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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	03/25/2014	8680712	30850-25732	1550

120363 7590 03/05/2014
Silicon Image/FENWICK
801 California Street
Mountain View, CA 94041

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 814 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Dongyun Lee, Sunnyvale, CA;
Edward Pak, Saratoga, CA;
John Hahn, Los Altos, CA;
Mayank Gupta, Sunnyvale, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	30850-25732	1550
120363	7590	02/20/2014		
Silicon Image/FENWICK 801 California Street Mountain View, CA 94041			EXAMINER DANG, KHANH	
			ART UNIT 2111	PAPER NUMBER
			NOTIFICATION DATE 02/20/2014	DELIVERY MODE 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):

ptoc@fenwick.com

Supplemental Notice of Allowability	Application No. 12/636,063	Applicant(s) LEE ET AL.	
	Examiner KHANH DANG	Art Unit 2111	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to IDS filed 01/27/2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 13-16, 18, 19 and 22-25. 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) | 5. ☐ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>20140127</u> | 6. ☐ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/KHANH DANG/
Primary Examiner, Art Unit 2111

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Complete if Known

<p>INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)</p>				Application Number	12/636,063
				Filing Date	December 11, 2009
				First Named Inventor	Dongyun Lee
				Art Unit	2111
				Confirmation Number	1550
				Examiner Name	Khanh Dang
Sheet	1	of	2	Attorney Docket Number	30850-25732

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document No. Number – Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-7,142,094	11-28-2006	Davidow et al.
	A2	US-2008/0122556 A1	05-29-2008	Oshima et al.

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ – Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶
	B1	JP 2007-134803 A (with English abstract)	05-31-2007	Flying Mole Corp.	
	B2	JP 2005-217799 A (with English abstract)	08-11-2005	Seiko Epson Corp.	
	B3	TW 200303711 A (with English abstract)	09-01-2003	Force 10 Networks, Inc.	
	B4	TW 200843279 A (with English abstract)	11-01-2008	Dell Products LP	

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T ⁶
	C1	Japanese Office Action, Japanese Application No. 2011-540936, January 6, 2014 (with concise explanation of relevance).	
	C2	Taiwan Office Action, Taiwan Application No. 098142426, December 23, 2013, 12 pages.	X

EXAMINER SIGNATURE

Examiner Signature	/Khanh Dang/
Date Considered	02/12/2014
<p>*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.</p>	
<p>¹ Applicant's unique citation designation number (option). ² See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ³ Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.</p>	
<p>⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language translation is attached.</p>	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)				Complete if Known	
				Application Number	12/636,063
				Filing Date	December 11, 2009
				First Named Inventor	Dongyun Lee
				Art Unit	2111
				Confirmation Number	1550
				Examiner Name	Khanh Dang
Sheet	2	of	2	Attorney Docket Number	30850-25732

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	/Frank Yang/	Date (YYYY-MM-DD)	2014-01-27
Name/Print	Frank Yang	Registration Number	65,788

30850/25732/DOCS/3094237.3

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

65702 7590 11/14/2013
~~SILICON IMAGE/BSTZ--~~
~~BLAKELY-SOKOLOFF-TAYLOR & ZAFMAN-LLP-~~
~~1279 OAKMEAD PARKWAY----~~
~~SUNNYVALE, CA 94085-4040---~~
 Silicon Image/FENWICK
 801 California Street
 Mountain View, CA, 94041

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	8029P150	1550

TITLE OF INVENTION: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$300 \$960	\$300 \$0	\$0	\$600 \$960	02/14/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
DANG, KHANH	2111	307-042000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.	1 <u>Fenwick & West LLP</u> 2 _____ 3 _____
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Silicon Image, Inc.

Sunnyvale, CA

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 192555 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☒ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /Frank Yang/

Date February 14, 2014

Typed or printed name Frank Yang

Registration No. 65788

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Frank Bou-Kain Yang/Loretta Griffith			
Attorney Docket Number:	30850-25732			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	18205592
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	120363
Filer:	Frank Bou-Kain Yang
Filer Authorized By:	
Attorney Docket Number:	30850-25732
Receipt Date:	14-FEB-2014
Filing Date:	11-DEC-2009
Time Stamp:	13:17:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$960
RAM confirmation Number	7751
Deposit Account	192555
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	25732_US_Issue_Fee_Transmittal_due_2_14_14_STATUS_CHANGED.PDF	2038147 58ec3f61556b2e5252b121bd48281d441405065	no	2

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30489 61557f947fafc712a9c3675e3b4a674a73445d17	no	2
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Warnings:

Information:

Total Files Size (in bytes):			2068636
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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.



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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	8029P150

120363
Silicon Image/FENWICK
801 California Street
Mountain View, CA 94041

CONFIRMATION NO. 1550
POA ACCEPTANCE LETTER



Date Mailed: 02/04/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/24/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/atesfai/

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	8029P150

65702
SILICON IMAGE/BSTZ
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

CONFIRMATION NO. 1550
POWER OF ATTORNEY NOTICE



Date Mailed: 02/04/2014

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/24/2014.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/atesfai/

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

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

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First Named Inventor	Dongyun Lee
Art Unit	2111
Confirmation Number	1550
Examiner Name	Khanh Dang
Attorney Docket Number	30850-25732

Sheet 1 of 2

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Document No. Number – Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document
	A1	US-7,142,094	11-28-2006	Davidow et al.
	A2	US-2008/0122556 A1	05-29-2008	Oshima et al.

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ – Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	T ⁶
	B1	JP 2007-134803 A (with English abstract)	05-31-2007	Flying Mole Corp.	
	B2	JP 2005-217799 A (with English abstract)	08-11-2005	Seiko Epson Corp.	
	B3	TW 200303711 A (with English abstract)	09-01-2003	Force 10 Networks, Inc.	
	B4	TW 200843279 A (with English abstract)	11-01-2008	Dell Products LP	

OTHER REFERENCES – NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published	T ⁶
	C1	Japanese Office Action, Japanese Application No. 2011-540936, January 6, 2014 (with concise explanation of relevance).	
	C2	Taiwan Office Action, Taiwan Application No. 098142426, December 23, 2013, 12 pages.	X

EXAMINER SIGNATURE

Examiner Signature	
Date Considered	
<p>*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.</p>	
<p>¹ Applicant's unique citation designation number (option). ² See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ³ Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document.</p>	
<p>⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁶ Applicant is to place a check mark here if English language translation is attached.</p>	

**INFORMATION DISCLOSURE
STATEMENT BY APPLICANT**
(Not for submission under 37 CFR 1.99)

Complete if Known

Application Number	12/636,063
Filing Date	December 11, 2009
First Named Inventor	Dongyun Lee
Art Unit	2111
Confirmation Number	1550
Examiner Name	Khanh Dang
Attorney Docket Number	30850-25732

Sheet	2	of	2
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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	/Frank Yang/	Date (YYYY-MM-DD)	2014-01-27
Name/Print	Frank Yang	Registration Number	65,788



Espacenet

Bibliographic data: JP2007134803 (A) — 2007-05-31

SIGNAL TRANSMISSION SYSTEM, SIGNAL TRANSMITTER AND SIGNAL RECEIVER

No documents available for this priority number.

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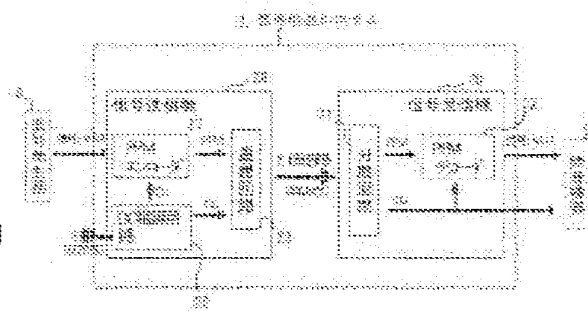
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Abstract of JP2007134803 (A)

PROBLEM TO BE SOLVED: To superimpose a transmission signal on a power source and transmit it with a simple configuration without deteriorating basic performance such as a frequency response.

SOLUTION: A signal transmitter converts the transmission signal into a PPM signal, and superimposes the converted PPM signal on the DC power source, and transmits it to a transmission path. Upon receiving the transmission signal transmitted from the signal transmitter, a signal receiver separates the received signal to the DC power source and the PPM signal, and demodulates the separated PPM signal into a transmission signal. In this case, a ternary PPM signal is preferably applied as the PPM signal. ; COPYRIGHT: (C)2007,JPO&INPIT



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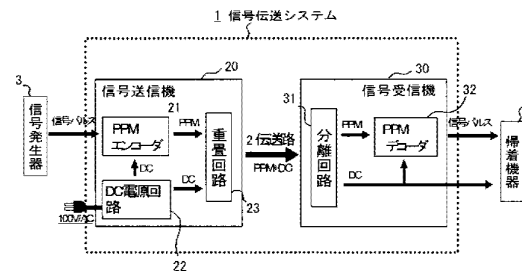
(54) 【発明の名称】 信号伝送システム、信号送信機及び信号受信機

(57) 【要約】

【課題】 f 特などの基本性能を劣化させることなく、簡易な構成で、電源に伝送信号を重畳して伝送できるようにする。

【解決手段】 信号送信機は、伝送信号をPPM信号に変換し、変換したPPM信号を直流電源に重畳して伝送路へ送出する。信号受信機は、信号送信機が送出した送出信号を受信すると、直流電源とPPM信号に分離し、分離したPPM信号を伝送信号に復調する。ここで、PPM信号として、3値PPM信号を適用することが好ましい。

【選択図】 図1



【特許請求の範囲】**【請求項 1】**

伝送信号を P P M 信号に変換する信号／P P M 変換回路と、
変換された P P M 信号に直流電源を重畳し、上記伝送路への送出信号を形成する重畳回路と

を有することを特徴とする信号送信機。

【請求項 2】

上記 P P M 信号は、3 値 P P M 信号であることを特徴とする請求項 1 に記載の信号送信機。

【請求項 3】

請求項 1 の信号送信機が伝送路に送出した送出信号を受信する信号受信機であって、
受信した上記送出信号を、直流電源と P P M 信号に分離する分離回路と、
分離された P P M 信号を伝送信号に復調する P P M／信号変換回路と
を有することを特徴とする信号受信機。

【請求項 4】

上記 P P M 信号は、3 値 P P M 信号であることを特徴とする請求項 3 に記載の信号受信機。

【請求項 5】

請求項 1 に記載の信号送信機と請求項 3 に記載の信号受信機とが伝送路を介して配置されていることを特徴とする信号伝送システム。

【発明の詳細な説明】**【技術分野】****【0001】**

本発明は信号伝送システム、信号送信機及び信号受信機に関し、例えば、オーディオアンプからスピーカへのオーディオ信号の伝送に適用し得るものである。

【背景技術】**【0002】**

独立したオーディオアンプとスピーカとをケーブルを介して接続したオーディオシステムがあり、このようなシステムでは、オーディオアンプからスピーカに対して、ケーブルを介してオーディオ信号を供給するようになされている。

【0003】

近年においては、オーディオアンプから独立したスピーカとして、電源が直接供給されて動作するパワードスピーカがある。このようなパワードスピーカに対応するため、オーディオ信号を交流電源に重畳して、オーディオアンプからスピーカに伝送することも考えられる。また、オーディオ信号ではなく、音声信号を取り扱うものであるが、音声信号を直流電源に重畳して、音声配給装置から音声出力端末に伝送するものがあり（特許文献 1 参照）、この技術を、オーディオアンプからスピーカの伝送に適用することも考えられる。

【特許文献 1】特開 2005-79768 号公報**【発明の開示】****【発明が解決しようとする課題】****【0004】**

オーディオアンプ及びスピーカ間のケーブル長は短いとは言え、ケーブルを介した伝送であるので、基本性能（f 特や歪み）が劣化することを避け得ない。

【0005】

特許文献 1 に記載のように、デジタル変調信号（例えば A S K）を伝送信号とすることにより、上記劣化を抑えることが可能になるが、オーディオ信号の場合には帯域が広いいため、デジタル変調信号の変調系及び復調系が複雑な回路となり、また、デジタル変調信号の帯域幅内のノイズ成分は当然に除去することができない。

【0006】

パワースピーカを考慮して交流電源にオーディオ信号を重畳して伝送する場合、スピーカ側に、AC/DCコンバータを持たせなければならない。この点からは、直流電源に伝送信号を重畳させることの方が好ましい。しかし、伝送信号として、デジタル変調信号を適用した場合には上述した不都合を有している。

【0007】

そのため、送信機から受信機に対し、基本性能を劣化させることなく、しかも、簡易な構成で、電源に伝送信号を重畳して伝送することができる信号伝送システム、信号送信機及び信号受信機が求められている。

【課題を解決するための手段】

【0008】

かかる課題を解決するため、第1の発明の信号送信機は、伝送信号をPPM信号に変換する信号/PPM変換回路と、変換されたPPM信号に直流電源を重畳し、上記伝送路への送出信号を形成する重畳回路とを有することを特徴とする。

【0009】

第2の発明の信号受信機は、第1の発明の信号送信機が伝送路に送出した送出信号を受信するものであって、受信した上記送出信号を、直流電源とPPM信号に分離する分離回路と、分離されたPPM信号を伝送信号に復調するPPM/信号変換回路とを有することを特徴とする。

【0010】

第3の発明の信号伝送システムは、第1の発明の信号送信機と第2の発明の信号受信機とが伝送路を介して配置されていることを特徴とする。

【発明の効果】

【0011】

本発明の信号伝送システム、信号送信機及び信号受信機によれば、伝送信号をPPM信号に変換して直流電源に重畳して伝送するようにしたので、f特などの基本性能を劣化させることなく、簡易な構成で、電源に伝送信号を重畳して伝送することができる。

【発明を実施するための最良の形態】

【0012】

(A) 実施形態

以下、本発明による信号伝送システム、信号送信機及び信号受信機の一実施形態を説明する。この実施形態における伝送信号は任意であり、オーディオ信号に限定されるものではない。なお、以下の説明においては、適宜、伝送信号がオーディオ信号である場合の具体例を挙げて説明する。

【0013】

図1は、実施形態の信号伝送システムの全体構成を示すブロック図である。図1において、実施形態の信号伝送システム1は、信号送信機20及び信号受信機30が伝送路2を介して接続されて構成されている。

【0014】

信号送信機20は、信号発生器3と接続されているものであり、内部に、PPM (pulse position modulation) エンコーダ21、DC電源回路22及び重畳回路23を備えている。一方、信号受信機30は、帰着機器4に接続されているものであり、分離回路31及びPPMデコーダ32を備えている。

【0015】

信号発生器3は、信号パルスを出力するものである。信号発生器3は、信号送信機20と同一装置内に設けられているものであっても良く、信号発生器3は、信号送信機20を外部装置として備えるものであっても良い。信号発生器3として、例えば、デジタルオーディオアンプにおけるPWMオーディオ信号を作成する部分を適用できる。信号発生器3からの信号パルスは、信号送信機20のPPMエンコーダ21に与えられる。

【0016】

PPMエンコーダ21は、入力された信号パルスの位置情報を一定幅の細いパルスで取

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り出した P P M 信号に変換して重畳回路 2 3 に与えるものである。この実施形態の場合、P P M エンコーダ 2 1 は、信号パルスの立上り情報を正のパルス、立下り情報を負のパルスで取り出した 3 値 P P M 信号に変換する。

【0017】

図 2 は、P P M エンコーダ 2 1 の詳細構成例を示すブロック図であり、図 3 は、その各部タイミングチャートである。なお、P P M エンコーダ 2 1 の詳細構成として、他の構成を適用しても良いことは勿論である。

【0018】

図 2 において、P P M エンコーダ 2 1 は、遅延回路 4 1、インバータ 4 2～4 4、4 8、2 入力 A N D ゲート 4 5、4 6、レベルシフタ 4 7、P チャネル M O S トランジスタ 4 9 及び N チャネル M O S トランジスタ 5 0 を有する。 10

【0019】

ここで、遅延回路 4 1 は、変換後の P P M 信号における細いパルスのパルス幅分だけ遅延させるものである。レベルシフタ 4 7 は、入力された 0～5 V をダイナミックレンジとするパルスを、5～10 V をダイナミックレンジとするパルスに変換（レベルシフト）する。

【0020】

遅延回路 4 1、インバータ 4 2、4 8、2 入力 A N D ゲート 4 5、レベルシフタ 4 7、P チャネル M O S トランジスタ 4 9 が、信号パルスの立上り情報を抽出する構成となっている。 20

【0021】

また、遅延回路 4 1、インバータ 4 2～4 4、2 入力 A N D ゲート 4 6、N チャネル M O S トランジスタ 5 0 が、信号パルスの立下り情報を抽出する構成となっている。

【0022】

入力された信号パルス P A は、遅延回路 4 1 によって、所定時間 D L だけ遅延された後、インバータ 4 2 によって反転され、その反転信号 P B が 2 入力 A N D ゲート 4 5 の一方の入力端子に入力される。2 入力 A N D ゲート 4 5 の他方の入力端子には、信号パルス P A が入力されている。これにより、2 入力 A N D ゲート 4 5 からは、信号パルスの立上り情報を反映させた、図 3 に示すパルス信号 P D が出力され、これがレベルシフタ 4 7 によってレベルシフトされ、5～10 V をダイナミックレンジとしたパルス信号 P H に変換された後、インバータ 4 8 によって反転されて P チャネル M O S トランジスタ 4 9 のゲートに印加される。 30

【0023】

P チャネル M O S トランジスタ 4 9 にパルスが印加されているときは、信号パルス P A の立上り時であり、N チャネル M O S トランジスタ 5 0 にパルスが印加されているときは、後述するように、信号パルス P A の立下り時である。そのため、P チャネル M O S トランジスタ 4 9 にパルスが印加されているときには、P チャネル M O S トランジスタ 4 9 及び N チャネル M O S トランジスタ 5 0 の接続点の電位である P P M 信号 P I には、正のパルスが生じる。

【0024】

インバータ 4 2 からの出力パルス信号 P B は、さらにインバータ 4 3 によって反転され、その反転パルス信号 P E が、2 入力 A N D ゲート 4 6 の一方の入力端子に入力される。2 入力 A N D ゲート 4 6 の他方の入力端子には、信号パルス P A をインバータ 4 4 が反転した反転パルス P F が入力されている。これにより、2 入力 A N D ゲート 4 6 からは、信号パルスの立下り情報を反映させた、図 3 に示すパルス信号 P G が出力され、これが N チャネル M O S トランジスタのゲートに印加される。 40

【0025】

このときには、P チャネル M O S トランジスタ 4 9 及び N チャネル M O S トランジスタ 5 0 の接続点の電位である P P M 信号 P I には、負のパルスが生じる。

【0026】

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上述した遅延回路 4 1 としては、遅延線構成のものを適用できる。この場合、LC 共振の恐れがあるが、遅延回路 4 1 に、LC 共振の Q を下げるダンパー抵抗を入れることにより安定動作を保証する。

【0027】

上述したレベルシフタ 4 7 の機能により、3 値 PPM 信号 P I の振幅を大きくとることができる。図 4 は、レベルシフタ 4 7 の詳細構成を示す回路図である。図 4 において、+10 V ライン及び入力端子間には、抵抗 R 2（抵抗値は例えば R 1 と一致）、N 形トランジスタ Q 1 のコレクターエミッタ、抵抗 R 1 が直列に接続され、トランジスタ Q 1 のベースは +5 V ラインに接続され、トランジスタ Q 1 のコレクタが出力端子に接続されている。これにより、入力電圧 +5 V が出力電圧になるようになされている。

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【0028】

以上のように、図 2 に詳細構成を示した PPM エンコーダ 2 1 により、信号パルス P A を 3 値 PPM 信号 P I に変換することができる。

【0029】

DC 電源回路 2 2 は、例えば、商用電源などの交流電源電圧を直流電源電圧（DC 電源）に変換して、PPM エンコーダ 2 1 に動作電源として供給すると共に、重畳回路 2 3 にも直流電源電圧を与えるものである。DC 電源回路 2 2 としては、一般的な AC / DC コンバータを適用できるので、詳細構成の説明は省略する。なお、DC 電源回路 2 2 として、DC / DC コンバータを適用することもできる。

【0030】

重畳回路 2 3 は、DC 電源回路 2 2 からの直流電源電圧（DC 電源）に、PPM エンコーダ 2 1 からの 3 値 PPM 信号を重畳して伝送路 2 に送出するものである。

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【0031】

図 5 は、重畳回路 2 3 の詳細構成と、後述する分離回路 3 1 の詳細構成とを示す回路図である。図 6 は、重畳回路 2 3 による重畳動作と、分離回路 3 1 による分離動作の説明図である。

【0032】

伝送路 2 への出力点 O U T に対し、PPM 信号の入力端子は、ハイパスフィルタ（HPF）を構成するコンデンサ C 1 を介して接続され、DC 電源の入力端子は、ローパスフィルタ（LPF）を構成する、インダクタンス L 1 及び抵抗 R 3 の並列回路を介して接続されている。これにより、出力点 O U T の位置において、直流分が除去された図 6（a）に示す PPM 信号と、図 6（b）に示す DC 電源とが結線合成（重畳）され、図 6（c）に示す重畳信号が伝送路 2 に送出される。なお、抵抗 R 1 は、ハイパスフィルタ要素のコンデンサ C 1 とローパスフィルタ要素のインダクタンス L 1 との LC 共振を避けるための（Q を下げるための）ダンパー抵抗である。インパルス信号と見なせる程度に高周波の PPM 信号に対するフィルタとして、ハイパスフィルタ（HPF）に代え、バンドパスフィルタ（BPF）を適用するようにしても良い。

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【0033】

伝送路 2 は、電氣的ケーブルであり、その種類（例えば、同軸ケーブル）は問われないものである。

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【0034】

信号受信機 3 0 の分離回路 3 1 には、伝送路 2 から、3 値 PPM 信号と DC 電源との重畳信号が入力される。分離回路 3 1 は、入力された重畳信号から、直流電源電圧（DC 電源）と 3 値 PPM 信号とを分離し、分離により得られた 3 値 PPM 信号を PPM デコーダ 3 2 に与え、分離により得られた直流電源電圧（DC 電源）を PPM デコーダ 3 2 及び信号受信機 3 0 外部の帰着機器 4 に動作電源として供給するものである。

【0035】

上述した図 5 は、分離回路 3 1 の詳細構成も示しており、また、上述した図 6 は、分離回路 3 1 の分離動作の説明図にもなっている。

【0036】

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伝送路 2 から図 6 (c) に示す重畳信号が入力される、信号受信機 30 の入力点 IN には、コンデンサ C 2 及び抵抗 R 4 でなるハイパスフィルタ (HPF) が接続されていると共に、インダクタンス L 2 及びコンデンサ C 3 でなるローパスフィルタ (LPF) が接続されている。従って、コンデンサ C 2 及び抵抗 R 4 でなるハイパスフィルタにより、図 6 (a) に示す 3 値 PPM 信号が抽出され、インダクタンス L 2 及びコンデンサ C 3 でなるローパスフィルタにより、図 6 (b) に示す直流電源電圧 (DC 電源) が抽出される。インパルス信号と見なせる程度に高周波の PPM 信号に対するフィルタとして、ハイパスフィルタ (HPF) に代え、バンドパスフィルタ (BPF) を適用するようにしても良い。

【0037】

PPM デコーダ 32 は、分離された直流電源電圧を利用して、分離された 3 値 PPM 信号を信号パルスに変換 (復調) するものであり、得られた信号パルスを信号受信機 30 外部の帰着機器 4 に送出するものである。PPM デコーダ 32 は、3 値 PPM 信号の上側パルス (正のパルス) で立上り、3 値 PPM 信号の下側パルス (負のパルス) で立下る信号パルスに形成する。

