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L255	180	(wordline OR word-line OR (word adj1 line))	(US-PGPUB; USPAT; USOCR; FIT (AU, AP,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 431
Micron v. YMTC
IPR2024-00795

		near5 pre-pulse$1	AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L256	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L257	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L258	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 432
Micron v. YMTC
IPR2024-00795

			SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L259	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L260	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L261	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L262	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 433
Micron v. YMTC
IPR2024-00795

			CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L263	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L264	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L265	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 434
Micron v. YMTC
IPR2024-00795

			TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L266	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L267	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L268	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L269	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 435
Micron v. YMTC
IPR2024-00795

			CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L270	158085	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L271	12888	365/230.06.ccls.	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L272	180	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 436
Micron v. YMTC
IPR2024-00795

			VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L273	242	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L274	208	(L1 OR L2) AND L4	(US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L275	120	L5 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L276	50	L6 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 437
Micron v. YMTC
IPR2024-00795

			EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L277	10	"11081164"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L278	28	"11205471"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L279	13	"10998049"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 438
Micron v. YMTC
IPR2024-00795

			JPO; DERWENT; IBM_TDB)				
L280	22	"11024371"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L281	12	"10957408"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L282	20	"11017838"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L283	40	"10153029"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB,	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 439
Micron v. YMTC
IPR2024-00795

			HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)				
L284	13	"10777254"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L285	11	"9620232"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L286	59	"10157674"	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT;	OR	ON	ON	2022/07/07 11:47 AM

Micron Ex. 1016, p. 440
Micron v. YMTC
IPR2024-00795

			IBM_TDB)				
L287	144	L21 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM
L288	57	L35 AND (cell$1 WITH string$1 WITH gate$1)	(US-PGPUB; USPAT; USOCR; FIT (AP, AT, AU, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, MC, MD, MY, NL, NO, NZ, OA, PH, PL, PT, RO, RS, RU, SE, SG, SI, SK, SU, TH, TN, TR, TW, UA, VN, WO); FPRS; EPO; JPO; DERWENT; IBM_TDB)	OR	ON	ON	2022/07/07 11:47 AM

PE2E SEARCH - Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	British Equivalents	Time Stamp
N1	41398	(G11C11/4085 OR G11C11/4074 OR G11C11/4094 OR G11C11/4099 OR G11C11/419 OR G11C16/0483 OR G11C16/10 OR G11C16/24 OR G11C16/08 OR G11C16/3427).cpc.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:41 PM
N2	7560614	YANGTZE MEMORY TECHNOLOGIES CO., LTD.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:43 PM
N3	530242	Jia, Jianquan; Cui, Ying; You, Kaikai	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:43 PM
N4	6894	365/230.06.ccls.	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:47 PM

Micron Ex. 1016, p. 441
Micron v. YMTC
IPR2024-00795

N5	50	(wordline OR word-line OR (word adj1 line)) near5 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:54 PM
N6	75	(wordline OR word-line OR (word adj1 line)) near9 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:54 PM
N7	77	(wordline OR word-line OR (word adj1 line)) near12 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:55 PM
N8	78	(wordline OR word-line OR (word adj1 line)) near15 pre-pulse$1	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:55 PM
N9	68	(N1 OR N4) AND (N2 OR N3) AND N8	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:56 PM
N10	52	N9 AND (precharg$4 OR pre-charg$4)	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:57 PM
N11	6	"11056196"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:58 PM
N12	3	"11205471"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 01:59 PM
N13	3	"11043279"	(US-PGPUB; USPAT)	OR	ON	ON	2021/12/26 02:01 PM

Bibliographic Data

Application No: 17/965,527

Foreign Priority claimed: ○ Yes ◉ No

35 USC 119 (a-d) conditions met: ☐ Yes ☑ No ☐ Met After Allowance

Verified and Acknowledged: /VIET Q NGUYEN/ (Examiner's Signature) | (Initials)

Title: NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/13/2022	365	2827	10018-01-0242-US-CON2
RULE			

APPLICANTS

YANGTZE MEMORY TECHNOLOGIES CO., LTD.,

INVENTORS

Jianquan Jia, Wuhan, CHINA

Ying Cui, Wuhan, CHINA

Kaikai You, Wuhan, CHINA

CONTINUING DATA

This application is a CON of 17353727 06/21/2021 PAT 11501822

17353727 is a CON of 16709944 12/11/2019 PAT 11081164

16709944 is a CON of PCT/CN2019/112409 10/22/2019

FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

10/25/2022

STATE OR COUNTRY

CHINA

ADDRESS

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102
UNITED STATES

FILING FEE RECEIVED

$1,820

UNITED STATES
PATENT AND TRADEMARK OFFICE

P.O. Box 1450
Alexandria, VA 22313 - 1450
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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/965,527	**11/21/2023 01:50:31 PM Z ET**	**10018-01-0242-US-CON2**

Title of Invention

NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7400	FILED BY	Anna O'Connor
PATENT CENTER #	63337384	FILING DATE	10/13/2022
CUSTOMER #	153988	FIRST NAMED INVENTOR	Jianquan Jia
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Zhiwei Zou