【0038】

図 7 は、以上のような機能を担っている PPM デコーダ 32 の詳細構成例を示すブロック図である。なお、他の構成を適用しても良いことは勿論である。

【0039】

図 7 において、PPM デコーダ 32 は、下波整流回路 61、上波整流回路 62、インバータ 63、64 及びラッチ回路 65 を有する。なお、分離回路 31 のハイパスフィルタ (HPF) に加え、PPM デコーダ 32 の下波整流回路 61 及び上波整流回路 62 の入力段にも、コンデンサ C 4、C 5 などの高周波成分の抽出構成 (結合コンデンサ) を設けるようにしても良い。

【0040】

分離された 3 値 PPM 信号は、下波整流回路 61 及び上波整流回路 62 に入力され、3 値 PPM 信号の下側パルスは、下波整流回路 61 によって分離 (抽出) され、3 値 PPM 信号の上側パルスは、上波整流回路 62 によって分離 (抽出) される。図 8 は、上波整流回路 62 の詳細構成例を示している。図 8 において、ダイオード D 1 に電流が流れるのは、入力電圧が {0 + (ダイオードの順方向電圧)} 以上のときであり、これにより、3 値 PPM 信号の上側パルスを分離できる。下波整流回路 61 については、詳細構成の図示は省略するが、ダイオードの向きを図 8 の場合と逆向きにした上波整流回路 62 と対称的な構成であり、ダイオードの機能により下側パルスを分離する。

【0041】

下波整流回路 61 によって分離された下側パルスは、インバータ 63 を介して反転されてラッチ回路 65 に入力され、上波整流回路 62 によって分離された上側パルスは、インバータ 64 を介して反転されてラッチ回路 65 に入力される。ラッチ回路 65 は、上側パルスで立上り、下側パルスで立下る信号パルスを形成する部分であり、RS フリップフロップ回路など、種々の構成を適用可能であるが、例えば、図 9 に示すような詳細構成のものも適用可能である。

【0042】

図 9 において、ラッチ回路 65 は、2 個のインバータ INV 1 及び INV 2 を縦続接続すると共に、その縦続接続の入出力を抵抗 R 7 を介して接続することで論理レベルを保持できるものとなっている。インバータ 63 の出力端は、ダイオード D 3 のアノード-カソードを介して縦続接続の入力端に接続され、インバータ 64 の出力端は、ダイオード D 4 のカソード-アノードを介して縦続接続の入力端に接続されている。

【0043】

インバータ 63 から 5 V のパルス信号が、ダイオード D 3 を介してインバータ INV 1 に入力されたとき、インバータ INV 2 の出力は 5 V、インバータ 64 からの入力も 5 V であり、電位は固定される。ある一定時間が経ち、インバータ 63 からのパルス信号が 0 V になったとき、ダイオード D 3 の両端間には 5 V の電位差が生じるが、ダイオード D 3

が逆方向を向いているため、電流が流れず、電位が変化しないので、ラッチされる。その後、インバータ64からのパルス信号が0Vになったとき、ダイオードD4に5Vの電位差が生じるが、今度は順方向を向いているため、電流がながれ、ラッチが解除される。次に、インバータ64からのパルス信号が5Vになるときも同様に、ダイオードD4に対して、電位差は逆方向なので、電流は流れず、電位が変化しないので、0Vにラッチされる。そして、インバータ63からの信号パルスが5Vになったとき、ダイオードD3に対して、電位差は逆方向なので、電流が流れ、ラッチが解除される。

【0044】

以上のような動作により、ラッチ回路65は、上側パルスで立上り、下側パルスで立下る信号パルスを形成する。

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【0045】

帰着機器4は、信号受信機30から与えられた信号パルスを、信号受信機30から与えられた直流電源電圧(DC電源)を動作電源として、適宜処理するものである。帰着機器4は、信号受信機30と同一装置内に設けられているものであっても良く、帰着機器4は、信号受信機30を外部装置として備えるものであっても良い。帰着機器4として、例えば、PWMオーディオ信号のアナログ信号への変換機能を有するパワードスピーカを挙げることができる。

【0046】

上記実施形態によれば、伝送信号(信号パルス)を3値PPM信号に変換し、直流電源電圧(DC電源)に重畳して伝送するようにしたので、伝送時の情報の欠落を抑え、伝送距離を長くすることができるという効果を奏することができる。以下、このような効果を具体的に説明する。

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【0047】

3値PPM信号において情報として意味を有するのは、立上りパルス及び立下りパルス(インパルスとみなせる程度)の超高周波成分である。そのため、伝送帯域は高周波側に制限でき、その帯域幅を狭めることができる。ノイズ成分は、帯域幅で定義されていて、狭いほど伝送路で混入されるノイズを低減することができ、また、伝送路からノイズ成分として放射される伝送信号の帯域幅も狭いものとなる。

【0048】

また、3値PPM信号は、パルス波形が全て均一であるため(例えば、パルス幅が一定で上側パルス数と下側パルス数とが同数など)、交流信号として、バイアスや波形を安定して伝送することができる。

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【0049】

さらに、3値PPM信号であるため、長距離伝送で波形が鈍り、遅れても、全てのパルス波形が一様に遅れるので歪にはならない。図10は、この効果の説明図である。上側パルスや下側パルスの中心電位からの変化エッジがなまったとしても、上側パルスや下側パルスを弁別する受信側の閾値電圧THP、THNが中心電位を挟んで上下対象であるので、上側パルスや下側パルスと認識する遅れ時間は全ての上側パルスや下側パルスについて同一となり、波形の遅れが歪にはならない。

【0050】

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さらにまた、3値PPM信号を適用しているため、信号パルスの1個のパルスについてエラーを起こしても、次のパルスではエラーから回復することができる。図11は、この効果の説明図である。3値PPM信号においては、上側パルスPN1、PN2、PN3と、下側パルスPP1、PP2、PP3とが交互に生じるものとなっているので、ノイズによる偽の下側パルスNZが、下側パルスPP1の前に生じた場合、復調された信号パルスにおいて、偽の下側パルスNZは1パルスについてのみ影響し、上側パルスPN2以降は正常に復調を行うことができる。

【0051】

また、上記実施形態によれば、3値PPM信号を伝送信号としているため、デジタル変調信号(例えばASK)を伝送信号にする場合と比較すると、変調系及び復調系の回路構

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成を簡易なものとすることができる。

【0052】

さらに、上記実施形態によれば、直流電源に伝送信号を重畳させているので、帰着装置での電源回路構成を不要又は簡易なものとすることができる。

【0053】

(B) 他の実施形態

上記実施形態の説明においても変形実施形態に言及したが、さらに、以下に、例示するような変形実施形態を挙げることができる。

【0054】

上記実施形態においては、当初の伝送信号が信号パルスであるものを示したが、当初の信号がアナログ信号であっても良い。アナログ信号の場合には、例えば、PWM信号などのパルス信号に変換した後、3値PPM信号に変換すれば良い。 10

【0055】

また、上記実施形態においては、変調方式が固定のものを示したが、一部の属性に可変機能を導入するようにしても良い。例えば、3値PPM信号におけるパルスのパルス幅を可変し得るようにしても良く、また、3値PPM信号のダイナミックレンジを可変し得るようにしても良い。

【0056】

さらに、上記実施形態では、3値PPM信号を重畳する電源が完全に直流電源であるものを示したが、重畳回路や分離回路のローパスフィルタが許容する程度の低周波の電源であっても良い。 20

【0057】

さらにまた、波形の歪みなどを考慮すると、3値PPM信号が好ましいが、2値PPM信号を本発明に適用することができる。

【図面の簡単な説明】

【0058】

【図1】実施形態の信号伝送システムの全体構成を示すブロック図である。

【図2】実施形態のPPMエンコーダの詳細構成例を示すブロック図である。

【図3】図2の各部タイミングチャートである。

【図4】図2のレベルシフタの詳細構成例を示す回路図である。 30

【図5】実施形態の重畳回路及び分離回路の詳細構成例を示す回路図である。

【図6】実施形態の重畳動作及び分離動作の説明図である。

【図7】実施形態のPPMデコーダの詳細構成例を示すブロック図である。

【図8】図7の上波整流回路の詳細構成例を示す回路図である。

【図9】図7のラッチ回路の詳細構成例を示す回路図である。

【図10】実施形態の信号伝送システムの効果の説明図(1)である。

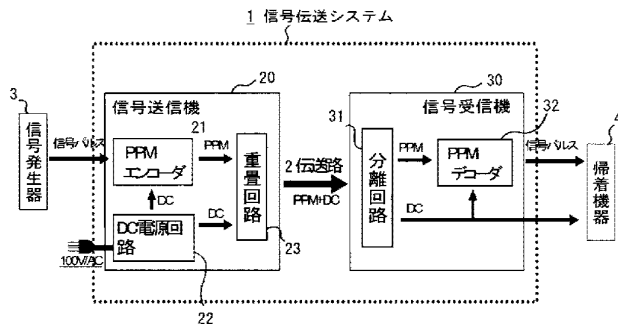
【図11】実施形態の信号伝送システムの効果の説明図(2)である。

【符号の説明】

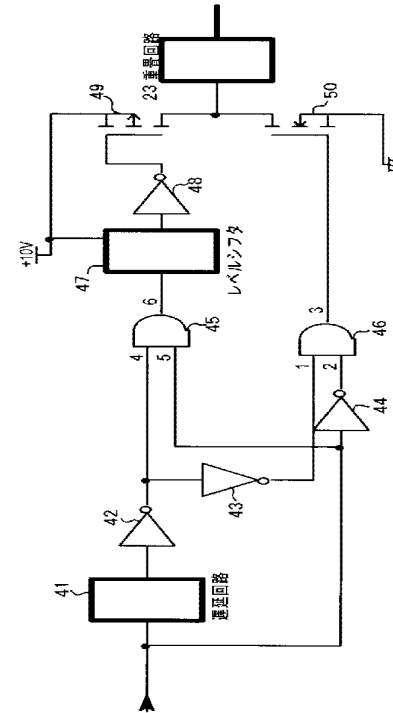
【0059】

1…信号伝送システム、2…伝送路、3…信号発生器、4…帰着機器、21…PPMエンコーダ、22…DC電源回路、23…重畳回路、30…信号受信機、31…分離回路、32…PPMデコーダ。 40

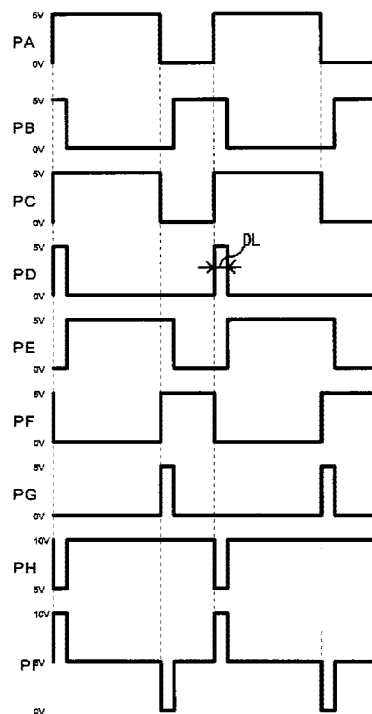
【図 1】



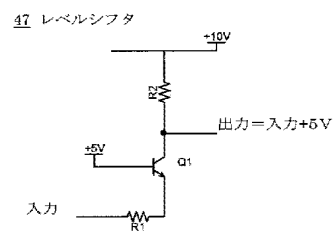
【図 2】



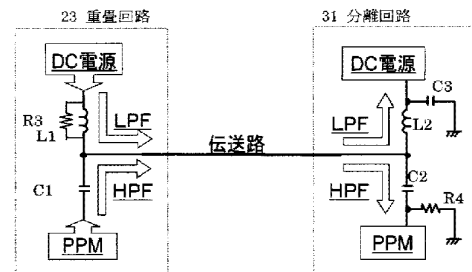
【図 3】



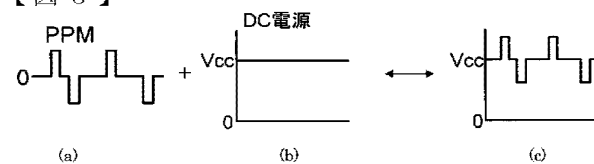
【図 4】



【図 5】

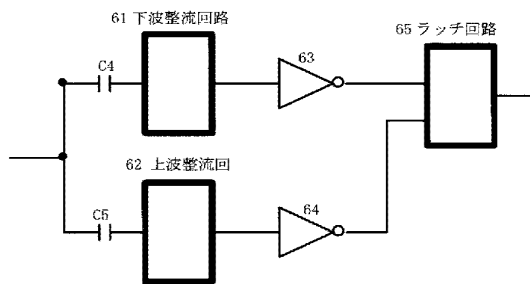


【図 6】

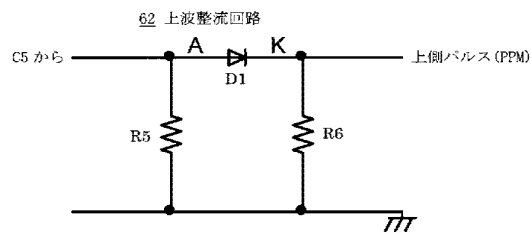


【図 7】

32 PPM デコーダ

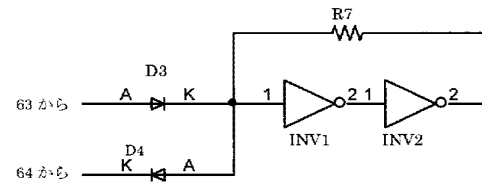


【図 8】

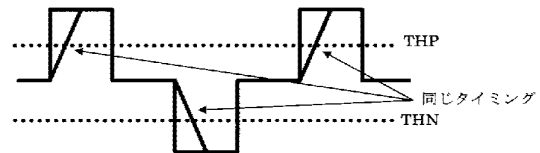


【図 9】

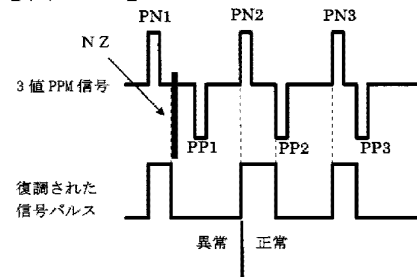
65 ラッチ回路



【図 10】



【図 11】





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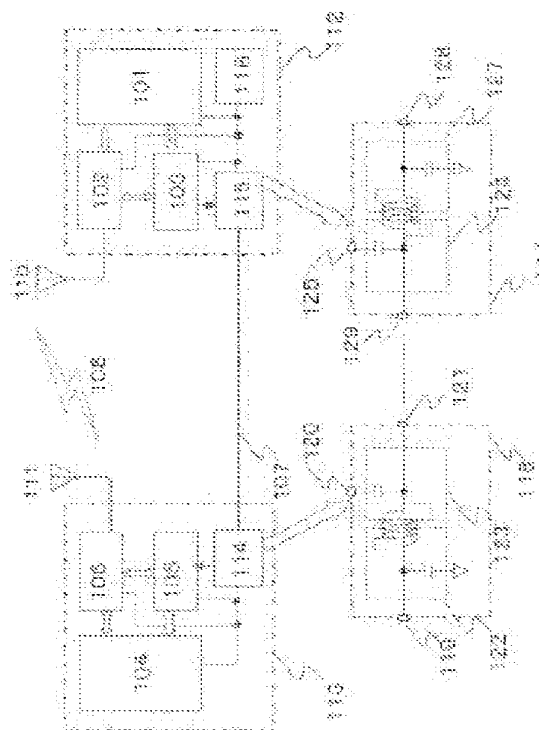
- cooperative:

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Also published as: JP3755530 (B2)

Abstract of JP2005217799 (A)



PROBLEM TO BE SOLVED: To provide an electronic apparatus with high reliability at a low cost by enhancing a conventional radio communication technology, applying the enhanced technology to data transmission in the same electronic apparatus, adopting radio transmission to a method of a high speed transmission of data wherein various problems and constraints exist and eliminating the defect and restriction of data transmission systems of prior arts. SOLUTION: The electronic apparatus includes: a radio transmission section for modulating first category information and transmitting the modulated information as an electromagnetic wave signal; a radio reception section for receiving and demodulating the electromagnetic wave signal; a wired transmission section for superimposing second category information on a signal on a power line and transmitting the information; and a wired reception section for separating the signal superimposed on the signal on the power line. The radio transmission section and the wired transmission section transmit the first and second category information items at the same time. Further, power is supplied to the radio transmission section and the wireless reception section via the common power line. ; COPYRIGHT: (C)2005,JPO&NCIPI

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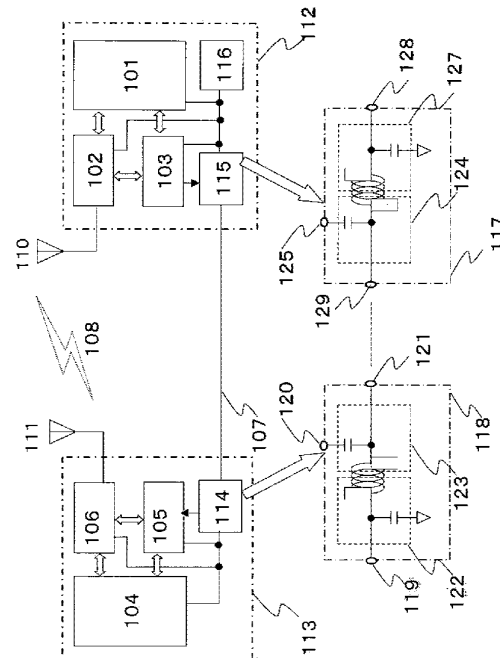
(54) 【発明の名称】 電子装置

(57) 【要約】

【課題】 伝送データの大容量化高速化にともないデータ伝送の消費電力が増加し、信号歪による特性劣化をひきおこし、ケーブルやコネクタの信頼性が低下、またコストアップの要因となる。無線によりデータを伝送すればこれらの問題はすべて解決するが、無線による伝送はハードウェアが複雑になり実現が難しい。本発明は構成を複雑にすることなく無線によるデータ伝送を可能とする。

【解決手段】 第1 カテゴリー情報を変調し電磁波信号として送信する無線送信部と前記電磁波信号を受信し復調する無線受信部と、第2 カテゴリー情報を電源線に重畳し伝送する有線送信部と、前記電源線に重畳された信号を分離する有線受信部を具備し前記第1 カテゴリー情報および第2 カテゴリー情報は前記無線送信部および有線送信部により同時に送信され、かつ前記無線送信手段と無線受信手段は共通の前記電源線より電源を供給する。

【選択図】 図1



【特許請求の範囲】**【請求項 1】**

第 1 カテゴリー情報を変調し電磁波信号として送信する無線送信部と前記電磁波信号を受信し復調する無線受信部と、第 2 カテゴリー情報を電源線に重畳し伝送する有線送信部と、前記電源線に重畳された信号を分離する有線受信部を具備し前記第 1 カテゴリー情報および第 2 カテゴリー情報は前記無線送信部および有線送信部により同時に送信され、かつ前記無線送信部と無線受信部は共通の前記電源線より電源が供給されていることを特徴とする電子装置。

【請求項 2】

第 2 カテゴリー情報は前記無線送信部と前記無線受信部の無線通信に関する同期情報であることを特徴とする請求項 1 記載の電子装置。 10

【請求項 3】

第 2 カテゴリー情報は前記無線送信部の搬送波情報であることを特徴とする請求項 1 記載の電子装置。

【請求項 4】

前記無線送信部は基準信号を発生する制御部と前記基準信号に同期して前記第 1 カテゴリー情報を電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第 2 カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期して前記第 1 カテゴリー情報を復調する復調部を具備することを特徴とする請求項 2 記載の電子装置。 20

【請求項 5】

前記無線送信部は基準信号を発振する制御部と前記基準信号に同期した搬送波を発振する第 1 搬送波発振部と前記搬送波発振部の発する搬送波を第 1 カテゴリー情報で変調し電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第 2 カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期した搬送波を発振する第 2 搬送波発振部と前記第 2 搬送波発振部の発する搬送波を使って第 1 カテゴリー情報を復調する復調部を具備することを特徴とする請求項 3 記載の電子装置。

【請求項 6】

前記無線送信部は基準信号を発振する制御部と前記基準信号に同期した搬送波を発振する第 1 搬送波発振部と前記搬送波発振部の発する搬送波を第 1 カテゴリー情報で前記基準信号に同期して変調し電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第 2 カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期した搬送波を発振する第 2 搬送波発振部と前記第 2 搬送波発振部の発する搬送波を使って第 1 カテゴリー情報を前記有線受信部により受信された前記基準信号に同期して復調する復調部を具備することを特徴とする請求項 2 または 3 記載の電子装置。 30

【請求項 7】

前記無線送信部は位相変調により第 1 カテゴリー情報を変調し、変復調の搬送波情報は第 2 カテゴリー情報として有線伝送される基準信号より生成し、かつ／または前記無線送信部で送信される送信パケットの先頭は前記第 2 カテゴリー情報として有線伝送される基準信号に同期が取られることを特徴とする請求項 3 乃至 5 記載の電子装置。 40

【請求項 8】

前記無線送信部はスペクトル拡散変調により前記第 1 カテゴリー情報を変調しまた無線受信部はスペクトル逆拡散し復調し、変復調の拡散コードの同期情報および／または搬送波情報は第 2 カテゴリー情報として有線伝送される基準信号より生成し同期が取られることを特徴とする請求項 3 乃至 5 記載の電子装置。

【請求項 9】

前記無線送信部は UWB 変調により第 1 カテゴリー情報を変調し、復調のためのパルステンプレートの同期情報は前記第 2 カテゴリー情報として有線伝送される基準信号より生 50

成し同期が取られることを特徴とする請求項 2 記載の電子装置。

【請求項 10】

表示体と、前記表示体に表示する情報を記憶する記憶部と、前記記憶部から表示情報を前記表示体の駆動順序に合わせて読み出し出力する表示制御部と、前記制御部が読み出した表示情報に基づき前記表示体を駆動する駆動部を有する電子装置において、前記制御部と表示体駆動部との間で伝送される情報を前記第 1 カテゴリー情報として無線伝送することを特徴とする請求項 1 乃至 9 記載のいずれかの電子装置。

【請求項 11】

撮像素子と、前記撮像素子から画像信号を読み出し出力する撮像制御部と、前記撮像制御部の出力信号を受信し処理する処理部を有する電子装置において、前記撮像制御部と処理部との間で伝送される情報を前記第 1 カテゴリー情報として無線伝送することを特徴とする請求項 1 乃至 9 記載のいずれかの電子装置。 10

【請求項 12】

集積回路上の電子回路と集積回路外部とで伝送される情報を前記第 1 カテゴリー情報として無線伝送することを特徴とする請求項 1 乃至 10 記載のいずれかの電子装置。

【請求項 13】

表示部とスピーカ部と前記表示部に表示する画像データおよび前記スピーカ部を駆動する音響データを生成するデータソース部から構成される電子装置において、前記表示部またはスピーカ部とデータソース部の間で伝送される前記画像データおよび音響データを前記第 1 カテゴリー情報として無線伝送することを特徴とする請求項 1 乃至 10 記載のいずれかの電子装置。 20

【発明の詳細な説明】

【技術分野】

【0001】

本発明は表示素子や撮像素子など高速なデータ転送を必要とする素子を擁する電子装置に関する。

【背景技術】

【0002】

近年、携帯電話やノートブックコンピュータ、デジタルカメラなどの機能向上は目覚しく内蔵される表示素子や撮像素子の高分解能、高精細化が求められますますます複雑化している。特に携帯電話においてはカメラ機能の内蔵や表示の大型化などの高機能化とともに小型軽量化、低消費電力化が求められその筐体構造もクラムシェル型と呼ばれる折り畳み型が主流になってきている。 30

【0003】

このような要請から、実装基板は複数にわたることが多く、その場合表示素子や撮像素子とそれらのデータを制御する CPU は別基板に搭載されることが多い。必然的に CPU と表示素子または撮像素子との間の結線が長くなる。素子の高分解能化に伴いそれらの線路の信号周波数が高くなり接続が困難になってきている。特にクラムシェル型構造では細いヒンジ部分を介して両者が接続される構造となる。表示素子や撮像素子の高分解能化に伴い両基板間でやり取りされるデータ量も多くなり高速転送技術が必要となってきた。この問題を解決するために高速データ伝送の方式としてたとえば (LVDS: Low Voltage Differential Signaling) を表示体や撮像素子の接続に使う (特許文献 1 および特許文献 2) ことが提案されている。特許文献 3 および特許文献 4 等ではこの方式でも十分な解決が得られないとして新たな方法が提案されている。 40

【0004】

【特許文献 1】 特許公報 3086456 (欄 44)

【特許文献 2】 特許公報 3330359 (欄 46)

【特許文献 3】 特許公報 3349426

【特許文献 4】 特許公報 3349490

た、半導体製造技術の進歩は目覚しく、システムオンチップとして集積度はますます上り1チップ内に入る半導体回路は全て搭載しようとする傾向がある。そのために半導体チップと外部回路との接続のピン数が膨大となり数百本を超えることも珍しくない。また、半導体回路の動作周波数も高くなり従来のワイヤボンディングを介して外部と接続する方法では高周波特性が問題となり正しく外部との信号やり取りが困難となってきた。このような問題に対し非特許文献1ではチップ間の接続を無線化する研究が報告されている。

【0005】

【非特許文献1】「日経マイクロデバイス」2003年12月号161ページ

【発明の開示】

【発明が解決しようとする課題】

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【0006】

しかしながら、最近の表示体の大型化はこれらの技術でも十分な性能を得られない。十分な対ノイズ特性（耐干渉性、与干渉性）を得るには細心の設計と調整が要求される。LVDSでは信号レベルが小さいため必然的にデジタルICでアナログ信号を扱うことになり消費電力が大きくなるという問題があった。

【0007】

また信号を精度よく伝送するためには整合の取れたインピーダンス終端が必要であるが、インピーダンス終端が必要な線の数が多い上に伝送インピーダンスはせいぜい100オームくらいなのでそれらの終端抵抗に消費される電力が容認できないほどに大きくなってしまいうという問題もあった。

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【0008】

さらに、また配線がヒンジ部などの可動部を通る場合は折れ曲がり具合により特性インピーダンスが変化するため状況によってインピーダンス不整合が生じ折れ曲がり部での反射等により信号劣化を引き起こす。このために伝送されるデータの速度が制限されたり、実装方法や部品の配置が制約を受けるという問題点があった。

【0009】

また、さらに当然のことながらヒンジ部を介してやり取りされる信号数は数十本となる上に基板上の配線を使用できないのでフレキシブル基板をコネクタを介して接続することになる。フレキシブル基板やコネクタによる接続はコストが高い上に接続信頼性も低いという欠点を有していた。

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【0010】

さらに転送データの高速化に伴う配線数の増大は配線のための物理的スペースを要し当然の事ながら機器のデザインに対し大きな制約を課することになる。

【0011】

さらに、このような高速で大量のデータを長い配線によって引き回すこと線路からの放射電磁界が増えては他の電子機器あるいは自分自身への電磁波妨害の要因となる。従来の信号線による信号伝送では受電端での振幅レベルが規定されており受電端で十分な品質を確保しても信号の振幅レベルを下げるできない。すなわちEMI対策が困難になり結果として機器デザインへの制約やコストアップを引き起こしている。また、送信側の駆動は受電端の負荷に加え線路の浮遊容量も同時に駆動することになるため信号伝達に余分

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【0012】

これらの問題は同一の電子機器内に従来の無線通信技術を導入し、配線が困難な部分のデータ転送を電磁波信号により無線転送すれば一気に解決できる。

【0013】

しかしながら、従来の無線通信技術を電子機器内のデータ転送に導入するには、その仕組みが、導線により伝送していた場合に比較し、非常に複雑であり実装には困難が伴う。

【0014】

そこで本発明は従来の無線通信技術を改善し同一の電子機器内におけるデータ伝送に応用することを可能にして、上述のような種々の問題や制約を持つデータの高速伝送の方

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法を無線化し、従来のデータ伝送方式の欠点や制約を除去し低コストで信頼性の高い電子装置を実現することを目的とする。

【課題を解決するための手段】

【0015】

本発明の電子装置は第1カテゴリー情報を変調し電磁波信号として送信する無線送信部と前記電磁波信号を受信し復調する無線受信部と、第2カテゴリー情報を電源線に重畳し伝送する有線送信部と、前記電源線に重畳された信号を分離する有線受信部を具備し前記第1カテゴリー情報および第2カテゴリー情報は前記無線送信部および有線送信部により同時に送信され、かつ前記無線送信部と無線受信部は共通の前記電源線より電源が供給されていることを特徴とする。

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【0016】

上記構成によれば高速伝送の困難な信号群の伝送を無線により伝送し、送信データの高速度に伴う様々な問題を回避し、無線伝送に必要な同期情報等の信号を電源線に重畳し有線で伝送することで無線化に伴うシステムの複雑化の回避し、しかも有線路も電源線と共用するので配線に伴う困難も軽減することができる。

【0017】

これによってシステムを複雑にすることなく、高速データの送信信号は空間を伝播して伝えることができ、そのための配線は不要となりフレキシブル基板やコネクタといった配線が簡略化できこれらに起因するコスト高や信頼性の問題が無くなる。またインピーダンスマッチングのための終端やデータ伝送速度の高速化に伴い上昇する消費電力の問題も回避できる。また配線の引き回しや部品配置の制約が緩和でき電子装置のデザインや使い勝手を向上することができる。またさらに信号伝送に使用される電磁波は同一システム内という至近距離で行われるためこの距離内での通信が確保できさえすれば良く、放射電磁波の強度を限界まで下げることが出るのでEMI特性が本質的に改善され対策が容易になる。しかも有線路も電源線と共用するので配線に伴う困難も軽減することができる。

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【0018】

本発明の電子機器の第2カテゴリー情報は前記無線送信部と前記無線受信部の無線通信に関する同期情報を含むことを特徴とする。

【0019】

上記構成によれば、無線伝送に際し受信側で同期捕捉のための手続きや回路を省略し無線伝送のための回路を簡略化することができる。

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【0020】

本発明の電子機器の第2カテゴリー情報は前記無線送信部の搬送波情報であることを特徴とする。

【0021】

上記構成によれば、無線伝送に際し送信側と受信側の搬送波を常にトラッキングさせることができるため搬送波発振器の精度を著しく緩和でき第1カテゴリー情報を送受するための送受信のためのハードウェアの精度を著しく緩和できコストメリットが大きい。

【0022】

本発明の電子機器の前記無線送信部は基準信号を発生する制御部と前記基準信号に同期して前記第1カテゴリー情報を電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第2カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期して前記第1カテゴリー情報を復調する復調部を具備することを特徴とする。

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【0023】

上記構成によれば、無線送信部と無線受信部は同一の基準信号に同期して動作することができるので、受信側で同期のための回路が不要となり第1カテゴリー情報を送受するための送受信のためのハードウェアの構成を著しく簡素化できる。

【0024】

本発明の電子機器の前記無線送信部は基準信号を発振する制御部と前記基準信号に同期

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した搬送波を発振する第1搬送波発振部と前記搬送波発振部の発する搬送波を第1カテゴリー情報で変調し電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第2カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期した搬送波を発振する第2搬送波発振部と前記第2搬送波発振部の発する搬送波を使って第1カテゴリー情報を復調する復調部を具備することを特徴とする。

【0025】

上記構成によれば、無線送信部と無線受信部は同一の基準信号に同期して発生する搬送波によって動作することができるので、受信側での搬送波再生のための回路が不要となり第1カテゴリー情報を送受するための送受信のためのハードウェアの構成を著しく簡素化
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【0026】

本発明の電子機器の前記無線送信部は基準信号を発振する制御部と前記基準信号に同期した搬送波を発振する第1搬送波発振部と前記搬送波発振部の発する搬送波を第1カテゴリー情報で前記基準信号に同期して変調し電磁波信号に変換する変調部を具備し、前記有線送信部および有線受信部により送受信される第2カテゴリー情報は前記基準信号であり、前記無線受信部は前記有線受信部により受信された前記基準信号に同期した搬送波を発振する第2搬送波発振部と前記第2搬送波発振部の発する搬送波を使って第1カテゴリー情報を前記有線受信部により受信された前記基準信号に同期して復調する復調部を具備
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【0027】

上記構成によれば、電源線に重畳された一つの基準信号に無線送信部と無線受信部の同期を取ることができ、かつ前記基準信号に同期して発生するトラッキングの取れた搬送波によって動作することができるので、受信側での同期のための回路や搬送波再生のための回路が不要となり第1カテゴリー情報を送受するための送受信のためのハードウェアの構成を著しく簡素化できる。

【0028】

本発明の電子装置の前記無線送信部は位相変調により第1カテゴリー情報を変調し、変復調の搬送波情報は第2カテゴリー情報として有線伝送される基準信号より生成し、かつ／または前記無線送信部で送信される送信パケットの先頭は前記第2カテゴリー情報として有線伝送される基準信号に同期が取られることを特徴とする
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上記構成によれば、第1カテゴリー情報を送受信する無線送信部および無線受信部を簡単な回路構成で実現でき信号伝送の電磁波(電波)による無線化ができる。特に、無線で伝送される信号の送信側と受信側で電源線に重畳され伝送される共通の制御信号を利用するため送受信端での特性のばらつきやタイミングのばらつきを吸収できるので高精度の部品を使わなくても品質の良い通信が確保できる。

【0029】

本発明の電子機器の前記無線送信部はスペクトル拡散変調により前記第1カテゴリー情報を変調しまた無線受信部はスペクトル逆拡散し復調し、変復調の拡散コードの同期情報および／または搬送波情報は第2カテゴリー情報として有線伝送される基準信号より生成し同期が取られることを特徴とする。
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【0030】

上記構成によればスペクトル拡散変調により複数の信号をシリアル化せずに多重化して送ることができるリアルタイム特性がよい。また拡散利得を稼ぐこともできるので送信される電磁波信号がシステムへ与える干渉、あるいはシステムから受ける干渉を減じ良いロバストなシステムを構築できる。さらに送受信端で同期情報および／または搬送波情報は電源線に重畳されて伝送されるため受信端ではその信号を利用して、同期タイミングや搬送波を再生できるので、受信側にて同期捕捉のための同期回路が不要となり逆拡散回路も簡素なものが使用でき回路の簡素化が容易である。また搬送波も簡素な回路で再生でき回路の簡素化が可能である。しかも第2カテゴリー情報は電源線に重畳されているので配線数
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も最小にできる。

【0031】

本発明の電子機器の前記無線送信部はUWB変調により第1カテゴリ情報を変調し、復調のためのパルステンプレートの同期情報は前記第2カテゴリ情報として有線伝送される基準信号より生成し同期が取られることを特徴とする。

【0032】

上記構成によれば電波によって通信を行う携帯電話のような、電磁波発生が基本的機能である電子機器の強電磁界環境化においても高速の信頼性の高いデータ伝送が可能となる。UWB通信であれば法律によって許容される最大放射電磁界の規定が緩和されより受信側の設計が容易となる。さらにUWBの変調器および復調器は有線によって伝送される同一の同期情報を使用するので受信側において同期抽出する回路が不要であり、回路の簡素化が図れる。しかも第2カテゴリ情報は電源線に重畳されているので配線数も最小にできる。

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【0033】

本発明の電子機器は表示体と、前記表示体に表示する情報を記憶する記憶部と、前記記憶部から表示情報を前記表示体の駆動順序に合わせて読み出し出力する表示制御部と、前記制御部が読み出した表示情報に基づき前記表示体を駆動する駆動部を有する電子装置において、前記制御部と表示体駆動部との間で伝送される情報を前記第1カテゴリ情報として無線伝送することを特徴とする。

【0034】

上記構成によればシステムを複雑にすることなく、液晶に表示させる表示情報は空間を伝播して伝えることができ、そのための配線は不要となりフレキシブル基板やコネクタといった配線が簡略化できこれらに起因するコスト高や信頼性の問題が無くなる。またインピーダンスマッチングのための終端やデータ伝送速度の高速化に伴い上昇する消費電力の問題も回避できる。また配線の引き回しや部品配置の制約が緩和でき電子装置のデザインや使い勝手を向上することができる。またさらに信号伝送に使用される電磁波は同一システム内という至近距離で行われるためこの距離内での通信が確保できさえすれば良く、放射電磁波の強度を限界まで下げることが出るのでEMI特性が本質的に改善され対策が容易になる。しかも第2カテゴリ情報は電源線に重畳されているので配線数も最小にできる。

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【0035】

本発明の電子機器は撮像素子と、前記撮像素子から画像信号を読み出し出力する撮像制御部と、前記撮像制御部の出力信号を受信し処理する処理部を有する電子装置において、前記撮像制御部と処理部との間で伝送される情報を前記第1カテゴリ情報として無線伝送することを特徴とする。

【0036】

上記構成によれば、撮像素子と撮像素子で得た画像データを使用するホスト側との間の信号のやり取りが無線化されるため、その間の配線が不要となり、撮像素子の大型化に伴い露見したさまざまな問題を回避できる。すなわち、クラムシェル構造の筐体でも容易に実装できる、フレキシブル基板やコネクタといった配線の必要がなくこれらに起因するコスト高や信頼性の問題が無くなる、高い伝送速度にも対応が可能などの効果がある。特にカメラにおいては光学系と電子部品を同一筐体の実装しなければならず電子部品実装の制約が多かったが本発明の上記構成によりこの制約を緩和することができる。しかも第2カテゴリ情報は電源線に重畳されているので配線数も最小にできる。

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【0037】

本発明の電子機器は集積回路上の電子回路と集積回路外部とで伝送される情報を前記第1カテゴリ情報として無線伝送することを特徴とする。

【0038】

上記構成によれば半導体集積回路のパッケージの入出力ピンの一部を無線化することができるのでその数を減らしパッケージのサイズおよびコストを低減できる。しかも第2カ

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테고リー情報は電源線に重畳されているので配線数も最小にできる。

【0039】

本発明による電子機器は表示部とスピーカ部と前記表示部に表示する画像データおよび前記スピーカ部を駆動する音響データを生成するデータソース部から構成される電子装置において、前記表示部またはスピーカ部とデータソース部の間で伝送される前記画像データおよび音響データを前記第1カテゴリー情報として無線伝送することを特徴とする。

【0040】

上記構成によれば映像データや音響データを扱うマルチメディア機器のスピーカやスクリーンとチューナデコーダ部間のデータは第1カテゴリー情報として無線により伝送されるので、それらの接続はできるので電源線のみで可能となりシステムの扱いにおいてその利便性を大きく向上することができる。しかも、電源線に重畳された第2カテゴリー情報により無線化のためのハードウェアを著しく簡素化される。

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【発明の効果】

【0041】

以上述べたように、本発明の上記構成によれば、電子機器の同一機器内または同一システム内のような極近距離に電磁波による無線データ伝送を使うことが可能となり、従来の高速データ伝送に伴う種々の問題や実装上の問題を除去することができ低コストで高信頼性かつ低消費電力の電子装置を実現することができる。

【発明を実施するための最良の形態】

【0042】

以下、本発明の実施形態を図面を使って説明する。

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【実施例1】

【0043】

図1は本発明にかかる情報伝送方式の実施例の要部を示す概念図である。送信部ブロック112から受信部ブロック113へデータを送信するものとする。101は送信すべき情報を有する回路であり104は前記送信情報を受信する回路である。送信ブロック112の発する送信情報はカテゴリー分けされ第1カテゴリー情報は前記送信データを変調器102により変調し送信アンテナ110より電磁波として送信する。第2カテゴリー情報はインターフェース回路103を経て電源線に重畳され電源とともに有線にて信号伝達される。前記送信アンテナ110より発せられ空間（伝播路108）を伝播する第1カテゴリー情報を運ぶ電磁波信号は受信アンテナ111により受信され復調器106により復調され、回路104へ出力される。また電源線に重畳され有線伝送された第2カテゴリー情報はインターフェース回路105を介して回路104へ伝達される。第2カテゴリー情報はデータの受信ブロック113から送信部ブロック112へ送信されることもありその場合はインターフェース回路105からインターフェース回路103へ送信される。

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【0044】

第1カテゴリー情報としては有線伝送の困難な高速データやバスラインのような多重化の必要な並列データが選ばれる。主として回路101が発生する情報であり、これら第1カテゴリーに属する情報は無線により伝送される。送信アンテナ110から放射される電磁界は法律によって定められる上限を超えないように設定される。免許を要しない無線局として許容される放射レベルはEMIの規定よりもはるかに低いレベルであるが、通信距離が至近距離であるためリンクバジェットを適当に設定することで十分な品質の通信路を確保できる。

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【0045】

このように高速伝送が必要な大量情報は信号線を介して伝えられるのではなく無線により空間を伝播するため信号線を使う必要がなくなりそれに伴うコネクタやヒンジ構造の従来の問題を除去することができる。また従来の信号線による伝送では、高速化に伴い浮遊容量への充放電が多くなり消費電力が増加し、さらに信号線路から発射される不要放射電力が増加し周囲の機器への干渉対策が困難となるという欠点があった。信号線による伝送ではロジックレベルが規定されているため本質的に消費電力を減らすことができなく、不要

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放射を減らすにはシールド強化などの対処療法しか方法がなかった。本発明のこのような方法によれば、送信アンテナ 110 から送信される放射電力を同一システム内という至近距離において十分な通信品質を確保できれば良いので送信アンテナ 110 からの放射電力をこの値程度まで下げることができ消費電力や EMI 対策が本質的に改善され容易となる。また通信線路のインピーダンスマッチングのための終端に伴う消費電力の増大や部品配置、線路の引きまわし等の制約から解放される。

【0046】

本発明に用いる無線通信の方法は通信距離が同一電源を使用する同一筐体あるいは同一システム内に限定されるため従来の無線通信機器に使用される技術より簡素な方法をとることができる。その方法を具現化するのが電源線に重畳され有線伝送される第 2 カテゴリー情報である。第 2 カテゴリー情報としては高速大量データ転送を要しないもの、無線送受信のための同期情報、発信器情報、データの受信状態をフィードバックするフィードバック情報などが考えられ、インターフェース回路 103 またはインターフェース回路 105 それ自身が発する情報もこの第 2 カテゴリー情報に含めることができる。インターフェース回路 103 は回路 101 の発する第 2 カテゴリー情報も収集しそれ自身の発生する第 2 カテゴリー情報も合わせて最終的に第 2 カテゴリー情報として送り出す。

【0047】

特に通信パケットの同期情報が無線伝送路によらず取得できれば、受信側で同期情報を抽出するための回路が不要となり受信側の回路が著しく簡略化できる。またスペクトル拡散や UWB (Ultra Wide Band) 通信に必要な相関器の同期情報を送ることにより相関器の構造を著しく簡略化することもできる。さらに発信器情報が送信できれば、送受間での基準となるクロック信号が共通にすることができ発信器に要求される発信周波数精度が著しく緩和され電子装置の実現が容易となる。また、携帯電話やブルートゥース (Bluetooth) または UWB (Ultra Wide Band) のような近距離通信インターフェースを持つ電子装置のような場合で、第 1 カテゴリー情報を送る電磁波が電子装置本来の通信に妨害を与えることがある場合、電子装置の使用電波に妨害を与えないよう電子装置の動作状況を第 2 カテゴリー情報として第 1 カテゴリー情報の送受間でやり取りすることにより第 1 のカテゴリー情報を伝送する電磁波の周波数を変更し本来の通信への妨害を除去することができる。すなわち第 2 カテゴリー情報として携帯電話などではその送信チャネルの周波数、ブルートゥースや UWB ではそのホッピングパターンなどを選ぶこともでき、これらの信号はインターフェース回路 103 またはインターフェース回路 105 から発生できる。

【0048】

第 2 カテゴリー情報は前記第 1 カテゴリー情報の受信側から送信側に向けて送られることもある。このようにして、第 1 カテゴリー情報の受信状況をフィードバックし、たとえば、再送要求や、放射される電磁波エネルギーの増減要求、伝送路のひずみを改善するためのプリエンファシスパラメータなどを受信側から送信側に送り、少ないハードウェアコストによって通信の品質を高めることが可能である。特に放射される電磁波エネルギーの増減要求をフィードバックすると受信側で通信品質を確保できる最低限の電磁波エネルギーに設定でき不要放射を減らすことができる。これは受電端の信号レベルが規定されており、その規定値を確保するために大きなエネルギーで浮遊容量とともに駆動される従来の有線による高速データ伝送の不要放射電磁界エネルギーよりも低い値であり、EMI 対策が極めて容易になる。また浮遊容量を含めて駆動する信号線が無くなり無線で伝送するために消費電力も減らすことが可能である。

【0049】

これらの第 2 カテゴリー情報は電源線 107 に電源とともに重畳され送信ブロック 112、受信ブロック 113 の間で送受信される。電源 116 は送信ブロック 112 内のすべての回路に電源供給し、インターフェース回路 103 の発する第 2 カテゴリー情報は重畳回路 115 により電源線に重畳される。重畳回路 115 の内部の詳細を一点鎖線 117 内に説明する。端子 128 は電源 116 に接続され、端子 129 は電源線 107 に接続され

る。インターフェース回路103より発する第2カテゴリー情報は端子125からハイパスフィルタ124を通じて電源線107に重畳される。ローパスフィルタ127により重畳された第2カテゴリー情報の信号は端子128側には漏洩せず、したがって送信ブロック112のすべての回路は正しく作動する。電源線107に重畳された第2カテゴリー情報は分離回路114により分離され、インターフェース回路105に伝えられる。一点鎖線118内に分離回路114の内部を詳述する。端子121は電源線107に接続される。端子107に入った第2カテゴリー情報の信号はハイパスフィルタ123により分離され端子120よりインターフェース回路114に伝送される。ローパスフィルタ122は第2カテゴリー情報の漏洩を阻止するため端子119からは電源より供給されるエネルギーのみが伝送され、端子119を通じて受信ブロック内のすべての回路に正しく電源を供給する。第2カテゴリー情報が受信ブロック113の側から送信ブロック112の側に送られるときは重畳回路112と分離回路114の回路の機能は逆になるが図1に示すように同一の回路構成でもよい。

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【0050】

このような構成をとることにより送受信の変復調回路を著しく簡略化するための第2カテゴリー情報を電源線に重畳して伝送できるため最小の配線数で電子機器内の信号のやり取りが可能となり、簡素な方法で信頼性の高い電子機器を実現することができる。

【実施例2】

【0051】

図2は本発明にかかる電子装置の一実施例を示す図である。実施例では電子装置は本体部205と表示部212に分けられヒンジ207を介して一体化されている。電源213は本体部205にあり、本体部205内では基板上の配線を通じて本体部内の各電子回路に供給され、また重畳回路214により第2カテゴリー情報が重畳され電線211を通じ表示部212へ送られる。分離回路215は重畳された電源と第2カテゴリー情報を分離し電源は表示部212の基板上の配線を通じて表示部212の各回路へ配給される。203は本体部基板で電子装置本体の機能制御を受け持つ。電子装置には様々な入出力デバイス例えばキーボードや表示装置が接続される。204は入力装置としてのキーボード、206は表示装置としての液晶表示体である。208は本体基板203上の電子回路の制御によって表示データを生成する液晶コントローラである。液晶コントローラ208が発生する表示データは第1カテゴリー情報として変調器200に送られ変調され送信アンテナ209より電磁波（電波）に変換され空間を伝播する。送信アンテナ209より送信された電磁波信号は受信アンテナ210により受信され復調器202により表示データに復調され液晶ドライバ201に送られ液晶表示体206に表示される。