Documents

TOTAL DOCUMENTS: 1

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
10018-01-0242-US-CON2 IF Transmittal.pdf	1	Issue Fee Payment (PTO-85B)	291 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
10018-01-0242-US-CON2 IF Transmittal.pdf	9A3DF27B97A1AD2BC005D19743F0DC5C9E82B39BD37FB382 0882B243DA558FA8F3CBA5CB87E581C23421AC3AC38F2AA26 7348F45BFCD9236F868647798EDE9F1

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.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for 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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ELECTRONIC PAYMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
17/965,527	11/21/2023 01:50:31 PM Z ET	10018-01-0242-US-CON2

Title of Invention

NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	-
CONFIRMATION #	7400	FILED BY	Anna O'Connor
PATENT CENTER #	63337384	AUTHORIZED BY	Zhiwei Zou
CUSTOMER #	153988	FILING DATE	10/13/2022
CORRESPONDENCE ADDRESS	-	FIRST NAMED INVENTOR	Jianquan Jia

Payment Information

PAYMENT METHOD	PAYMENT TRANSACTION ID	PAYMENT AUTHORIZED BY
CARD / 9598	E2023AKD51549497	Anna O'Connor

PRE-AUTHORIZED ACCOUNT	PRE-AUTHORIZED CATEGORY
602227	37 CFR 1.16 (National application filing, search, and examination fees); 37 CFR 1.17 (Patent application and reexamination processing fees)

FEE CODE	DESCRIPTION	ITEM PRICE($)	QUANTITY	ITEM TOTAL($)
1501	UTILITY ISSUE FEE	1200.00	1	1200.00
			TOTAL AMOUNT:	$1,200.00

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.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for 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

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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.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (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 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. **Because electronic patent issuance may occur shortly after issue fee payment, any desired continuing application should preferably be filed prior to payment of this issue fee in order not to jeopardize copendency.**

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

153988 7590 08/24/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

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 transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

Anna O'Connor	(Typed or printed name)
/Anna O'Connor/	(Signature)
November 21, 2023 E-FILED	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

TITLE OF INVENTION: NON-VOLATILE MEMORY DEVICE AND CONTROL METHOD

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	11/24/2023

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, VIET Q	2827	365-230060

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/AIA/122 or PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or 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 BAYES PLLC
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 must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: YANGTZE MEMORY TECHNOLOGIES CO., LTD.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): WUHAN, CHINA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ☒ Corporation or other private group entity ❑ Government

4a. Fees submitted: ☒ Issue Fee ❑ Publication Fee (if required)

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

☒ Electronic Payment via Patent Center or EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 60-2227

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

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.

❑ Applicant asserting small entity status. See 37 CFR 1.27

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.

❑ Applicant changing to regular undiscounted fee 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 /Zhiwei Zou/ Date 11/21/2023

Typed or printed name Zhiwei Zou Registration No. 66,041

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Micron Ex. 1016, p. 448
Micron v. YMTC
IPR2024-00795

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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	01/02/2024	11862230	10018-01-0242-US-CON2	7400

153988 7590 12/13/2023

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

ISSUE NOTIFICATION

The projected patent number and issue date are specified above. The patent will issue electronically. The electronically issued patent is the official patent grant pursuant to 35 U.S.C. § 153. The patent may be accessed on or after the issue date through Patent Center at https://patentcenter.uspto.gov/. The patent will be available in both the public and the private sides of Patent Center. Further assistance in electronically accessing the patent, or about Patent Center, is available by calling the Patent Electronic Business Center at 1-888-217-9197.

The USPTO is implementing electronic patent issuance with a transition period, during which period the USPTO will mail a ceremonial paper copy of the electronic patent grant to the correspondence address of record. Additional copies of the patent (i.e., certified and presentation copies) may be ordered for a fee from the USPTO's Certified Copy Center at https://certifiedcopycenter.uspto.gov/index.html. The Certified Copy Center may be reached at (800)972-6382.

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 Center (https://patentcenter.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 Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

Micron Ex. 1016, p. 449
Micron v. YMTC
IPR2024-00795

INVENTOR(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional inventors):

Jianquan Jia, Wuhan, CHINA;
Ying Cui, Wuhan, CHINA;
Kaikai You, Wuhan, CHINA;

APPLICANT(s) (Please see PATENT CENTER site https://patentcenter.uspto.gov for additional applicants):

YANGTZE MEMORY TECHNOLOGIES CO., LTD., Wuhan, CHINA;

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.

Micron Ex. 1016, p. 450
Micron v. YMTC
IPR2024-00795

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
17/965,527	10/13/2022	Jianquan Jia	10018-01-0242-US-CON2	7400

153988 7590 01/02/2024

Bayes PLLC
8260 Greensboro Drive
Suite 625
McLean, VA 22102

EXAMINER	
NGUYEN, VIET Q	

ART UNIT	PAPER NUMBER
2827	

NOTIFICATION DATE	DELIVERY MODE
01/02/2024	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):

USPTO@dockettrak.com
eofficeaction@appcoll.com
uspto@bayes.law

Micron Ex. 1016, p. 451
Micron v. YMTC
IPR2024-00795

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