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【0052】

変調器200および復調器202の同期信号は第2カテゴリー情報として重畳回路214により電源線211に重畳され電源線211を通過して分離回路215に送られ、分離回路215は電源から第2カテゴリー情報を分離して復調器202に伝送する。この信号はデータ速度がそれほど高くなくまた必要な信号線の本数も少ないので電源線に重畳しヒンジを通過して配線することは容易である。配線や部品配置の自由度も増し図2のように信号の送信部である変調器200や送信アンテナ209および受信部である復調器202や受信アンテナ210をヒンジから遠いところに配置することも可能である。

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【0053】

伝送しようとするデータが高速化するに伴い伝送線路内を伝送させることは困難となるが空間内の電磁波による伝送はより容易になってくる。このように有線路で信号を送り変復調器の同期をとれば復調器側で同期のための同期検出が不要となり回路が簡略化できる。しかも有線路は電源線と共用されるためその配線数は最小となる。近年の半導体素子製造技術の向上に伴いこのようにして高周波の無線伝送の変復調器を簡略化し組み込むことはわずかなコストで可能であり実用性の高いものである。

【実施例3】

【0054】

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図3は本発明にかかる情報伝送方式のより詳細と、それを利用した電子装置の実施例を示すブロック図である。CPU301は演算等により表示すべき表示データを生成しビデオメモリ302に記録する。液晶コントローラ303は表示体に表示させるデータ319を所定順序によりビデオメモリ302から読み出し、垂直同期信号321、水平同期信号320とともに出力する。表示するデータ319は通常ビデオメモリより画素単位でワード毎に並列でデータとして読み出されるため、並直変換回路304によって並直変換されロジック回路307に伝送される。ロジック回路307は並直変換回路304と水平同期信号320および垂直同期信号321を受けてパケットを生成し第1カテゴリ情報として変調器308に送り、またその先頭をあらわす基準信号306を第2カテゴリ情報としてPLL309および重畳回路326に出力する。前記第1カテゴリ情報はPLL309で基準信号306を逡倍し基準信号に同期した搬送波を発生させる。この搬送波は変調器308で変調され送信アンテナ310より送信される。同時に基準信号306は第2カテゴリ情報として電源線330に重畳回路326により重畳され受信側にある分離回路327へ伝えられる。

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【0055】

受信アンテナ311は前記送信アンテナ310より送信された電磁波信号を受信しプリアンプ312によって増幅された後、バンドパスフィルタ313により不要帯域の成分を除去して復調器314に入力される。また、第2カテゴリ情報として電源線330に重畳され送られてきた基準信号を分離回路327で分離して、この出力をもとにしてPLL315により逡倍し搬送波を復元し復調器314に供給し電磁波信号の復調を行う。ロジック回路316では受信信号パケット内のプリアンプを検出しパケットからパケット内の表示データ322と水平同期信号323、垂直同期信号324、Xドライバの転送クロック325を発生させ液晶表示体318のドライバへ出力し表示を行う。

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【0056】

PLL309およびPLL315の発振周波数はラジオ受信機や携帯電話のように電波を利用する電子機器の本来の目的を妨害しないような、また妨害を受けないような周波数を選択する。2GHz以上の周波数を選べば100Mbpsのデータを伝送しても占有帯域は200MHz程度であり、通常ほとんどの場合問題無く使用が可能である。

【0057】

一般に無線通信において送信側の変調器と受信側の復調器は扱う搬送波周波数が一致している必要があり、送信と受信の間の搬送波発信器の周波数には高い精度が要求され、その2者の誤差は直接通信品質の劣化となって現れる。しかし上記の本発明の構成によれば変調器308と復調器314は同一の基準信号306を使いPLL309およびPLL315により逡倍し搬送波を生成しているので両者の発進周波数は一致し誤差とならない。搬送波発信器の精度は問題とならずコストダウン効果がある。基準信号306のかわりに直接PLL309出力を重畳回路326により電源線330に重畳し送出しても良い。この場合は分離回路327で分離された搬送波はPLL315を使わず直接復調器314に入力することができてPLL315は不要である。しかし、一般的には搬送波周波数は高いため有線路を伝送するのは困難である。上記構成のように周波数の低い基準信号を用いて送信、受信の双方で特性のそろったPLLで逡倍して搬送波を作り出すほうが実現性が高い。

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【0058】

基準信号306は第1カテゴリ情報を送るためのパケットの先頭を表す信号であり、この基準信号は第2カテゴリ情報として電源線に重畳されて送られてくるので受信側では容易にパケットの先頭を検出することができる。そのため、パケットからデータを取り出す回路は非常に簡単になり、またパケットの先頭を表すプリアンプの付与が必要なくなりパケットの構造を著しく簡略化でき、また通信の実効レートをあげることができる。

【0059】

上記構成を取ることで表示体への高速かつ大量の表示データの無線化が実現でき、表示体の大型化に伴いより顕在化してきた、消費電力、配線位置の制約、EMI対策、信頼性

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確保など有線伝送によって生じる種々の問題を除去できる。

【0060】

また第2カテゴリ情報は電源線に重畳されているので第2カテゴリ情報のための特別な配線を要しない。電子機器の実現に当たって実装上の効果も大きい。

【実施例4】

【0061】

図4(a)は本発明にかかる電子装置の実施例の要部のブロック図を示す図であり実施例3の変調器308および復調器314をより詳述する図である。PLL402は実施例3のPLL309に相当し制御回路407の発する基準信号を逡倍し前記基準信号に同期した矩形パルス搬送波を発生する発信器である。乗算器401は前記PLL402と入力データ403の乗算を行い送信信号404として出力し送信アンテナへ送る。乗算器401は入力データ403およびPLL402出力ともデジタル信号であるため排他的論理和回路で良い。論理0のとき値1のアナログ値、論理1のとき値-1のアナログ値を対応させると排他的論理和回路の入出力はちょうど乗算器として作用する。また、通信の通達距離が極めて近い場合他の機器等に与える高調波妨害などはもともと低く抑えられるためアンテナと変調器出力の間にフィルタなどは不要である。

【0062】

復調部は以下のように動作する。受信アンテナ311(図3)により受信された受信信号は増幅され不要帯域を除去した後、受信信号407として乗算器405に入力され、PLL408により再生された搬送波クロック信号と乗算された後、ローパスフィルタ406で高周波成分を取り除き復調信号409が復調される。ローパスフィルタ406は乗算器405の出力の高域周波数成分(受信信号407とPLL408の再生クロック波形とのわずかな移相差により生ずる細いパルス成分)を除去し復調信号409として出力する。PLL408は第2カテゴリ情報として電源線に重畳され伝送されてくる制御回路407が発する基準信号を逡倍しPLL402と同じ周波数で位相が同期している搬送波パルスを再生する。なお図4(a)では重畳回路と分離回路は省略してあるが実際は制御回路407とPLL408の間にそれらが挿入されていることはいうまでもない。

【0063】

図5(a)~(c)に上記に説明した変調器のタイム図を示す。すなわち同図(a)は送信側PLLすなわちPLL402により生ずる搬送波クロック信号、同図(b)は送信データ403、(c)は出力される送信信号404である。同図のタイム図をデジタル回路と見れば変調器は排他的論理和であり、±1の値を取るアナログ値と見れば変調器は乗算器である。

【0064】

図5(d)~(f)に復調回路のタイム図を示す。すなわち同図(d)は受信信号、同図(e)は受信側のPLLすなわちPLL408から発生されるパルス列、(f)は乗算器405の出力でローパスフィルタ406はこの信号から受信信号407とPLL408出力のわずかな位相差により生ずる高周波成分を取り除き復調信号409を復元する。

【0065】

同図から明らかなように送信側搬送波クロック(図5(a))と受信側の再生搬送波クロック(図5(e))は周波数が違っていたり位相がずれていたりとすると復調がうまく作動しない。従来の無線通信では送信側と受信側で別々に高精度の発信器を持ち誤差を最小限に抑えていた。本発明のこの構成によれば送信側および受信側の搬送波発生は送信側の制御回路407の発する基準信号を基準にして同じ特性のPLLで発生しているので常に同じ周波数が確保できる。そのため発信周波数の安定度や周波数精度による誤差が生じない。安価な回路でもきわめて安定度の高い回路を構築できる。

【0066】

図5のタイム図をデジタル回路と見れば変調器は排他的論理和であり、±1の値を取るアナログ値と見れば変調器は乗算器である。本発明に使用される無線信号伝送は通達距離が至近距離であり十分にS/N比の良い通信品質が確保できるため信号をデジタル値と見て

良い程度まで増幅することができる。この場合、増幅された信号レベルは論理値レベルまで大きくなるが該論理値によって駆動される負荷はCPUから表示体までというような大きな浮遊容量を伴う長い距離ではなく同一半導体チップ内のような極めて短く低負荷であるため消費電力の増大にはならない。また、受信信号が論理値レベルまで増幅されないアナログレベルであってもPLL408出力は(±1の値を取る)矩形であるため乗算は簡単なスイッチ回路で実現できる。すなわち受信信号を増幅度の絶対値が等しく極性が逆の2つの増幅器を用意し、PLL408出力の論理レベル1のとき反転増幅器出力をスイッチにより選び論理レベル0のとき正転増幅器出力を選択することによって実現できる。このような構成の回路を乗算器407として用いても良い。

【0067】

上記構成によれば変調器は排他的論理和回路、復調器も排他的論理和回路1つまたは正負の増幅度を持つ増幅器とスイッチ回路、およびローパスフィルタによりきわめて簡単に実現できる。

【実施例5】

【0068】

図4(b)は本発明にかかる電子装置の実施例の要部のブロック図を示す図であり実施例3の変調器308および復調器314の他の例をより詳述する図である。実施例4では簡素化したBPSK変調であるが実施例5はより一般的な位相変調を使用した場合を示すためにQPSKに基づく例をあげる。PLL413は実施例3のPLL309に相当し、制御回路417の発する基準信号を逡倍し基準信号に同期した搬送波を発生する矩形パルス発振器である。QPSKでは送信をシンボル毎に2ビットずつ(すなわちデータビット1 410およびビット2 411を)割り当ててエンコードし送信する。すなわち基準のクロックに対して移相量を例えば表1に示す様にエンコードして変調し送信する。エンコーダ412はデータビット1 410およびデータビット2 411のビットパターンにより表1に示すような移相となるように移相器414および乗算器415を制御する。

【0069】

【表1】

ビット1	0	1	0	1
ビット2	0	0	1	1
移相量	0	+90°	+180°	+270°

【0070】

図5(g)~(j)は図4(b)に示す変調器の各部の動作を示すタイム図である。送信データのビット1 410(図5(h))およびビット 411(図5(i))はエンコーダ412によりエンコードされ、送信側PLLすなわちPLL413により発振された搬送波(図5(g))を移相器414によって90°の移相を行うかどうか、さらに乗算器415によって搬送波を反転(180°の移相)を行うかどうかを制御し最終的にQPSK変調された送信信号415(図5(j))を出力する。

【0071】

制御回路417は実施例3のロジック回路307に相当し、制御回路417の発する基準信号は第2カテゴリー情報として電源に重畳され受信側にも伝送される。なお図4(b)では重畳回路と分離回路は省略してあるが実際は制御回路407とPLL408の間にそれらが挿入されていることはいうまでもない。PLL420は実施例3のPLL315に相当し電源線に重畳されて送られてくる基準信号を逡倍し再生クロックすなわち受信側の搬送波(図5(l))を発生する。前記PLL420の出力する再生クロックは第1の乗算器419により受信信号418(図5(k))と乗算され第1のローパスフィルタ(LPF)423に伝送され高域成分が除去され判別回路425に伝えられる。同時に受信信号418はまたPLL420の発生する再生クロックパルス列を90°移相器422によって90°移相したパルス列(図5(o))と第2の乗算器421によって乗算され第

2のローパスフィルタ(LPF)424によって高域成分が除去され判別回路425に伝えられる。判別回路425は前記第1、第2のローパスフィルタの出力(図6(n)および(q))から送信データを割出して受信信号を復調する。

【0072】

上記構成によれば送信信号の占有帯域を増やすことなくデータ伝送の高速化がはかれる。また変復調器とも簡単なデジタル回路で実現できるため半導体チップ内に組み込むことができコストや消費電力の増加は無視できる。送受信で必要となる搬送波クロックは送受信で同一の制御回路から発生される基準信号を同一の特性を持つPLLで逡倍して位相のそろった同一の周波数を得ているため送受間でクロック周波数精度による誤差が生じない。安価な発信器でも安定したデータ伝送が可能である。基準信号は制御回路417が一方的に変更しても常に送信側および受信側が追従するから、例えば無線通信機のような電子装置において、通信チャネルに応じて通信チャネルに妨害を与えないような周波数を選び一方的に変更することができる。(これは上記実施例3、4のいずれにおいても同じである。)この性質をうまく使うと通信機等の電子装置本来の目的とする通信への干渉や妨害対策を著しく容易にすることも可能である。

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【実施例6】

【0073】

図6は本発明にかかる他の情報伝送方式および電子装置の実施例の要部のブロック図を示す図である。CPU601、ビデオメモリ602、液晶コントローラ603の機能は上記実施例3で説明したものと同一であり、液晶コントローラ603により発生される表示データ625、水平同期信号623および垂直同期信号624は拡散コード発生器605によって発生される拡散コードと符号多重化回路604により多重化される。この実施例では以下のように並列データは符号多重されるため実施例3の並直列変換回路304による並直列変換は不要であり、したがってその逆変換すなわち直並列変換回路317も不要である。拡散コードとしては互いに直交しているコードセットが用いられることが多い。拡散コードは液晶コントローラ603の発する水平同期信号623にコードの先頭が同期し発生する。また拡散コード発生器605クロックは水平同期信号623をPLL606により逡倍したものを使用するので搬送波と拡散コードは完全に同期している。表示データ625はビデオメモリ602からピクセル毎にまとめて読み出されるため並列のデジタルデータとして出力される。このデータ信号の各ビットと水平同期信号623および垂直同期信号624は拡散コード発生器605により発生される各コードと乗算し(排他的論理和をとり)アナログ加算し符号多重化を行う。多重化された信号は変調器607によってPLL606で発生される搬送波で変調され送信アンテナ608より第1カテゴリー情報として電磁波信号によって伝播路626(空間)を通り送信される。搬送波はPLL606により水平同期信号623を逡倍して発生させるため、水平同期信号623と完全に同期している。また上述のように水平同期信号623は拡散コード発生器605とも同期している。水平同期信号623はまた第2カテゴリー情報として重畳回路613により電源線623に重畳され受信側の分離回路622に送出される。

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【0074】

送信された電磁波信号は受信アンテナ609で受信されプリアンプ610で増幅されバンドパスフィルタ611により所定帯域以外の不要信号を除去したのち復調器612により復調する。PLL615は第2カテゴリー情報として電源線627に重畳して送られてくる水平同期信号623を分離回路622により分離しこれを基準として逡倍し搬送数を発生する。復調器612により復調された信号は逆拡散回路614により拡散コード発生器616により発生される多重化のための拡散コードと相関を計算することによって多重化されたデータを分離する。ロジック回路617は検出した表示データや各種タイミングから液晶ドライバを駆動するための表示データ信号618、水平同期信号619、垂直同期信号620およびXドライバのクロック信号621に波形整形とタイミング調整を行い液晶表示体の駆動信号として液晶表示体に送り表示を行う。

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復調器612と変調器607の搬送波は同一の基準信号として水平同期信号623に同期

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し同じ特性のPLL606およびPLL615で発振されるため両者の周波数と位相は一致し搬送波周波数の精度による誤差を生じない。また、拡散コードも送信側および受信側双方においてその先頭が水平同期信号に一致しているため、逆拡散のためのタイミングを検出する必要がない。これにより受信側での同期捕捉のための回路が不要となり回路の簡略化が図れる。とくにコード多重の場合には逆拡散の回路として整合フィルタでなく相関器を使用することが可能となる。良く知られているように逆拡散において整合フィルタは回路が複雑であるが応答時間が短く同期も不要である。一方相関器を逆拡散に使用するときには同期が取れないと逆拡散を行うことができず通常は1チップずつスライディングして試行錯誤的に計算を行うので時間がかかり即座に逆拡散ができない。しかし本発明による上記構成によれば相関器の同期情報が第2カテゴリー情報として有線で送られてくるので同期捕捉やスライディングを行う必要がなく非常に簡単な回路で逆拡散が可能となる。 10

【0075】

また水平同期信号623と垂直同期信号624も表示データ625とともにコード多重して送信するため受信側では逆拡散によって即座にそれらの表示のための同期信号も検出できる。水平同期信号623は第2カテゴリー情報として電源線にも重畳され送られてくるので、コード多重せずこの信号を水平同期信号619として用いても良い。

【0076】

上記構成によればデータの並直列変換を行うことなく信号を多重化して送受信することができ、これは何本ものバスラインを並列に引き回すのと同等の効果がある。特に直交コードによる多重化は制限が少なく、バスラインのように物理的なスペースも必要としない。また、送信部、受信部各々を複数個配備して信号の送受信が必要ないいくつかの異なる場所で同時に通信することも可能である。また、拡散によって拡散利得も稼ぐことが可能であり特に携帯電話などの電波を発生する機器において本来の目的とする電波との耐干渉および与干渉特性改善にも効果がある。拡散利得を稼ぐためには拡散コードの周波数帯域が十分広いものを選び、変調器607の後にさらに拡散変調を行っても良い。第2カテゴリー情報として同期情報、搬送波周波数の情報が電源線に重畳されて送られてくるため、特別な有線線路の追加なしに、送受間で搬送周波数を一致させることが容易で搬送波発信器の精度を要求しない。また、逆拡散やパケット同期のための同期捕捉も不要となり逆拡散の回路が大幅に簡略化でき実現性が高い。 20

【実施例7】

【0077】

図7は本発明にかかる電子装置のさらに他の実施例の要部のブロック図を示す図であり、本発明にかかる情報伝送方式を撮像素子を用いる電子装置に応用した例を示す。撮像素子701は制御回路702から発生される水平同期信号720および垂直同期信号721により起動され撮像した画像データ719を出力する。ロジック回路703はこれらの信号を受けて無線伝送のためのパケットを構築する。該パケットは変調器705により変調し送信アンテナ707から電磁波として放射される。前記変調器705に用いる搬送波はPLL706により制御回路702で発する基準信号を逡倍して発振される。基準信号は制御回路702により例えばロジック回路703が構築するパケットの先頭を示す信号や撮像素子を起動するための水平同期信号720などが用いられる。この基準信号は重畳回路704により第2カテゴリー信号として電源線723に重畳され受信側の分離回路711に送られる。 30 40

【0078】

前記送信アンテナ707から送信された電磁波信号は無線伝播路(空間)722を通過して伝播し受信アンテナ708で受信されプリアンプ709で増幅され、バンドパスフィルタ710により不要な帯域外信号を除去して復調器712に入力される。PLL715は第2カテゴリー情報として電源線723から分子回路711により抽出された基準信号を基準として逡倍し搬送波を生成する。復調器712にはまた第2カテゴリー情報として有線路723を通過して伝送されてくる制御回路702からの基準信号から復調に必要な同期タイミングも利用し、受信信号の復調を行う。直並列変換回路714は復調された受信パ 50

ケットの中から画像データ部分を抽出し画素毎に直並列変換を行い画素データを生成する。これらの回路は第2カテゴリ情報として制御回路702からの基準信号が利用できるため同期のための信号検出を行う必要がなく回路構成が著しく簡略化できる。また搬送波周波数は送信側と常に同期しトラッキングが取られるためその要求される精度が著しく緩和される。

【0079】

ロジック回路716は復調された画素データに合わせてビデオメモリ717に書きこむためのメモリアドレスを発生し直接またはCPU718を介して画像データをビデオメモリ717の該アドレスに書きこむ。CPU718はビデオメモリ717をアクセスし画像データを様々なアプリケーションに使用する。通常撮像素子の起動などのコントロールはCPU718が行うがこの起動に関する情報を撮像素子の制御回路702へ伝送するために第2カテゴリ情報として電源線に重畳し有線で伝送することもできるが無線伝送することもできる。その無線伝送の場合はCPU側、撮像素子側双方で無線の送受信手段を持ち双方向通信を行う。特にクラムシェル構造の携帯電話では撮像素子と表示素子は接近して置かれCPU側とは反対側にあることが多く撮像された画像データはCPU側に送られて処理をしたのち表示素子側に送り返される。このような場合は実施例3を2つ背中合わせに置いたような構成を取ることで実現が可能である。第2カテゴリ情報は制御回路の置かれる側に一つあればよくその制御回路の基準信号を共通に使うことで双方の同期を取ることができる。

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【0080】

上記構成、すなわち撮像素子からのデータ伝送を無線化することで撮像素子の大型化に伴いより顕在化してきた、消費電力、配線位置の制約、EMI対策、信頼性確保など有線伝送によって生じる種々の問題を除去できる。また受信側では復調に必要な同期タイミングが電源線に重畳されて送られてくるため同期捕捉の必要がなく最小の配線数で回路が大幅に簡略できる。また、送受間で同一の発信源により発生する搬送波を基準とするため搬送波発信器に要求される周波数精度は著しく緩和されコストダウンや実現性に大きな効果がある。

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【実施例8】

【0081】

図8は本発明にかかるデータ伝送および電子装置の実施例の要部のブロック図を示す図である。CPU801、ビデオメモリ802、液晶コントローラ803の機能は上記実施例3および実施例6で説明したものと同一である。液晶コントローラ803により発生される表示データ825、水平同期信号823および垂直同期信号824はロジック回路804により並直変換およびプリアンプ付与やパケット構築などのデータの並べ替えが行われシリアル信号に変換される。一次変調器805はこの信号にパルス発生器806によって発生されるパルス列を変調する。一次変調にはパルス列に対しパルス位置変調やバイフェーズパルス変調などが利用できる。一次変調を受けた信号は拡散コード発生器808により発生された拡散コードで拡散変調器807により拡散変調される。

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【0082】

拡散変調されたパルス列はパルス整形回路809によりスペクトル密度の低い広帯域パルスとなるように非常に短時間のパルスに波形整形を受けた後送信アンテナ810によって電磁波として放射される。放射される電磁界はサイン波に変調をかけたものではなく非常に細いパルス列である。このように短パルスで広帯域のパルスを使用する通信はインパルスラジオ (Impulse Radio) またはUWB (Ultra Wide Band) 通信方式と呼ばれるものである。

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【0083】

一方、水平同期信号823はパルス位置変調などのパルス変調のためのパルス発生の基準も決める。この信号は第2カテゴリ情報の基準信号として重畳回路828により電源線に重畳され受信側の分離回路829に伝送される。

【0084】

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放射された電磁波は無線伝播路 8 2 6 を通って受信アンテナ 8 1 1 に受信され、必要に応じてプリアンプ 8 1 2 により増幅された後、相関器 8 1 4 によってパルス発生器 8 1 3 の発生するパルステンプレートとの相関が計算される。前記相関器 8 1 4 出力は拡散コード発生器 8 1 6 の発生する拡散コードによって逆拡散回路 8 1 5 で逆拡散されたのち復調器 8 1 7 で復調され一次変調前の信号（一次変調器 8 0 5 の入力）に変換される。ロジック回路 8 1 8 は復調器 8 1 7 により検出された表示データや送信側から第 2 カテゴリー情報として電源線 8 2 7 に重畳され送られてくる水平同期信号 8 2 3 を元に液晶ドライバを駆動するための表示データ信号 8 1 9、水平同期信号 8 2 0、垂直同期信号 8 2 1 および X ドライバの X クロック信号 8 2 2 を発生し液晶表示体に送り表示を行う。受信側でこのような基準となるタイミング情報がある場合は相関器 8 1 4 やロジック回路 8 1 8 の構成が基準となるタイミング情報がない場合に比較しはるかに簡素化される。 10

【0085】

ここで、UWB 通信の本質はきわめてスペクトル密度の低い短パルスを使用することにある。UWB を使用する場合、放射エネルギーの法的な上限は EMI で規制される不要放射レベル程度まで許容されており、免許を要しない無線局の上限よりはるかに（20 dB 程度）緩い。このため携帯電話のような本来の目的である強い電波を内部で発生するような電子機器においても、十分な通信品質を確保できるリンクバジェットの設定が容易となる。使用するパルスはパルス幅を狭くして波高値を高く設定できるのでプリアンプ 8 1 2 を省略することが可能である。

【0086】

UWB を近距離通信のインターフェースとして持つ電子装置の場合、電子装置内のデータ伝送に本実施例を適用しようとするすると互いに干渉し重大な妨害となる可能性があるが、これは時間軸上の窓を同期させる、周波数ホッピングを行いそのホッピングシーケンスを同期させるなどの方法で回避できる。その場合の同期情報は第 2 カテゴリー情報として本実施例を適用すればよい。 20

【0087】

上記構成によれば変調操作は時間軸上のみで行われ構成要素のほとんどがパルスを扱うデジタル回路のみで実現でき回路素子の IC 化が容易である。短パルスの採用によって時間方向の拡散利得を稼ぎ電子装置本来の機能として発射される電波との耐干渉、与干渉特性を改善するばかりでなく通信伝送路としてのマルチチャネル化も図ることができる。 30

【実施例 9】

【0088】

図 9 は本発明にかかる電子装置のさらに他の実施例を例示する図である。本実施例は前記実施例 1 から実施例 8 において第 2 カテゴリー情報を電源線に重畳する他の方法を例示する。第 2 カテゴリー情報として搬送波のような周波数の高いものは基本的に電源線に重畳できない。本発明の目的はこのような高い周波数の信号がうまく伝送できないので無線で伝送するということであつた。逆に第 2 カテゴリー情報の周波数が低くすぎても電源線にうまく重畳できない。重畳できても受信側で分離がうまく行かなかったり、電源線の電圧レベルが変動することになり機器動作に重大な影響を与えたりする。第 2 カテゴリー情報の周波数がこのように低くすぎる場合は図 9 のように変調を掛けて伝送する。入力端子 9 0 1 に入力された第 2 カテゴリー情報は変調器 9 0 3 で変調し重畳回路 9 0 4 に送出する。重畳回路 9 0 4 は図 1 に示した重畳回路 1 1 8 と同様にハイパスフィルタとローパスフィルタで容易に構成できる。変調器 9 0 3 に入力する搬送波は搬送波発信器 9 0 2 で発振される。その発振周波数は電源線に重畳できて、電子機器への影響のない適当な周波数を選ぶ。搬送波発信器 9 0 2 は例えば第 1 カテゴリー情報を電磁波にて伝送するための搬送波を分周するなどの手段でもよい。電源端子 9 1 1 から供給される電源は重畳回路 9 0 4 で第 2 カテゴリー情報が重畳され電源線 9 0 5 を通じて受電端に送られる。分離回路 9 0 6 は第 2 カテゴリー情報を分離し復調器 9 0 7 に出力するとともに端子 9 1 2 から電源を受信部各部へ供給する。復調器 9 0 7 は第 2 カテゴリー情報を復調する。復調された第 2 カテゴリー情報は復調により通常時間遅れが伴うが、回路 9 0 9 によりこれを修正する 40 50

。搬送波発信器 908 は復調のための搬送波発生を行うが、遅延検波などを用いると復調に必ずしも搬送波は必要でない。回路を簡単にするためには搬送波発信器 908 が省略できる復調方式を選択すると良い。

【0089】

このような回路は半導体技術の進歩によりすべて半導体チップ上に組み込むことができコスト的な増大がほとんど無しに実現が可能である。

【実施例 10】

【0090】

図 10 は本発明にかかる情報伝送方式を用いる電子装置の実施例を例示する図であり、半導体チップ間のデータ伝送に用いた例である。1012 および 1013 は半導体チップをあらわしデータ伝送がチップ 1012 から 1013 に向かって行われる場合を例示する。1001 は半導体チップ 1012 内の送信すべき複数のデータを持つ（生成する）回路であり、1005 は半導体チップ 1013 内の前記データを受信する回路である。制御回路 1003 は送信すべきデータを回路 1001 が出力するよう起動し多重回路 1002 は回路 1001 から前記送信データを受け取り多重化する。多重化は実施例 3 で述べたような並直列変換や実施例 6 のような符号多重化を使用する。変調器 1004 は多重化回路 1002 の出力をうけて変調を行い送信アンテナ 1010 により電磁波信号として送信する。制御回路は同時に多重化や変調の同期その他のタイミング信号や搬送波も発生する。実施例 3 乃至 8 に説明したような手法を使って搬送波の基準となる信号も発生し、これらの信号は第 2 カテゴリー情報として重畳回路 1017 により電源線 1014 を通り受信側の分離回路 1016 に伝送される。分離回路 1016 は電源線 1014 から第 2 カテゴリー情報を抽出し制御回路 1006 に伝えられる。空間（無線伝播路）1015 を伝播し受信アンテナ 1011 で受信された信号は復調器 1008 で復調されデマルチプレクス回路 1007 により多重化された信号を元に戻し、信号を受信する回路 1005 に送られる。制御回路 1006 は多重化や変調の同期その他のタイミング信号や搬送波の基準信号を重畳回路 1017、電源線 1014 および分離回路 1016 を通じて送信側制御回路 1003 から受け取り復調やデマルチプレクスの同期を取りまた、復調器 1008 で使用する搬送波を復元する。このような方法により信号の送信側、受信側で同一の基準信号により同期を取ることににより多重化、デマルチプレクスや変復調の回路が大幅に簡略化でき発信周波数の精度への要求が大幅に緩和され、半導体チップ上の回路としてすべて実現可能にする。

【0091】

送受信アンテナ 1010 または 1011 は半導体チップ 1012、1013 の上に作りこんでも良いしまたボンディングパッドを介してチップ外部へ信号を取り出しアンテナを外付けとしても良い。

【0092】

実施例 9 のような重畳回路および分離回路を用いると幅広い範囲で実現が可能となる。

【0093】

上記のこのような構成をとることにより半導体チップのピン数を大幅に削減でき、またボンディングパッドを介してロジックレベルの信号を取り出すために浮遊容量とともに駆動する従来の方法に比較し大幅な電力の削減が可能となる。

【実施例 11】

【0094】

図 11 は本発明にかかる情報伝送方式を用いる電子装置のさらに他の実施例を例示する図であり、ホームシアタに応用した例である。ホームシアタでは画像表示部 1105 とチューナデコーダ部 1101 とスピーカ部 1124 で構成される。画像表示部 1105 は画像表示装置を内蔵し画像信号を受けて表示する。また、スピーカ部 1124 は通常複数のスピーカ 1111、1112、1113、1114、1115 とスピーカ毎に音声信号を受けて音響効果の制御や増幅を行いスピーカを駆動する駆動部分より構成される。それらの間の接続に以下のような方法を取る。チューナデコーダ部 1101 の再生部 1102 は

制御回路 1120 の指令により TV チューナや DVD レコーダなどの画像や音声ソースから画像や音声のデータを取り出す。再生部 1102 が出力するデータは多重化回路 1103 にて画像および音声チャンネル毎に多重化される。多重化は制御回路 1120 の発する基準信号に同期して拡散コード発生器 1121 が発する拡散符号とチャンネル毎に乗算しアナログ加算して行われる。多重化されたデータは変調器 1109 により変調され第 1 カテゴリー情報として送信アンテナ 1117 より送信される。搬送波発振器 1104 は制御回路 1120 の発する基準信号をもとに通倍し搬送波を発生する。制御回路 1120 の発する基準信号は第 2 カテゴリー情報として重畳回路 1125 により電源線 1116 に重畳され画像表示部 1105 やスピーカ部 1124 に伝送される。上記実施例 1 乃至 10 とは異なりこの電源線は AC 電源であるが重畳回路 1125 や分離回路 1126 は図 1 に示したようなローパスフィルタとハイパスフィルタにより構成できる。端子 1127 は電源線でチューナデコーダ部 1101 の各部に電源を供給する。画像データ、テキストデータまたは音声データは第 1 カテゴリー情報として無線伝搬路 1119 を伝搬し受信アンテナ 1118 にて受信され復調器 1107 で復調され逆拡散回路 1108 により逆拡散され多重化を解いて画像信号のみを取り出し、取り出した画像データを表示部記憶回路 1110 にストアされる。表示記憶回路 1110 にストアされた画像データは順次読み出され画像表示部 1105 に内蔵される画像表示装置のスクリーンに表示される。

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【0095】

同様にスピーカ部 1124 に送られる情報も画像表示部 1105 内部と同様な構成で複製される。説明は重複するためこれ以上は詳述しない。

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【0096】

ここで、第 2 カテゴリー情報として電源線 1116 に重畳されて伝送されてくる基準信号は分離回路 1126 により分離され、それをもとに受信側の制御回路 1123 は画像表示部 1128 内の動作を規定する各種信号を生成する。復調のための搬送波は制御回路 1123 の生成する制御信号を基準とし通倍し搬送波発振器 1106 が発振する。また、逆拡散に用いる多重化コード発生器 1122 は制御回路 1123 の制御を受け第 2 カテゴリー情報として送られてくる基準信号に同期し拡散コードを発生する。このような構成を取ることにより搬送波は常に送受双方でトラッキングが取られるため搬送波発信器に要求される周波数精度の高いものを必要としない。また、逆拡散のコードも同期が取れるため逆拡散の回路も著しく簡素化できる。

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【0097】

上記のような構成を取ることにより従来は電源線のほかにチューナデコーダ部よりスピーカ部や画像表示部にスター型の信号線配線が必要でかつ並直変換や高速伝送のために複雑なプロトコルを取っていたのが、電源線のみで接続でシステム構築が可能となり、著しく簡素化される。また全ての信号を無線で伝送する場合に比較しても回路やプロトコルが著しく簡素化され実施上の効果は大きい。

【産業上の利用可能性】

【0098】

本発明は前述の実施形態に限定されるものではなく、例えば電子機器に内蔵するハードディスクドライブなどの記憶装置と CPU との接続等、幅広い用途に適用できる。

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【図面の簡単な説明】

【0099】

【図 1】 本発明にかかる電子装置の一実施例を示す図。

【図 2】 本発明にかかる電子装置の他の一実施例を示す図。

【図 3】 本発明にかかる電子装置のさらに他の一実施例を示すブロック図。

【図 4】 本発明にかかる電子装置の実施例 3 の変調器および復調器をより詳述する図。

【図 5】 本発明にかかる電子装置の実施例 4 および実施例 5 を詳述するタイム図。

【図 6】 本発明にかかる電子装置のさらに他の実施例の要部のブロック図。

【図 7】 本発明にかかる電子装置のさらに他の実施例の要部のブロック図。

【図 8】 本発明にかかる電子装置のさらに他の実施例の要部のブロック図。

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【図 9】本発明にかかる電子装置の重畳回路および分離回路の他の一実施例のブロック図。

【図 10】本発明にかかる電子装置のさらに他の一実施例の要部のブロック図。

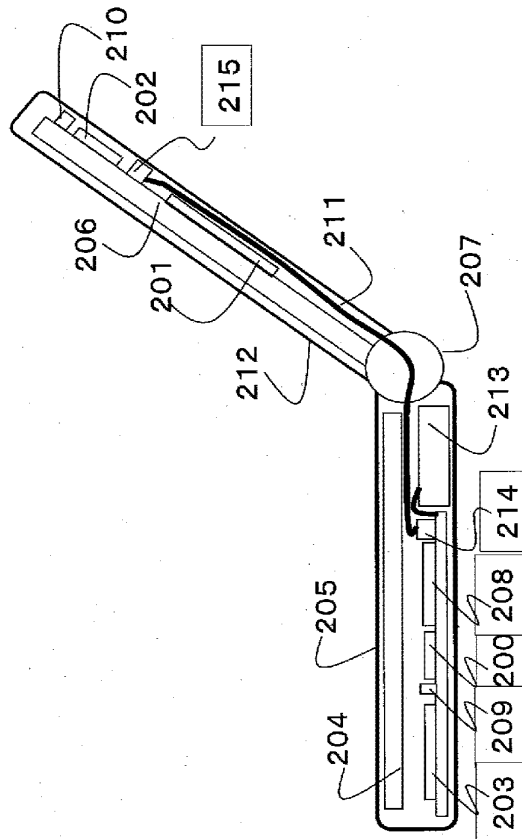
【図 11】従来の液晶表示体を持つ電子装置を説明するブロック図。

【符号の説明】

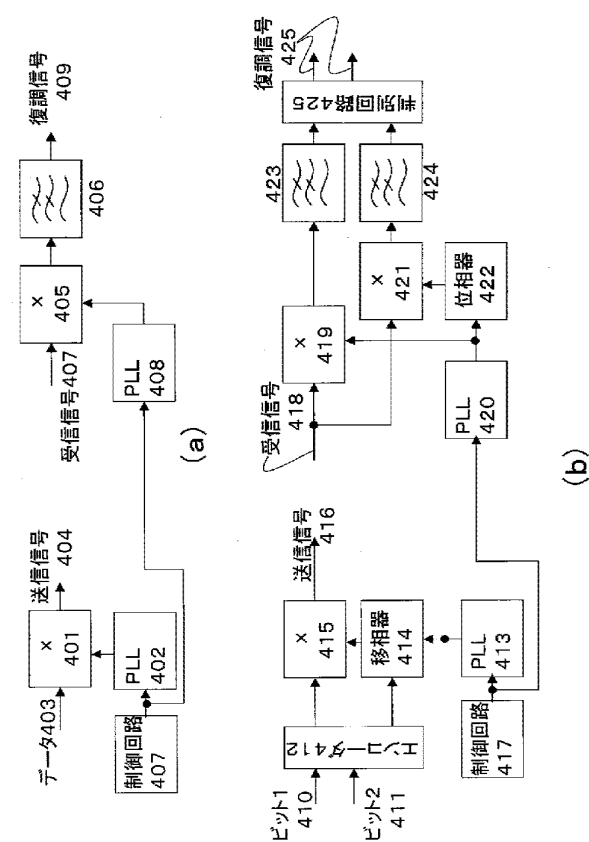
【0100】

107、211、330、627、723、827、1014、1116：・・・電源線
 115、117、214、326、613、704、828、904、1017、112
 5：・・・重畳回路
 114、118、215、327、622、711、829、906、1016、112 10
 6：・・・分離回路
 108、211、329、626、722、826、1015、1119：・・・無線伝
 播路
 301、701、501、518、601、718、801：・・・CPU
 302、702、502、517、602、717、802：・・・ビデオメモリ
 208、303、703、503、603、803：・・・液晶コントローラ
 102、200、308、607、705、1004、1109：・・・変調器
 110、209、310、608、707、810、1010、1117：・・・送信ア
 ンテナ
 111、210、311、609、708、811、1011、1118：・・・受信ア 20
 ンテナ
 106、202、314、612、712、817、1008、1107：・・・復調器
 805：・・・一次変調器
 807、1103：・・・拡散変調器
 206、318：・・・液晶表示体
 701：・・・撮像素子
 309、315、402、408、413、420、606、615、706、715、
 1104、1106：・・・PLL
 401、405、415、419、421：・・・乗算器
 414、422：・・・+90°移相器 30
 605、616、808、816、1121、1122：・・・拡散コード発生器
 604：・・・符号多重化回路
 614、1108：・・・逆拡散回路
 806、813：・・・パルス発生器
 809：・・・パルス整形回路
 814：・・・相関器

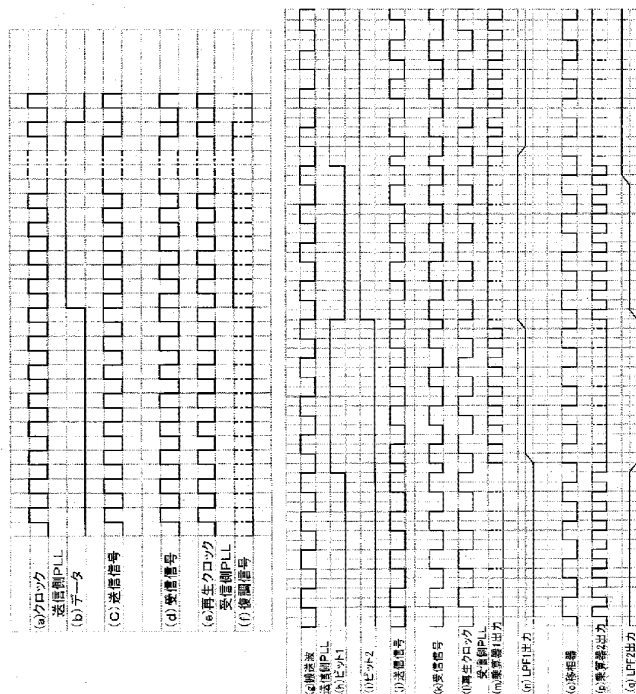
【图 2】



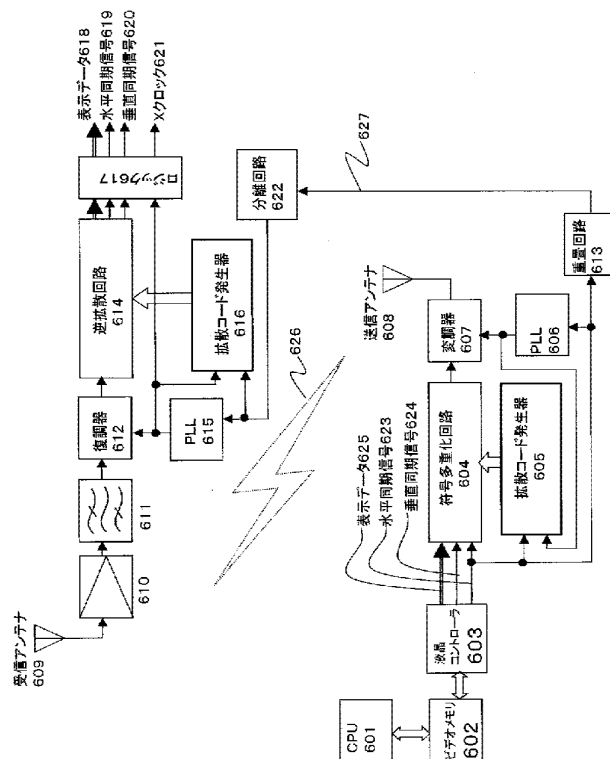
【图 4】



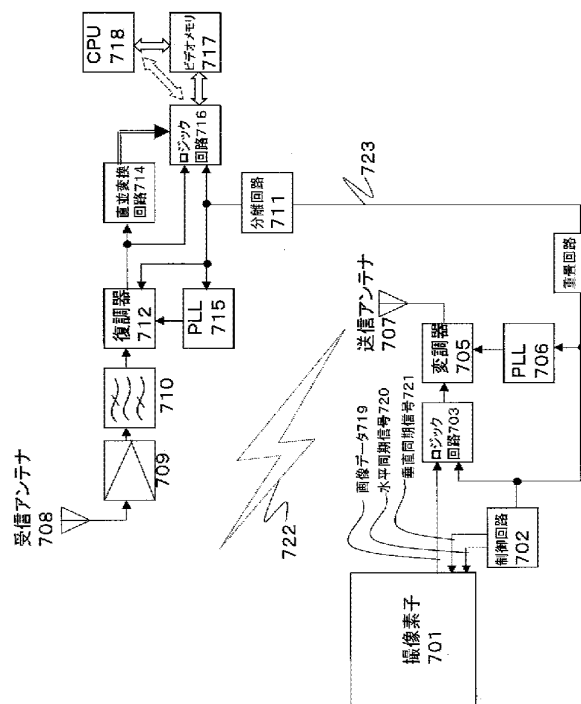
【 ㊦ 5 】



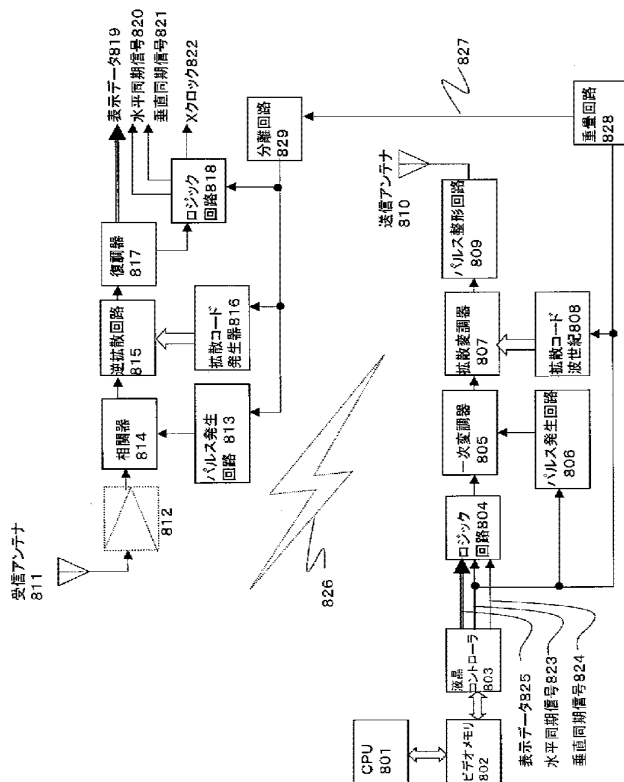
【图 6】



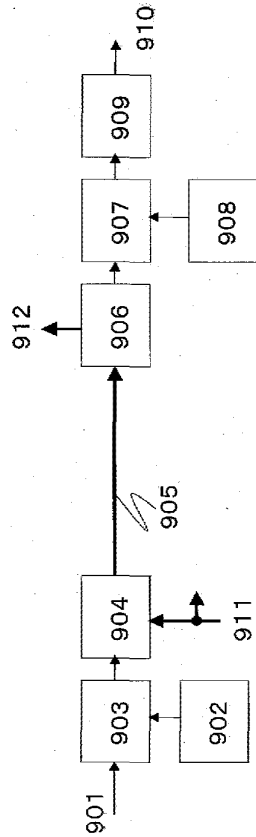
【图 7】



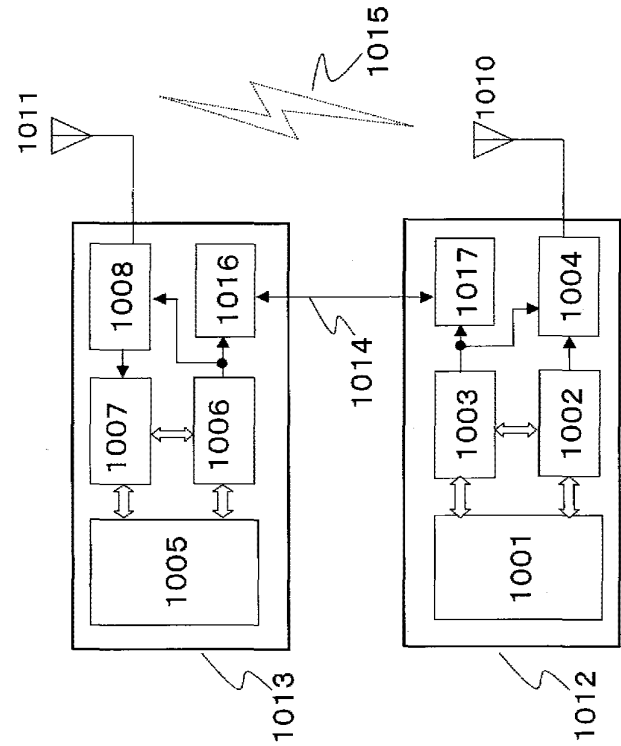
【 8 】



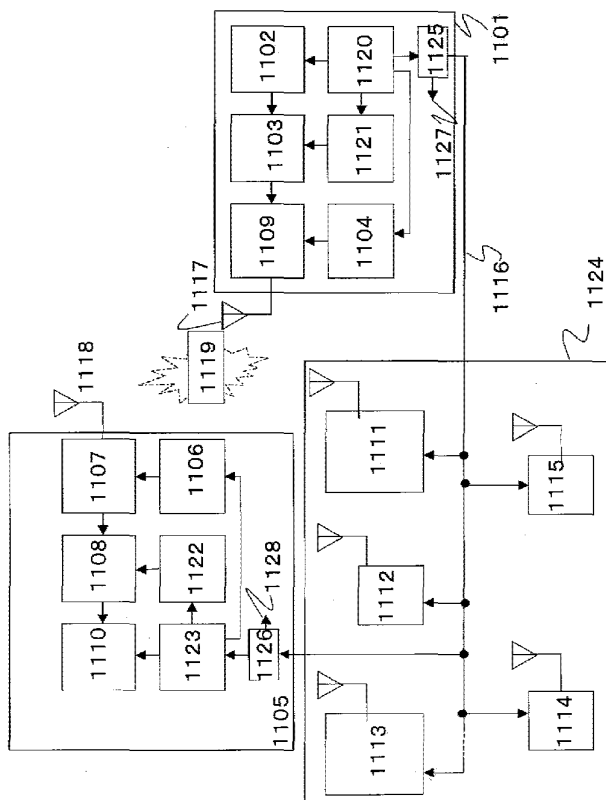
【図 9】



【図 10】



【図 11】



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肆、中文發明摘要

一種高速路由器底板被揭示。該被揭示之構造與配置技術促成路由器用之可靠、high-layer-count且經濟的底板之構造，其使用以2.5Gbps以上之追蹤速度通過底板的傳信(Signaling)。具有重要的單端耦合至相鄰接地面之差別軌跡幾何特徵的特定範圍已被找到以提供此傳信所需的參數。新的軌跡路徑選擇與分層技術亦有助於實現包含約600個可操作的高速差別對之底板實施例，而亦提供充份的電磁干擾管理以讓電力分配在同一底板內發生。

伍、英文發明摘要

A high-speed router backplane is disclosed. The disclosed construction and layout techniques enable the construction of a reliable, high-layer-count, and economical backplane for routers and the like that use signaling across the backplane at trace speeds of 2.5 Gbps or greater. Specific ranges of differential trace geometry characteristics, with significant single-ended coupling to adjacent ground planes, have been found to provide the parameters needed for such signaling. New trace routing and layering techniques also help in the realization of a backplane embodiment containing roughly 600 operable high-speed differential pairs, while also providing sufficient electromagnetic interference management to allow power distribution to occur within the same backplane.

陸、(一)、本案指定代表圖為：第 3 圖

(二)、本代表圖之元件代表符號簡單說明：

100...底板

柒、本案若有化學式時，請揭示最能顯示發明特徵的化學式：

捌、聲明事項

☐ 本案係符合專利法第二十條第一項 ☐ 第一款但書或 ☐ 第二款但書規定之期間，其日期為：_____

☐ 本案已向下列國家（地區）申請專利，申請日期及案號資料如下：

【格式請依：申請國家（地區）；申請日期；申請案號 順序註記】

1. _____
2. _____
3. _____

☒ 主張專利法第二十四條第一項優先權：

【格式請依：受理國家（地區）；日期；案號 順序註記】

1. 美國； 2002, 02, 05； 10/068,616
2. PCT； 2002, 09, 03； PCT/US02/27988
3. 美國及依此是取
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

☐ 主張專利法第二十五條之一第一項優先權：

【格式請依：申請日；申請案號 順序註記】

1. _____
2. _____
3. _____

☐ 主張專利法第二十六條微生物：

☐ 國內微生物 【格式請依：寄存機構；日期；號碼 順序註記】

1. _____
2. _____
3. _____

☐ 國外微生物 【格式請依：寄存國名；機構；日期；號碼 順序註記】

1. _____
2. _____
3. _____

☐ 熟習該項技術者易於獲得，不須寄存。

玖、發明說明

(發明說明應敘明：發明所屬之技術領域、先前技術、內容、實施方式及圖式簡單說明)

【發明所屬之技術領域】

本發明係有關於底板，且更明確地有關於用於如路由
器與交換器之高度地相互連接的高速模組式通信系統之底
5 板配線系統。

【先前技術】

一底板通常包含一印刷電路板，具有數個卡片連接槽
或格間(bay)。每一槽或格間例如包含安裝於底板之一個以
上的模組式信號連接器或卡片邊緣連接器。一可拆卸式電
10 路板或「卡片」可被插入每一槽之連接器內。每一可拆卸
式電路板包含必要的驅動器與接收器以與其他可拆卸式電
路板上的對應之驅動器與接收器通信信號。

一層以上的傳導軌跡在該底板上(內)被形成。該等軌
跡連接在各種槽之各別信號連接點以形成資料線路與控制
15 線路。

路由器底板呈現電路板設計之一引人注意的區域(為
了方便起見，路由器與交換器在此一起被稱為「路由器」
，因為此二者之分別在此處所描述的本發明中是不重要的
)。由於其真實的性質，可組配的模組式路由器在其可拆
20 卸式的路由器卡片間需要高度的相互連接性。以任何可感
知的數片之卡片下，在每一對卡片間建立大的點對點連接
匯流排是不可行的。當下一代的大路由器會很清楚地看出
以每秒兆位元量測的產量要求時，此限制會妨礙大路由器
產量的進一步成長。由於此產量要求會需要數十(甚至數百

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)個邏輯埠以二十至一百之每秒十億位元(Gbps)的速度交換資料，其可被了解對大路由器底板之連接性與產量的要求是很極端的。

很多路由器製造商已相信電路板之限制在大路由器底板之領域已到達，現在其為下一代產品設計光學底板。光學底板避免電氣底板之某些最有問題的特徵，如軌跡密度、信號衰減、信號反射、放射雜訊、串音、與製造限制，這些特徵在單軌跡信號速度推進至多Gbps範圍下漸增地變為重要的。然而光學底板出現其自己的問題，主要為成本與複雜性。

【發明內容】

發明概要

此揭示描述一種電氣路由器底板，其克服習知技藝的大電氣底板之電氣與機械限制，並揭示其設計與製作之方法。一般而言，此底板包含以接地層分離之具有差別傳信對的多高速傳信層。較佳的是，電力分配層與/或低速傳信層被埋入靠近底板堆疊中心，介於高速傳信層之外面群組間。各種額外設計可在此總架構內被組合以已用達到10.7Gbps單軌跡對差別傳信速度、200安培電力分配及大於1.6兆位元/秒之全部底板產量測試過的底板。

在本揭示中，廣泛範圍之新底板特點與製造過程被揭示，其每一個對底板設計之整體成功有貢獻。最佳的是，這些層面被組合於單一底板內以累積每一層面的利益。

圖式簡單說明

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第1圖包含高速路由器之方塊圖；

第2圖顯示在一線路卡進入路由器及在另一線路卡離開路由器之一可能的交通路徑；

第3圖顯示依據本發明一實施例之路由器底板電路板
5 的外部配置；

第4圖顯示與第3圖相同的配置，具有相疊的內部差別配對的軌跡用於為一線路卡與一交換裝配卡 (switching fabric card) 間之連接選擇路徑；

第5圖顯示通過一路由器底板之卡片連接器區域的數
10 對高速差別信號軌跡；

第6圖顯示在被連接於一對信號變形修正之一路由器底板的傳信層上之一對高速信號軌跡，在一軌跡中具有一迴路以使軌跡長度相等；

第7圖顯示一路由器底板之一電源層的面板罩；

15 第7A圖包含第7圖之罩的放大段，顯示一隔離斷流器被用以隔離來自路由器卡片電力之機械設備電力；

第7B圖包含第7圖之罩的放大段，顯示圍繞該電力層之一防護環；

第8圖以斷面圖顯示依據本發明之混合介質實施例的
20 路由器底板之完整材料堆疊；

第9圖以斷面圖顯示依據本發明之單一介質材料實施例的路由器底板之完整材料堆疊；

第10圖顯示通過一路由器底板高速傳信層之一段落的斷面圖，說明依據本發明一實施例之軌跡/接地層/介質層

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組配；

第11圖顯示一差別信號之理想的眼圖；

第12圖顯示一差別信號之完全開啟的眼圖；

第13圖顯示一非較佳的眼圖，顯示底板在沒有第15圖
5 之裁剪後端頭(Stub)時所預期得到者；

第14圖顯示第15圖顯示之信號通孔以3.125GHz作業的
路由器底板之典型眼圖；

第15a與15b圖每一個以斷面顯示依據本發明二實施例
之路由器底板的一信號通孔與一接地孔；

10 第16-19圖顯示與第15a與15b圖之信號通孔有用的之
各種填襯與間隙組配；

第20圖用於路由器底板中之高速傳信層的面板罩；

第21圖顯示一路由器底板之部分斷面圖，說明較短的
差別對如何連接於較淺的傳信層及較長的差別對如何連接
15 於較深的傳信層；

第22a與22b圖分別顯示一個二疊層週期處理之第一個
疊層週期之放大與組裝圖；

第23圖包含第20圖之罩的放大部位，顯示在一實施例
中所使用的偷取；

20 第24圖顯示在路由器底板之數位接地層用之面板罩；

第25圖顯示二相鄰低速傳信層用之偷取；以及

第26圖顯示在低速傳信層上用之一淚滴信號填襯。

【實施方式】

較佳實施例之詳細說明

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1.定義

數個名稱已在此揭示之文意內被指定特殊的意義。如此處被使用者，高速傳信係指以大於2.5 Gbps之資料率在一對差別信號對上的信號發送。一高速傳信層或路由器差別軌跡層包含路由器差別信號軌跡對，但亦可包含低速與/或單端軌跡。介質層係在組裝電路板前被硬化且電鍍。b級介質層係在將心組配到電路板內之際被硬化。差別傳信(或平衡傳信)為一種信號傳輸模式，使用二導體，其中每一導體承載相同振幅但相反極性之信號。單端傳信(或不平衡傳信)為一種信號傳輸模式，其中一導體針對一共同接地承載一信號。一差別軌跡之阻抗若在此軌跡與其差別地成對的軌跡間之阻抗小於此軌跡與接地間之阻抗時比起單端者更有差別。

2.基本路由器組配與操作

在簡介之方式下，可採取此處所揭示之底板的好處之一種路由器組配型式將被描述。第1圖顯示一路由器20之高階方塊圖。線路卡30，40，50與60提供對該裝置之實體埠。例如線路卡30與40之每一個可被提供達到24個Gigabit乙太網路埠22至路由器20內。線路卡50提供二個10Gigabit乙太網路埠52，及線路卡60提供一OC-192 POS(Packet-Over-Sonet)埠62。雖然四片線路卡被畫出，很多底板提供多槽以容納很多很多卡片，例如在第3圖顯示之實施例中達到14片線路卡。使用者可組配裝置20以用線路卡之適當選用的數目與型式來容納不同的交通容量、交通模型與實

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體埠混合。

交換裝配70交換來自一封包之入口埠/線路卡之每一被路由的資料封包至該封包之出口埠/線路卡。交換裝配70經由二個完整的雙工通過連接(如見埠連接44, 46至線路卡40)。交換裝配70可以逐一紀元(epoch)之基準被迅速地重新組配(一紀元為一確定的時間切片)。例如, 在一紀元, 交換裝配70可由入口埠44交換封包至出口埠54及由入口埠46至出口埠66, 而在下一個紀元, 交換裝配70可由入口埠44交換至出口埠64。在任一特定紀元, 入口埠與出口埠被配對以儘可能地多運用交換埠以不致於不適當地延遲特定的封包集合。

第3圖之底板的實施例中, 交換裝配功能在9個相同的交換裝配卡間分配, 其中八個被結成一夥以平行地主動交換封包資料(第9個提供備用之冗餘)。在此組配中, 一完整的雙工交換裝配「埠」實際上包含18個差別對被連接至一線路卡—由該線路卡至每一交換裝配卡之一傳輸對與由每一交換裝配卡至線路卡之一接收對。

路徑處理模組(RPM)80駐於一RPM卡上。RPM 80具有數個工作。RPM 80負責整體系統作業。即辨識及啟動新的線路卡、辨別故障的線路卡、封包路徑發現、及與線路卡共用路徑選擇表資訊。RPM 80亦提供使用者介面(未畫出)以讓系統作業員組配系統及觀察系統參數。就每一這些功能而言, RPM 80總體地在控制匯流排90上與線路卡通信。該控制匯流排比起交換裝配可為低速的頻道。

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RPM 80之另一工作為將交換裝配70排程。在一較佳實施例中，RPM 80在每一紀元重新組配交換裝配70。

RPM 80使用排匯流排92與交換裝配70以及線路卡30，40，50，60通信，此為到來的紀元之交換裝配組配。RPM

5 80企圖在每一紀元之際儘可能多將交換裝配埠排程及確保資料被迅速且完好地被處置。該排程匯流排比起交換裝配埠可為相當低速的頻道。

RPM 80亦維持其本身的交換裝配埠連接82，讓其使用任何線路卡實體埠接收及傳輸路由器外部的封包。在第
10 3圖之底板設計中亦提供有一第二RPM卡被連接至路由器20以提供失效接管(fail over)能力。

第2圖顯示被部分封包在其橫越路由器20時所採取的解釋性資料路徑。第2圖顯示被插入一典型系統之三片卡片：一入口線路卡30、一出口線路卡50與交換裝配卡70a
15 。注意，完整功能之系統亦包含至少7片額外的交換裝配卡及至少一有作用的RPM卡，但這些在第2圖中為了清楚起見已被省略。

卡片30，50與70a被顯示使用板連接器35，55，75與插座37，57，77典型地被連接至底板100。該等板連接器
20 用壓下被配裝到其各別的卡片上，且相配的插座用壓下被配裝到底板上。然後卡片可在所欲的卡槽上用插座與連接器媒合而被連接至底板。位於每一槽之其他連接器(如連接器39)實施如供應電力至卡片之功能。

積體電路之數目及卡片上電路功能之劃分對本發明並

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非關鍵的，其有很多變化方式。在第2圖中，線路卡電路在一可能的組配中被顯示：一入口電路(31與51)用於處理在線路卡接收之封包、一出口電路(32與52)用於處理將被線路卡傳輸之封包、及序列並列轉換器(串列器/解串器33與53)用於在入口/出口電路與交換裝配卡間傳送封包。在一可能組配中所顯示之交換裝配卡電路為與序列並列轉換器73通信之交換器71以在交換器71與線路卡間傳送封包資料。

通過路由器20之一可能的資料路徑在第2圖中被顯示。一到來的封包PacketIn在線路卡30上於一埠被接收。入口電路31處理該封包、判斷適當的路由器入口埠在線路卡50上、及將該封包排在對應於線路卡50之一佇列內。在一適當的紀元中，交換器71之一資料路徑被組配(與未畫出的其他交換裝配卡上的對應之交換器一起)以由線路卡30至線路卡50交換資料。在此紀元時，序列並列轉換器33由該佇列接收該釋例性的資料、將之串列化、及傳輸此資料之一部分至每一交換裝配卡。序列並列轉換器33朝向交換裝配卡70a經由包含連接器35、插座37、底板100中之差別對34a、插座77與連接器75之實體路徑傳輸此資料之一部分。序列並列轉換器73接收此資料、將之解串列化、及傳送至交換器71。交換器71為線路卡50交換該資料至一適當的頻道，然後傳送該資料回到序列並列轉換器73。序列並列轉換器73將該資料重新串列化並在包含連接器75、插座77、底板100中之差別對56a、插座55與連接器57之實體路

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徑上傳輸該資料。序列並列轉換器73由該等交換裝配卡被接收之序列資料並傳送解序列化後之資料至出口電路52。出口電路52實施額外的封包處理，並將該封包排佇列以便傳輸至適當的出口埠作為PacketOut。

5 3.底板橫向配置

底板設計之描述被分為兩段。此第一段描述本發明之實施例有關該底板的橫向配置之層面。第二段描述本發明之實施例有關底板的斷面設計之層面。

3.1總配置

10 第3圖顯示第1與2圖描述之路由器20與底板100的詳細配置。底板100之頂端面板區具有用於16片卡片之連接器區域(「槽」)。每一外板的7槽，每一個被組配以接受一線路卡(槽LC0至LC6及LC7至LC13)。最中間的二槽每一個被組配以接受一路徑處理模組(槽RPM0與RPM1)。每一槽具
15 有三個上層連接器區(如槽LC4之JL4U0，JL4U1與JL4U2區)被用以分配電力及將信號接地至卡片。在這下面，每一線路卡槽具有三個路由器連接器區(如槽LC4之JLC4A，JLC4B與JLC4C區)。RPM槽比線路卡槽服務較多的卡片連接，且因而使用較大的路由器連接器區。在一實施例中，
20 該路由器連接器區被配置以接受可由Tyco電子公司(前身為AMP公司)購得之HS3壓下配裝式插座。

底板100之底部面板區包含用於9片卡片之連接器區或槽。這些槽每一個被組配以接受交換裝配卡(槽SF0至SF8)。每一槽具有二下層連接器區(如槽LC8之JSF8U0與

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JSF8U1區)。被用以分配電力及將信號接地至一交換裝配片。在這上面，每一交換裝配卡槽具有三個路由器連接器區(槽SF8之JSF8A，JSF8B與JSF8C區)。

該底部面板區亦包含連接器區用於連接電力及接地至
5 底板。二個48伏特之電力分配層被埋入底板100內，即“A”電力分配層及“B”電力分配層。在底板100左下方，二個大通孔區48VA與48VA RTN用於讓“A”電力之連接及回送導線至一電源，及一第三個大區CGND用於共同接地之連接。“B”電力分配層有類似的連接至存在於底板100
10 右下方的一第二個電源。

3.2信號分配

第3圖之配置的一優點在於其允許各種卡片間之路由器傳信連接的有效率之路徑選擇。RPM槽位於中央，因其需要最多連接。交換裝配卡亦位於中央，但位於線路卡與
15 RPM卡下面，為交換裝配卡架與線路/RPM卡架間之連接提供路徑選擇空間。

如下面將描述者，較佳的底板實施例運用路由器傳信層、低速傳信層與電力分配層之特定組合以提供路由器功能的必要連接。底板100之路由器連接器區使用路由器傳
20 信層來相互連接。如路由器之控制匯流排、排程匯流排與時鐘分配軌跡的連接雖然以相當低的速度作業亦可運用路由器層，但低速層較佳地為其被提供。電力分配層被用以由路由器之電源分配電力至路由器之卡片。

3.2.1差別對組配

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通過低板之路由器傳信較佳地運用差別軌跡對。本發明之一層面因而涉及在路由器傳信層內之差別軌跡對的路徑選擇配置。使用預先存在的技術達成可用的路徑選擇配置因較佳實施例的其他屬性在最有利情況下是困難的。例如，差別對的較佳節距為在16 mil間隔之8 mil軌跡及在17 mil間隔之7 mil軌跡，比慣常差別對可能使用者(如8 mil間隔之8 mil軌跡)寬很多。此較佳節距降低在特定傳信層之可達成的差別對路徑選擇密度。同時，為了限制最大的軌跡長度及將大量的卡片包裝至標準安裝機架的底盤空間內，卡片間之路徑選擇空間(與其各別的連接器區)已被限制(在與較佳的差別對節距被組合時)，組配結果僅允許約五個差別對在特定傳信層之任二相鄰的卡片間邊靠邊地被定出路徑。進而言之，為確保可製造性，路由器傳信層之數目亦被限制，如在此實施例中為10。

3.2.2 典型的路由路徑

在上面所定出的限制內，第4圖就一釋例性線路卡槽至交換裝配卡槽顯示路由器差別對路徑選擇。每一線路卡槽(與RPM槽)以類似於每一交換裝配卡槽地為高速傳信之目的連接。如第4圖顯示者，線路卡槽LC3經由四個差別對102，104，106，108連接至交換裝配卡槽SF7。這些差別對之兩個被用於由LC3至SF7之高速傳信；其餘兩個被用於相反方向之高速傳信。

在某些實施例中，連接交換裝配卡槽SF7至其他線路卡(與RPM)之一些(或全部)差別對與差別對102，104，106

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，108駐於共同高速傳信層。未顯示之對以類似於顯示之對地路徑選擇，以較靠近底板中心之線路卡槽連接至靠近其頂端之SF7，以較靠近底板端部之線路卡槽連接至靠近其底部之SF7。左邊的線路卡槽一般連接至SF7左邊的通孔，且右邊的線路卡槽一般連接至SF7右邊的通孔。一般而言，類似的路徑選擇亦存在於其他高速傳信層上(每一槽一般服務一交換裝配卡槽)，其中一例外將即刻被描述。

3.2.3通過連接器區之路徑

由於在此實施例型式中，大量的差別對(在某些情形超過60)路由至每一高速傳信層上之一交換裝配卡槽，若要維持緊密的卡片間隔與短的交換裝配卡高度，至少要有某些對必須通過其他交換裝配卡槽之連接器區。在第4圖中，對102與104每一個通過二連接器區(SF5與SF6)，對106通過三連接器區(SF4，SF5與SF6)，及對108通過四連接器區(SF3，SF4，SF5與SF6)。在最壞的情形中，一差別對可能須通過八個交換裝配連接器區。

該等連接器區稠密地殖入交替的信號與接地腳之列，再次地說是為了使空間需求最小。本發明之一層面涉及通過連接器區之差別對路徑選擇的特別方式，其大大地避免串音與信號衰減。此型式之釋例性差別對路徑選擇在第5圖之比例圖中被顯示。

第5圖為一高速傳信層之段110的上方圖，顯示在一連接器區中通孔之典型的比例間隔。此段包含多列6個傳信腳通孔(如一系列中之孔112a-f)及交替的多列3個接地腳通孔(

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如一系列中之孔114a-c)。此為AMP HS3連接器之通孔模型的典型組配。

每一通孔被電鍍，而以每一傳信通孔在底板中被使用，以電位方式地承載一高速信號。因而信號干擾之電位存在於5 在每一位置，差別對在此被路由通過一傳信通孔。該等較佳實施例藉由在與接地腳通孔(如見差別對116a，116b)相交之對齊處中為差別對路徑選擇通過連接器區使此電位干擾最小。此儘可能地將該等差別對置於遠離鄰近的傳信腳通孔，且同時在其橫過連接器區大大地維持每一軌跡對10 之所欲的阻抗特徵。

該等差別對之軌跡在材料堆疊垂直地由相鄰的接地層被測量下已大約以6至8mil之間隔選擇路徑。結果為，非常小的軌跡至接地阻抗淨效果由大約以10mil間隔通過水平地通過一接地腳通孔(被連接至這些相同的接地層)之此15 軌跡產生的結果。而且，使用僅與單端稍微更多差別的軌跡允許多對軌跡不致大大地影響傳輸地分割且與一通孔耦合。

該等較佳實施例使用一路徑選擇配置，其在接近一接地腳通孔時分割一差別對，讓一軌跡通過該孔一側，且另一軌跡通過該孔另一側。一旦通過該通孔，該等二軌跡在20 該孔的相反側之差別組配重新接合。此做法有效地允許該差別對經由連接區沿著路徑的很多地方保留一差別組配，而避免對經由連接區的傳信通孔內出現之信號的大程度之干擾。

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在較佳的組配(以差別對116a, 116b顯示)中, 差別對之中心線對準該列接地腳通孔(114a-c)之中心線。當軌跡116a與116b由左邊趨近接地腳通孔114a時, 該等軌跡轉彎並以約90度角分離(該等軌跡分別由其原來運行方向之正、負45度被路由), 直至被分離超過通孔所需的間隙為止。然後該等軌跡向後彎並彼此平行地通過連接器, 及以約90度角再重新接合, 直至到達原來的差別組配為止。軌跡116a與116b在離開該卡片前以實質相同的方式圍繞接地腳114b與114c而路由。

雖然所顯示之軌跡116a, 116b之路徑選擇為較佳的, 其他的路徑選擇為可能的。例如, 差別對124a, 124b由左方稍微偏離中心軸趨近通孔126a-c, 讓軌跡124a恰通過通孔126a下方而沒有轉彎。軌跡124b向下彎以恰通過通孔126a, 然後向外伸出。在軌跡124a通過通孔126a後, 其亦向下彎以在一差別組配中重新接合軌跡124b。在趨近接地腳通孔126b之際, 此模型因差別對向上輕推回來而被逆轉, 餘此類推。此路徑選擇之優點在於其在軌跡116a, 116b之路徑選擇的要求下僅需一半的軌跡轉彎。缺點為該等被置於多少較靠近傳信通孔的某些相鄰列, 且該等軌跡以較長的段離開其差別組配。

第5圖顯示其他有用的差別對構造。例如, 差別對118a, 118b經由區110被路由至二信號腳通孔120a, 120b。此差別對維持對齊一列接地腳通孔(122a-c)至到達信號腳通孔120a, 120b附近為止。然後該差別對朝向信號腳通

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孔120a，120b形成角度，使得該差別組配儘可能地被維持。

3.2.4 差別對路徑媒合

注意如第5圖描述及顯示者，差別對118a比差別對118b稍微長。在某些情況中，其可能在該軌跡的另一端逆轉此組配，使得軌跡長度相等。然而藉由在該差別對之一端偏置不相配來去除在該對之另一端出現的不相配並非永遠可能或較佳的。因之，第6圖顯示在此情況中使用的軌跡截斷組配。一迴路接合130被置於靠近軌跡118b之起源端，因而使名義上較短的軌跡118b之長度與名義上較長的軌跡相等。

注意如第6圖顯示者，迴路接合130之補足比軌跡118a之額外長度還多。軌跡118b之此額外長度亦就AMP HS3連接器中之路徑長度差異為連接至軌跡118a與118b之腳加以補足。僅交叉該等軌跡可能補足連接器路徑長度差異，使得被連接至連接器腳之軌跡118b的出口端具有較長的路徑長度。在所揭示的實施例中，此為非較佳的。否則，在一軌跡之上升信號邊緣與另一軌跡之下降信號邊緣將在整個底板路徑上無法對齊，造成信號失真及降低該差別對之共同模態雜訊拒絕能力。注意，要完全消除一差別對之上升與下降信號邊緣間的不對齊是極端困難的，但所描述之接合技術大大地降低此問題。

3.3 電力分配

該等較佳實施例運用嶄新的電力分配做法，其運用四片相當厚的傳導層靠近該底板中心用於分配電力至線路與

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交換裝配卡。這些傳導層比起如匯流排條棒或分離的電力分配電路板之更平常的電力分配做法提供相對地免於雜訊且經濟的電力分配做法。本實施例咸信為第一個能分配100安培以上之電流至附裝元件的底板(在較佳實施例中，
5 有兩個不同的電力分配層，每一個有分配200安培電力之能力)。

3.3.1電力區塊/位置

第3圖顯示一較佳的底板實施例之電力入口/出口點。大的電鍍區48VA，48VA RTN，48VB與48VB RTN為冗餘
10 的電源A與B提供連接點。電力由這些角落位置為沿著底板底部被配置之交換裝配電力連接器(如JSF8U0與JSF8U1)的通孔與沿著底板頂端被配置之線路與RPM卡電力連接器(如JL4U0，JL4U1與JL4U2)的通孔被扇出。此配置為較佳的，部分的原因在於其在靠近底板中心留下較多軌跡路徑
15 選擇空間以便創立較短的高速軌跡。

3.3.2免於有導孔(via)之路徑

第7圖顯示用於48VA電力分配層之面板罩，其中暗的區域代表在製作模型之際銅將被蝕刻掉的區域。在第7圖中，該面板罩已針對第3圖逆時針地被轉90度。由第7圖可
20 了解到電力分配被大的中央實質上免於有導孔之路徑(在此實施例中為板對齊腳被殖入相當少的孔)的存在而被強化。位於第7圖最左邊線路卡/RPM高速連接器與最右邊交換裝配高速連接器間之此區提供能分配數百安培電流之寬廣的路徑。

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介於相鄰卡片之高速連接器間的區域亦實質為免於有導孔的。此允許通過中央的免於有導孔之路徑的電力分配在高速連接器的相鄰列間自由地槽化以到達靠近底板頂端與底部的電力區塊。

- 5 該免於有導孔的路徑觀念之一層面為路徑選擇設計的固有特性，其避免層交換之經由。換言之，在通孔被注入該板之某一信號層的通孔之每一信號由一第二通孔被抽取至同一信號層，而沒有被連接於二信號層之中間經由，其交換該信號至不同的層。層交換做法經常在習知技藝中被
- 10 採用以解決路徑選擇問題，但在本發明之較佳實施例中特別被避免。此不僅改良電力分配，但亦避免因高速信號路徑的中間經由所致之外生反射的創立。

3.4雜訊抑制

- 如先前提及者，較佳實施例之埋入式電力分配層的一個優點為比起電力分配之慣常方法的雜訊抑制強化。此雜訊抑制的某些層面與底板的層順序有關，此將在第4節中討論。其他的層面與電力分配層之水平方式有關，特別是使用隔離斷流器與使用銅防護環。
- 15

3.4.1扇電力分配之隔離斷流器

- 20 在較佳實施例中，底板不僅分配電力至交換裝配、RPM與線路卡，亦分配至電力連接器作為用於路由器提供對流空氣冷卻之風扇盤的補充。後果為風扇馬達引發在底板電力層馬達產生的雜訊存在之可能性——此雜訊可能傳播至路由器卡上敏感電子的電力電路。為了降低此雜訊可能

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到達路由器卡的程度，「隔離斷流器」被設計至電力分配層內。

第7A圖顯示第7圖之罩的一段。通孔群組131，132用作為完整路由器風扇盤電力連接器。通孔群組131，132享
5 用至48VB電源之底板電力附掛點之相當短且無阻礙的底板路徑再回來(見第3圖)。此路徑不會為任何路由器卡通過靠近電力連接器。但電力在此實例中至少被分配至線路卡LC13(見第3圖)，且易於在不是用於出現斷流器之通過大
10 部位的通孔群組131，132內流動。斷流器133實際上提高底板電力附掛點與包括通孔群組131，132的LC13電力連接器間之電流路徑的電阻，嚴重地降低被此路徑承載的電流分配。

3.4.2電力分配層上之銅防護環

第7圖顯示底板之整個「面板」用之罩子，包括對齊
15 標記、測試結構(包括「聯票」)、與流動壩(dam)結構。在面板裝配後，底板由該面板被割下。有關此割除過程與結果形成之板組配及效能的數個課題如此段被描述地在靠近板邊緣之每一電力層所運用之特別設計提出。

該等48伏特的電力分配層被較佳地做成模型，其方式
20 為在靠近面板之板邊緣儘可能地留下銅，以減少在這些特別厚的層中有板邊緣散掉疊層之可能性。但是該等48伏特的電力分配層在實務上無法伸展至太靠近底板的邊緣，其原因至少有幾個：用於將底板分離面板所普遍使用的工具在割開銅時會迅速地磨損且具有確定的容差、該底板的邊

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緣在最終產品中將被接地、差不多有一位元之數位雜訊由該高速層投射，若電力層伸展至其各別層之邊緣，其可被耦合至所分配之電力、以及如Underwriters實驗室之產品測試實驗室定出由一板至任一電力軌跡之大的最小間隙(如一實施例中為62mil之最小值)。

這些看起來是衝突的設計關切問題在於電力分配層134上使用銅防護環134的較佳實施例中被解決。如在第7圖及在第7B圖之放大圖中顯示者，銅防護環134係圍著電力分配層的周邊被做成模型。銅防護環134趨近至所意圖之板邊緣的約15mil內。以規律間隔在銅防護環134被鑽穿然後電鍍的孔(在罩子中未畫出)允許該銅防護環134在板電鍍之際被繫至底盤面。電力層136用一壕溝135與銅防護環134被分離。

該銅防護環提供數個益處。首先，由於該銅防護環比起電力軌跡更靠近板邊緣很多，在電力分配層的板邊緣散掉疊層的問題可被減少或消除。第二、在板的邊緣電鍍前週邊某些點有不利的疊層散掉的情形中，若該邊緣電鍍短路，則會對底盤面在該防護環處有害地短路。第三、該防護環在每一電力層與在板邊緣被注入之雜訊間提供額外等級之隔離。

4.底板斷面

雖然很多優點因該等較佳實施例的圖面配置的改良所致而存在，或許甚至有更多優點存在於底板斷面的設計，即多層如何被配置以在底板的「材料堆疊」中一起工作。

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二種一般的材料堆疊在下面被描述。首先，為「混合」堆疊，在材料堆疊中運用二不同型式之介質材料。第二種堆疊型式在材料堆疊中使用單一介質材料，但該材料所使用的為高速介質，此在以前被認為不可能製作成此厚度之板。

5 4.1一般性的層配置—混合疊層設計

第8圖顯示在使用混合材料堆疊較佳底板中之材料堆疊的整個斷面。第8圖之材料堆疊具有34個傳導層L01至L34與適當的絕緣層。就每一傳導層而言，第8圖為該層以mil計之層厚度及一辨識元來標示該層。以GND標示之層為數位接地層。以HSn標示之層為高速傳信層，其中n為層的編號。以Signal xn與Signal yn標示之層為低速傳信層。二個A48V層為用於一電源之供應(dc)與回送(rtn)，及二個B48V為用於另一電源之供應與回送。就每一絕緣層而言，該層被伴隨描述說該層為心或b級層，該層是否為低速

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15 (LS)材料、及該層以mil計之最後厚度。

有關第8圖之材料堆疊的數個一般觀察將在進行更特別描述前被進行。首先，低速傳信層與電力分配層使用慣常之介質，如FR4(可由Park/Nelco之“N4000-6”產品族系線中購得)，具有可改進靠近該較厚的電力分配層之板整合性的良好重新流動與黏合特性。較薄的高速層使用具有較佳實施例之多Gbps低速速度顯著地較低損失的介質，如熱硬化烯丙塑膠(可由Park/Nelco之“N6000-21”產品族系線中購得)。該介質材料轉移點出現於數位接地層L12與L13，其被形成於FR4心上然後被黏結至N6000-21 b級材料。

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在此材料堆疊中同樣值得注意的是每一高速層(與其差別低速軌跡)以由二數位接地層及其之間以相同的間隔被形成，如高速層HS1在層L03上及在接地層L02與L04間被形成。類似地，低速傳信層L13與L14被二數位接地(L12與L15)由其餘的堆疊被隔離、低速傳信層L21與L22由二數位接地(L20與L23)被隔離、及四個電力分配層L15至L19被二數位接地(L15與L20)在該材料堆疊中心由其餘的堆疊被隔離。而且，二電源層被置於該等二電力回送層間以還提供更多層之隔離。結果為一材料堆疊能有效率地管理電磁干擾(EMI)以為高速信號提供乾淨的電力分配與良好的絕緣。

一額外的觀察為該完整的材料堆疊比起習知技藝的板為相對較厚，即約280mil包括34個傳導層。此如將於第5段被描述地需要發展新的裝配技術。

4.2一般性的層配置—單疊層材料之設計

一第二材料堆疊被顯示於第9圖中。雖然第9圖的材料堆疊在很多方面類似第8圖顯示之材料堆疊，但在數個層面中有所不同。首先，第9圖排他地使用N6000-21介質材料(有數種不同的樹脂含量)，結果為某些最中間層的不同厚度(與不同的裝配過程)及產生大約335mil之較厚的完成板。其他的差異也存在，這些將在第5段中詳細地被描述。

4.3信號分配

如上面總體描述者，高速信號沿著10個高速傳信層HS1至HS10路由。此段描述考慮高速傳信之底板材料堆疊。

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4.3.1 高速差別對斷面

第10圖顯示一段典型高速層140之斷面。此段橫斷式切割通過一差別對142a，142b與二相鄰的數位接地層144a與144b。二層50.6%樹脂含量331.3 N6000-21心材料以大
5 約7.0至7.5mil將對142a，142b底部與較底接地層144b隔開。二層硬化後(經組裝)之50.6%樹脂含量331.3 N6000-21心材料以大約6.0至6.9mil將對142a，142b頂端與較低接地層144a隔開。該介質材料之晶體通過底板由左至右被對齊。

數稱軌跡幾何已在底板實施例中被使用。在一實施例
10 所使用的混合材料堆疊中，第10圖之軌跡142a與142b每一個在底部為8mil寬、頂端為7.6mil寬、及1.4mil高(即由一盎司銅做成)。該等軌跡以16mil之水平距離(以在其底部測量)被隔開。在此組配中，每一導體之單端(偶數)阻抗約為45.7歐姆，而每一導體之差別(奇數)阻抗約為44.6歐姆。
15 此差別對組配因而邊際地比單端者較有差別。

在使用僅有N6000-21的材料堆疊之實施例中，第10圖之軌跡142a與142b每一個在底部為7mil寬、頂端為6.6mil寬、及1.4mil高。該等軌跡以17mil之水平距離(以在其底部測量)被隔開。在此組配中，每一導體之單端(偶數)阻抗
20 約為48.2歐姆，而每一導體之差別(奇數)阻抗約為47.3歐姆。此差組配之一吸引人的特點在於就N6000-21材料而言，48歐姆之天生的材料阻抗非常接近且介於偶數與奇數阻抗值間。

如下面將被描述者，該差別對阻抗特徵已小心地與通

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孔阻抗特徵小心地被媒合以大大地保留通過底板之高速差別信號的眼圖模型。

4.3.2 用於等化之非功能性填襯與通孔組配

在較佳的底板中，底板運用重大數量之傳導層以傳送大量的信號與供應電力至電路板。此大量的層造成材料堆疊與對應的通孔長度約為300mil之結果。在使用01位元模型且為3.125Gbps的高速傳信位元率下，在差別對上之連續傳信「眼」間的中心一對一中心時間將為320ps。在每微微秒6.29mil的傳播速度下，沿著一差別運行之連續傳信「眼」間的中心一對一中心的隔離僅約為2000mil，或大約為通孔長度來回的三倍。具有01模型之真實的眼睛打開可能短了很多——在某些情形為120ps，對應於沿著該對約750mil之距離。因而當通孔電氣式地被考量它是什麼——在傳輸線路上之端頭——其可被了解在較佳的3.125Gbps與更高速度的傳信，通孔反射會以此長度之通孔出現嚴重問題。

此處，其被了解操縱底板通孔與差別對之單端阻抗以允許底板之較高頻率的作業是可能的。媒合通孔與差別對之反應的效應可藉由檢查第11-14圖顯示之眼圖而被了解。

第11圖顯示可理論地著手於一底板之一系列信號轉移的理想眼圖。眼圖之「眼」為暫時相鄰的信號轉移間的開口。差別接收器需要最小的眼「打開」以偵測信號轉移，即在正壓方向前進的軌跡電壓必須以至少某些門檻電壓 ΔV_{th} 就至少某些最小時間量 ΔT_{min} 超過在負壓方向前進的軌跡電壓。全第11圖中，眼打開的期間被顯示為 ΔT_1 。若 ΔT_1

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超過 $\Delta T_{\min}$ ，一接收器應該能分辨該信號轉移。

第12圖顯示就通過一差別對之相當低速的傳信被期待之所接收的眼圖型式。雖然高頻衰減另人注意地影響眼型，此眼仍是完全開啟的，即在每一軌跡被感應的電壓就所有實務目的到達信號轉移間之長期穩定狀態值。第12圖之眼開啟為時間上稍微平移，但其期間 ΔT_2 不會比理想眼開啟之期間短太多。

第13圖顯示就通過因在通孔之反射所致的在每一端具有不想要的端頭(長度類似於所描述之實施例者)之差別對的相當高速傳信被期待之所接收的眼圖型式。高速傳信抑制該眼圖偵測器，因為眼睛在連續的信號轉移間無法完全打開。為調合此問題，在軌跡之每一端的未媒合的端頭(其會偶然彼此媒合)可對差別對反射—交替地在構造上及在破壞上添加至信號轉移之反射。在某些情形中，類似於第13圖顯示之反應已被觀察，此處眼睛因端頭反射開始打開然後開始關閉。在某些情形，此可能致使該接收器偵測二個眼打開，此處只有一個應存在，或者一個也沒有偵測到。

第14圖顯示依據本發明一實施例就通過具有媒合的端頭之差別對的高速傳信被期待之所接收的眼圖型式。利用控制反射如何在通孔發生，可偵測的眼打開反應可被設計而不致有第13圖顯示之下降。

所以，在依據本發明一實施例對設計底板的較佳做法中，通孔與軌跡之轉換函數一起被考慮以補償在通孔端頭

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之信號反射。考慮在一對通孔進入之傳輸信號 $T_x[t]$ 通過一差別對，及在另一端由一對通孔出來，對應的被接收之信號 $R_x[t]$ 可由合成函數被描述。

$$R_x[t] = T_x[t] * H_i[t] * L[t] * H_o[t],$$

- 5 此處 $H_i[t]$ 為信號被發出進入之通孔的轉換函數， $L[t]$ 為差別對之轉換函數，及 $H_o[t]$ 為信號被發出進入之通孔的轉換函數。這些轉換函數可考慮反射、衰減、模式群組分離、與其他已知的效應以就特定的底板組配預測眼圖。

- 該較佳實施例運用對端頭阻抗控制之嶄新做法，其中
10 每一通孔之阻抗特徵藉由調整此通孔與該數位接地與/或該通孔通過之電力分配層間的單端耦合而被裁剪。參照第15a圖，一傳信通孔170與數位接地通孔180以斷面被顯示。在此實施例中，通孔170與180具有28至30mil及最小有1mil電鍍之鑽孔。傳信通孔170通過每一接地與電力層之
15 孔，且因而電容式地被耦合至每一層。此電容耦合使用某些層上之非功能性填襯(死填襯)以沿著通孔在所選取的位位置放入被添加的電容。

- 雖然其他的死填襯可在本發明的實施例中被使用。所揭示的填襯組配根據數個準則被選用。第一，任何被添加
20 的死填襯被給予最小的直徑，其可能在沒有鑽入位元漏失填襯之一側的高機率地在鑽入之際被撞擊。此允許填襯與其間隙維持在合理的尺寸，並允許較多填襯被添加。第二，填襯以大約每25%之板被分佈，以減輕板應力並均勻的間隔分配電容。第三，在混合的板設計中，每一電力分配

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層接收一死填襯，原因在於這些層很厚且靠近板之中心(單一材料實施例之不同的裝配方法與較長的孔身長度的允許電力層死填襯被取出)。第四，由於這些填襯較厚，電力分配層上的間隙被提高，且因而具有較大的面積用於形成一電容器。

在第15a圖顯示之材料堆疊下，沒有死填襯之習知技藝的傳信通孔具有約1.2至1.4Pf之電容。如所顯示的傳信通孔具有約1.6至2.0Pf之電容。當與第10圖顯示之不同的軌跡幾何相符時，具有添加電容(與小量的添加電導)之此傳信通孔可實質地消除如第13圖之眼圖顯示的高速傳信下降。

傳信通孔170被設計以具有以底板之接地與電力分配層的特定電容耦合特徵。在大多數接地層上，如層L02與L04者，通孔170通過一個52mil直徑間隙(見第16圖之在通孔170的層L02之切除上方圖)。在層L08，L15，L20與L27之接地層上，通孔170通過在54mil直徑間隙(見第17圖之在通孔170的層L08之切除上方圖，顯示填襯172)中心之一個34mil直徑的填襯172(L08)。在層L16，L17，L18與L19之厚電力分配層中，通孔170通過在70mil直徑間隙(見第18圖之在通孔170的層L16之切除上方圖，顯示填襯174)中心之一個34mil直徑的填襯170。注意，在電力分配層上，很多相鄰的通孔(如170與182，184與186)之間隙會合併，原因為孔間的距離小於特定間隙的兩倍。第19圖顯示高速層HS5(層L11)之切除圖，顯示在此層被連接至軌跡176之功

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能性填襯178。

第15b圖類似於第15a圖，但顯示單介質材料實施例之斷面。最引人注意的是，無死填襯在電力分配層上被使用，且信號通孔171通過這些層上之一個52mil的間隙。

5 4.3.3 每一交換裝配卡上一層

較佳底板設計的一個目標是要設計具有已知且可控制的阻抗之差別信號路徑。就此而言，高速傳信差別對每一個被設計而以無層交換導孔地在一單一層上之其卡片連接器間運轉。為了允許無層交換之有效率的路徑選擇解法，
10 九個高速層之每一個對在單一交換裝配卡來回傳信為專用的。例如，第20圖顯示層L07(高速傳信層HS3)用之面板罩，其連接交換裝配卡SF1(第3圖)至每一線路卡。其可被了解，結果所得的配置允許非常直接又短的差別對路徑選擇。第十高速層如下面解釋地被用以短達傳信至數片交換裝
15 配卡。

4.3.4 用於信號路徑選擇之高速層的選擇

不僅差別對已就有效率的路徑選擇被配置，而且將被每一交換裝配卡使用之高速層的選擇亦改良績效。一般而言，下層的高速層已被設計以承載真正最長的高速軌跡，
20 且最長的軌跡已在上層的高速軌跡上被避免。

參照第21圖，底板150之簡化斷面圖被顯示。斷面圖150顯示一第一軌跡154與一第二軌跡160。第一軌跡154位於下層高速層，且被連接至二通孔152與156。第二軌跡160位於下層高速層，且被連接至二通孔158與162。發出

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進入通孔152之信號向下運行至軌跡154，但向下運行至通孔152的其餘部分，其形成一端頭164以另一方向將該信號反射回來。類似地發出進入通孔158之信號向下運行至軌跡160，但向下運行至通孔158的其餘部分，其形成一長了
5 很多之端頭166以另一方向將該信號反射回來。類似的反射在軌跡154與160之出口端發生。

較長的端頭166比較短的端頭164產生多很多的有問題之反射。在較佳實施例中此傾向被補償之一方法係為上層高速層上之較短的軌跡路徑選擇(此處之反射更顯著，但
10 信號因長的傳播路徑而不致品質惡化)，及為上層高速層上之較長的軌跡路徑選擇(此處之反射較不顯著，且為較長的路徑，更多的衰減可被容忍)。

關於藉由專致於高速層至交換裝配卡分割軌跡之目標，該等較佳實施例使用至少二技術以選擇路徑選擇層。第一，最上面的層(具有最長的端頭)為非單一交換裝配卡所
15 專用，原因此會需要某些更長的軌跡以到達板外的線路卡。代之的是，HS1服務一群組相當短的連接，因為這些線路卡實質地與對應的交換裝配卡垂直對齊。某些連接符合此準則，因而就HS1被選擇，此為：至交換裝配卡SF8之
20 線路卡LC11，LC12與LC13、至交換裝配卡SF7之線路卡LC9與LC10、及至交換裝配SF6之線路卡LC7與LC8。

降低上面層之軌跡長度之一第二技術為選擇線路卡連接器腳，其方式為該上面層有較佳短長度的結果。例如見相關的第3與20圖，其可了解連接SF1至線路卡的軌跡不使

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用上面一組連接器區塊(JLC4A與在另外卡片上的其相對者)，而是使用JLC4C之下方腳與JLC4B之腳，及其相對者。此以數吋減少層HS2，HS3與HS4上最大的軌跡長度。從層HS5開始，JLC4A中之腳與其相對者自底部開始被使用。

- 5 第4圖顯示HS9之典型腳出處。因而，雖然所有的高速層包含某些短軌跡，具有真正最長軌跡者為經由端頭而具有最短者，嚴格地由軌跡長度的立足點來看，此是與直覺相反的，原因在於插入該最長的水平軌跡信號至最底部的高速層及由此抽取比起在最上面的層之對應比較路徑甚至會增加更多長度(在所描述的實施例中幾乎為2/3英吋)至這些信號路徑。
- 10

4.3.5 低速信號分配

- 某些底板低速不以高的交換速度作業。該等較佳的實施例指定數層用於這類信號。典型而言，這些信號為合用匯流排(party bus)、時鐘分配等所用之單端信號。在第8圖中，層L13(信號x1)、L14(信號y1)、L21(信號y2)與L22(信號x2)被用於低速傳信。注意，L13與L14以L21與L22未顯示接地層被插入於其間。然而，這些低速傳信層對用一數位接地層與相鄰的高速層隔離。這些低速傳信層對亦用一數位接地層與電力分配層對隔離。進一步由電力分配層推進高速傳信及以伴隨的較高層之EMI送回接地雜訊之此配置作用來進一步由EMI隔離電力分配。
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- 20

4.4 電力分配與雜訊隔離

本項之數個層面雖然在先前已被討論，該等較佳實施

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例使用層堆疊，此以優異的雜訊隔離允許經濟的電力分配。層之較佳實施例及材料選擇允許顯著數量的雜訊隔離之電力(在某些實施例中就每一電源被額定於200安培)在一共同板內被分配，此亦服務該路由器之高速與低速傳信之需求。

4.4.1被埋入之電力層的配置

該較佳材料堆疊之特殊設計比先前設計具有數個優點。如剛所討論者，被埋入且與接地層隔離之電力供應層L16-19為路由器提供相當免於雜訊之電力分配系統。假若電力用如匯流排棒之慣常設施分配，每一卡片大略需有兩倍多之電力調節與過濾以達成類似的雜訊特徵。藉由將該等電力供應層置於埋入二隔離的接地層L15與L20間及維持電源連接與傳信連接有相當的隔離，第8與9圖顯示之設計避免對耗成本之電力分配元件的需求。

然而，將電力供應層置於這麼厚的材料堆疊會造成其他的困難。為維持低電阻，該等電力供應層必須相當厚，如三或四盎斯之銅。高速層用之較佳介質材料不會好好地填補相當厚的軌跡間之間隙，且因而在此被適應於在使用特殊處理的某些實施例中之使用。而且，該等較佳的高速介質材料一般是不適用於此種厚材料堆疊，因集中在通孔位置之應力易於在鑽出通孔之際致使分裂與破碎。二種較佳的做法已被發展用於處理此問題而又允許在高速傳信層上N6000或類似材料之使用。

4.4.2混合疊層設計

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在第8圖顯示之做法中，對L12與L23間所有層之使用低速FR4材料允許具有埋入式電力分配層之厚材料堆疊不會創立孔洞地被裝配。在一較佳實施例中，二片具有57.5%樹脂內含之1080 N4000-6玻璃板就電力分配層於每一低速傳信層上被使用，及具有較高樹脂內含(63.5%)之1080 N4000-6板被使用以加強間隙充填。二片心板在每一電力分配供應與回送層對間被使用。三片b級板在每一電力分配回送層與相鄰的數位接地層間被使用。以及四片b級板在相鄰的供應層間被使用。在此實施例中，N6000與FR4間之介面於接地層(L12與L23)發生，使得銅大大地分離該等二介質材料且良好的黏結被達成。

在層L15至L20上被使用之經由一電容一裁剪填襯被作用成一第二目的；即其有助於該板之可製造性。在高速連接器導孔之應力，以及在裝訂之際必須被充填之孔洞的尺寸利用在電力分配層與相鄰數位接地層上死填襯之使用而被學習。

此材料堆疊對雜訊排斥具有額外的優點。注意，由於FR4比N6000在高頻信號具有較高損失，靠近電力分配層之FR4的使用提供在電力供應與低速傳信層間之高頻雜訊排斥的額外措施。

4.4.3純粹的N6000疊層設計

一第二裝配做法可產生如第9圖顯示之材料堆疊。此材料堆疊為高速、低速與電力分配較佳地專門使用N6000-21材料。其樹脂含量在靠近板之中心被修改以如下列地加

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強孔洞充填：二片3313，50.6%樹脂含量之N6000-21玻璃板形成除了L16與L17間及L18與L19間係使用二片1080，60.3%樹脂含量之N6000-21玻璃板外之心的板中所有的心。在被設計來充填被做成模型之四盞斯銅層中深的孔洞之一第一裝訂中，每一個二片做成模型之電力心在二片3313，53.4%樹脂含量之b級板與一片1080，65%樹脂含量之N6000-21玻璃板間於每一側被夾於其間。額外的四片1080，60.3%樹脂含量之b級材料在最後裝訂前被置於層L17與L18間，而以三片此種層被置於L15與L16及L19與L20間。二片1080，60.3%樹脂含量之b級板亦被置於L13與L14、L21與L22、及L33與L34間。類似於混合式設計，用於高速層之b級材料包含二片3313，50.6%樹脂含量之N6000-21玻璃板。

純粹N6000設計比起混合式設計之優點在於其解決可能在混合式設計中存在之任何介質相容性課題。

5.高速HIGH LAYER COUNT底板之裝配

組裝一底板之各層的較佳方法現在將被描述。單材料之多疊層週期裝配之處理首先將整體被描述。然後單疊層週期之混合材料裝配之與第一種處理不同的處將被描述。

20 5.1單材料/多疊層週期設計

製作底板之一較佳方法實施例全部使用單一高速介質材料。此改良此設計之可製造性，多疊層週期被使用以完成一面板。

5.1.1心組成

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在組裝底板前，底板製作之第一步驟為組合電鍍且做成模型後之心板。就高速層而言，較佳的心板由二片3313，50.6%樹脂含量之板組成，其在製造商所推薦的疊層條件下被疊層在一起以使之硬化。一旦被黏結及硬化後，此二板形成約7.5mil厚之心介質層，而有0.1mil程度之尖峰粗度特點。雖然由模式群組分離觀點，此粗度不一定是所要的，而對平滑導體表面之欲求可被N6000與銅間良好接合之需求被較佳地平衡。

此心在兩側用一盞斯銅被電鍍。一側上之銅使用蝕刻補償處理被做成模型以產生所欲的高速差別對層之一；另一側之銅使用類似的處理被做成模型以產生相鄰的接地層。在一較佳實施例中，十個差別地做成模型之鍍銅的心形成十片高速層，其將在最後成品中被組裝，且另外四個差別地做成模型形成十片低速層，其將在最後成品中被組裝。

在做成模型後，成為模型之心藉由氧處理過程被處理，其使鍍銅的外表面被粗化以及將之清潔以在疊層週期之際強化銅對b級之黏合。較佳的是，此處理之參數被控制以產生類似於在電鍍對心介質邊界被找到的銅表面粗度。調整頂端表面與底部表面軌跡粗度為大約相等或信會防止額外的模式群組分離，因為沿著軌跡頂端與底部運行的電流將因表面粗糙引發類似的延遲。

該等二個電力心以多少類似的方式被準備。二片1080，60.3%樹脂含量之N6000-21材料在製造商所推薦的疊層條件下被疊層在一起以使之硬化。一旦被黏結及硬化後，

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此二板形成約6mil厚之心介質層，而有0.5mil程度之尖峰粗度特點。由於電力層不通過高頻率，較大的粗度為較佳的以提高金屬對介質之黏合。

5 每一電力心以四盎斯銅在兩側被電鍍。一側之銅使用蝕刻補償處理被做成模型以產生所欲的DC電源層之一；另一側的銅使用類似處理被做成模型以產生對應的DC回送層。在較佳實施例中，二差別地做成模型之鍍銅的心形成底板所使用的二組電力層。

10 在做成模型後，成為模型之心藉由氧處理過程被處理，其使鍍銅的外表面被粗化以及將之清潔以在疊層週期之際強化銅對b級之黏合。較佳的是，此處理之參數被控制以產生類似於在電鍍對心介質邊界被找到的銅表面粗度。即對電力層為0.4至0.5mil。

5.1.2 第一疊層週期

15 在較佳雙疊層週期實施例中，一第一疊層週期黏結二片3313，53.4%樹脂含量與一片1080，65%樹脂含量N6000-21材料至二電力心(分別為層L16/L17與L18/L19)之每一側。此以高樹脂含量玻璃之分離配置追蹤確保四盎斯做成模型之電力層中之特點被玻璃充填且免於有孔洞。此
20 第一疊層週期在製造商所推薦的疊層條件下被實施。

該1080材料被置於次總成之外面層上。該3313材料富有樹脂並自由地放出此樹脂以被壓到被蝕刻之銅的區域。不幸的是，此在會在疊層以黏結該玻璃至心之際以壓力不足地在次總成表面留下區域。該1080材料填入而避免這些

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低壓力之面積並為最終疊層週期之準備產生平滑、完整疊層之板。

5.1.3 提供對齊

5 面板罩慣常地包含對齊標記(見第7與20圖中之標記202, 204)。這些標記被登錄在每一層, 使得當材料堆疊於裝訂前被建立前, 該等層可藉由對齊該等標記而被共同對齊。

該雙疊層週期針對對齊呈現問題。一旦如L16之傳導層在第一疊層週期之際已被疊層於玻璃, 該等對齊標記為
10 不清楚的, 而無法以所欲的精度在第二疊層週期中被用以對齊該等層。

在較佳實施例中, 在第一疊層週期前對玻璃板刻痕可解決此問題。如第22a圖顯示者, 電力心210具有對齊標記202與204。六片玻璃板220, 221, 224, 225(3313材料)與
15 222, 226(1080材料)被切割為適當尺寸, 然後在玻璃板將與對齊標記重疊的位置被加刻痕。在第一疊層週期後, 玻璃板220, 222, 224與226被黏結至電力心210, 但不會使中間總成230之對齊標記202與204(見第22b圖)模糊不清。結果為, 第二疊層週期可依賴對齊標記202與204來與其他
20 的心適當地對齊該中間總成。

其被了解在最後面板總成中, 非常不良之填充抑或無填充可在刻痕206, 208之位置被觀察。該等對齊標記被置於非關鍵位置, 遠離該板本身或任何聯票, 使得靠近對齊標記之疊層散掉沒有什麼重要。

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5.1.4 第二疊層週期

底板面板利用來自第一疊層週期之具有電力心總成的不同之高速與低速層以第9圖顯示順序堆疊及對齊以銅做成模型的心而被形成。如第9圖中顯示者，在高速層相鄰處，一高速層之接地層面對相鄰高速層之高速軌跡，而以二片3313，50.6%樹脂含量之N6000-21的b級玻璃板被插入。相鄰的低速層以二片被插入之b級板被堆疊，但其材料具有60.3%樹脂含量。在接地層L15與被疊層為電力回送層L16之中間玻璃層間，三片1080，60.3%樹脂含量之N6000-21的b級玻璃板被插入。相同的配置被插入層L19與L20間。四片這種玻璃板被插入二個中間電力心總成(介於層L17與L18間)之間。

一旦以銅做成模型之心與b級板被堆疊及對齊，該材料堆疊被置於裝訂壓器。整個堆疊在製造商所推薦的疊層條件下被裝訂。

在材料堆疊冷卻後，通孔在底板被鑽入，且整個總成以一盞斯銅被電鍍。然後填襯被做成模型，且保護罩被添加以完成該板。然後連接器以壓迫裝配至該板之適當位置以完成底板總成。

20 5.1.5 鑽孔週期

由於材料堆疊之厚度與多個金屬填襯在導孔之製作時被鑽穿，該鑽孔錐可能變熱。此提高玻璃變得夠熱以讓鑽孔錐「旋轉」死填襯或傳導填襯之機率。旋轉填襯係指填襯在鑽孔壓力下由玻璃散掉疊層或被撕掉而毀損該板並可

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能將之破壞。

為避免旋轉填襯，該較佳的鑽孔週期與該板本身已被設計以保持鑽孔錐冷卻。該鑽孔被規劃程式以對每一關鍵的導孔實施「多啄孔」之鑽孔週期。該鑽孔錐之第一次啄孔將板穿透至介於層L17與L18之大約中間處，即板的中間。由於介於層L17與L18間之厚度約為24mil，在設定此啄孔的深度有相當的誤差餘地。然而，該第一次啄孔不是恰在傳導層結束處是重要的，因此可能致使鑽孔錐為了第二次啄孔被插入時會傷及銅填襯。

在第一次啄孔後，該鑽孔錐由該部分導孔簡短地被抽出，讓熱由鑽孔錐與部分導孔消散。然後鑽孔錐在同一位置實施第二次啄孔，此次穿透至板的底部。

若每塊板或每批板之板厚度差異太顯著，為該第一次啄孔之預設深度規劃鑽孔可能還不夠。在此情形中，該面板的不需用到的部位可被分段及測量以就每塊板或每批板各別地調整鑽孔深度。

5.1.6 偷取

每一高速與低速層實際需要用來形成傳信軌跡之鍍銅很少(見第20圖)。另一方面，每一這些層與接地層共用心(見第27圖)，其使用原本鍍在心上大量之銅。由於銅覆蓋之此不均勻，其已被發現做成模型後之心易於捲曲而很難使用。而且，其已發現在裝訂處理之際，高速與低速軌跡易於朝向板的邊緣稍微移入，形成最終面板之不對齊的結果。偷取亦有助於維持整片板之一致的介質厚度，此提供

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較佳阻抗均勻性之優點。

為對抗此問題，該較佳實施例在傳信層罩子中使用「偷取」。在目前的揭示中，偷取包含一模型(如第20圖中之模型240)，在該板之免於軌跡與免於導孔的區域具有未連接銅之高坪。由於該等較佳實施例避免層交換之導孔，該板之非連接器區域一般為免於導孔的且適於偷取之做法。第23圖顯示來自第20圖之面板200的一放大段落以較佳地顯示偷取之做法。高速層上之偷取模型240以柵格模型被佈置。每一「點」為一50mil直徑之銅高坪。這些點以柵格模型之中心對中心75mil相隔。在該高速層上，一150mil之間隔在偷取模型與最近的軌跡或導孔間被維持。在該低速層上，一100mil之間隔在偷取模型與最近的軌跡或導孔間被維持，此為在同一層或相鄰的低速層上均可。同時，就相鄰的低速層(L13/L14對與L21/L22對)而言，其偷取模型如第25圖顯示之「星點」型態般地被相互交插。

5.1.7 流壩

在每一層上，板區外之面板被設計有流壩250(見第20圖)。該流壩阻擋樹脂在裝訂之際流到面板外面，而迫使樹脂儘可能地填充板模型內之孔洞。但流壩未完全停止樹脂之流動—受控制的流儘可能地維持該樹脂而不至於在該板外層邊緣將由該面板被路由之位置創造壓力。此步驟咸信會降低板外層邊緣在路徑選擇之際散掉疊層之機會。

5.2 混合疊層設計

在混合疊層設計中高速層之較佳的心組成與在雙疊層

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週期設計的心組成相同。然而，低速心與電力心是不同的。每一低速或電力心係由1080 57.5%(低速)或63.5%(電力)樹脂含量之N4000-6做成。電力心由二片玻璃板做成，及低速心由二片玻璃板做成。

5 其已被發現雙疊層週期可用N4000-6避免，原因在於材料流動與再流動比N6000-21容易很多。因而，一旦該等心已如就雙疊層週期設計所描述地被弄得粗糙，所有的心被堆疊以便裝釘。用於高速心之b級板與就疊層週期設計所描述的板相同。二片57.5%1080 N4000-6之玻璃板被置
10 於相鄰的低速心間。三片63.5%1080 N4000-6之玻璃板被置於相鄰的低速與電力心間。及四片63.5%1080 N4000-6被置於二電力心間。

5.2.1 疊層週期

單一疊層週期被使用以裝釘混合式面板。疊層條件如
15 製造商所推薦地被使用。

5.2.2 淚滴形填襯構造

類似雙疊層週期設計者，應事先注意混合式設計以大大地降低旋轉填襯之可能性。FR4因鑽孔之熱而咸信比N6000更容易重新流動，且此增加旋轉填襯在材料堆疊之
20 FR4部位的傾向。類似雙疊層週期設計者，多啄孔之鑽孔週期被使用。但除此之外，低速層中之信號填襯被形成淚滴形填襯，即每一低速填襯以一「半填襯」被增大以取代第一填襯而形成淚滴形填襯。該淚滴被導向連接於該填襯之軌跡。第24圖顯示一淚滴形填襯240之構造。

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淚滴形或加大尺寸之填襯有時在低成本之板中使用以補償不良的鑽孔容差。但本發明人相信此為在不需要淚滴形填襯來補償不良的鑽孔處理的此種填襯之首要使用，其中在鑽孔之際該容差允許該導孔朝向淚滴之端部偏置。此

5 較強壯的填襯在鑽孔之際抵抗旋轉方面就是好的很。

5.2.3鑽孔週期

使用三次分離的啄孔之一種多啄取鑽孔週期對混合式設計是較佳的。三次的啄孔允許鑽孔機在進入板之FR4部位前冷卻一次及在離開入板之FR4部位後冷卻一次。

10 該第一次啄孔之較佳結束點為在介質層中介於HS4(層L09)與在層L10之下的數位接地層間(見第8圖)。此結束點被選擇以確保在層L09之任何填襯已經被鑽穿，且因而不會在第二次啄孔時被旋轉。同時，當該鑽孔機就第二次啄孔被插入時，其將在L10遭遇固態銅或空的導孔空間，

15 但不是填襯。

類似的考慮導向之較佳結束點為在介質層中介於信號號x2(層L22)與在層L23之下的數位接地層間。

一般熟習本技藝者將了解此處被教習的觀念可以很多其他有利方法被修改為特定的應用。雖然特定的高速與低

20 速介質材料在較佳實施例中被使用，為較厚、被埋入的電力分配層使用不同介質材料或不同樹脂含量之原理可被適應於其他材料與材料堆疊。該材料堆疊不需如較佳實施例顯示地對其中心對稱。作為另一例子下，為差別對藉由將之圍繞通孔分割而選擇路徑通過接地通孔之原理可適應於

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非AMP HS3連接器幾何所使用之連接器模型。雖然一底板實施例已被揭示，此處被教習之觀念相等地應用於如中間層之相互連接配置。以及在其他設計中，分派信號層至各別交換裝配卡之觀念可被逆轉，而分派信號層至各別線路卡。

雖然本說明書在數處稱到「一個」、「某一」、「另一」或「一些」，此並不一定意謂此說法被用到相同的實施例，或者該特點只應用於單一實施例。

【圖式簡單說明】

10 第1圖包含高速路由器之方塊圖；

第2圖顯示在一線路卡進入路由器及在另一線路卡離開路由器之一可能的交通路徑；

第3圖顯示依據本發明一實施例之路由器底板電路板的外部配置；

15 第4圖顯示與第3圖相同的配置，具有相疊的內部差別配對的軌跡用於為一線路卡與一交換裝配卡(switching fabric card)間之連接選擇路徑；

第5圖顯示通過一路由器底板之卡片連接器區域的數對高速差別信號軌跡；

20 第6圖顯示在被連接於一對信號變形修正之一路由器底板的傳信層上之一對高速信號軌跡，在一軌跡中具有一迴路以使軌跡長度相等；

第7圖顯示一路由器底板之一電源層的面板罩；

第7A圖包含第7圖之罩的放大段，顯示一隔離斷流器

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被用以隔離來自路由器卡片電力之機械設備電力；

第7B圖包含第7圖之罩的放大段，顯示圍繞該電力層之一防護環；

第8圖以斷面圖顯示依據本發明之混合介質實施例的
5 路由器底板之完整材料堆疊；

第9圖以斷面圖顯示依據本發明之單一介質材料實施例的路由器底板之完整材料堆疊；

第10圖顯示通過一路由器底板高速傳信層之一段落的斷面圖，說明依據本發明一實施例之軌跡/接地層/介質層
10 組配；

第11圖顯示一差別信號之理想的眼圖；

第12圖顯示一差別信號之完全開啟的眼圖；

第13圖顯示一非較佳的眼圖，顯示底板在沒有第15圖之裁剪後端頭(Stub)時所預期得到者；

15 第14圖顯示第15圖顯示之信號通孔以3.125GHz作業的路由器底板之典型眼圖；

第15a與15b圖每一個以斷面顯示依據本發明二實施例之路由器底板之一信號通孔與一接地孔；

第16-19圖顯示與第15a與15b圖之信號通孔有用的之
20 各種填襯與間隙組配；

第20圖用於路由器底板中之高速傳信層的面板罩；

第21圖顯示一路由器底板之部分斷面圖，說明較短的差別對如何連接於較淺的傳信層及較長的差別對如何連接於較深的傳信層；

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第22a與22b圖分別顯示一個二疊層週期處理之第一個疊層週期之放大與組裝圖；

第23圖包含第20圖之罩的放大部位，顯示在一實施例中所使用的偷取；

5 第24圖顯示在路由器底板之數位接地層用之面板罩；

第25圖顯示二相鄰低速傳信層用之偷取；以及

第26圖顯示在低速傳信層上用之一淚滴信號填襯。

【圖式之主要元件代表符號表】

20…路由器	51…入口電路
22…Gigabit乙太網路埠	52…10 Gigabit乙太網路埠，出口電路
30…線路卡	53…序列並列轉換器
31…電路	54…埠
32…出口電路	55…連接器
33…序列並列轉換器	56…埠
34…埠	56a…差別對
34a…差別對	57…插座
35…連接器	60…線路卡
36…埠	62…OC-192POS埠
37…插座	64…出口埠
39…連接器	66…出口埠
40…線路卡	70…交換裝配
44…埠連接，入口埠	70a…交換裝配卡
46…埠連接，出口埠	71…交換器
50…線路卡	

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73…序列並列轉換器	116b…差別對
75…連接器	118a…差別對
77…插座	118b…差別對
80…路徑處理模組(RPM)	120a…信號腳通孔
82…埠連接	120b…信號腳通孔
84…埠連接	122a…每一腳通孔
90…控制匯流排	122b…每一腳通孔
92…排程匯流排	122c…每一腳通孔
100…底板	124a…差別對
102…差別對	124b…差別對
104…差別對	126a…通孔
106…差別對	126b…通孔
108…差別對	126c…通孔
110…段	130…迴路結合
112a…孔	131…通孔群組
112b…孔	132…通孔群組
112c…孔	133…斷流器
112d…孔	134…銅防護環
112e…孔	135…壕溝
112f…孔	136…電力層
114a…孔	140…高速層
114b…孔	142a…差別對
114c…孔	142b…差別對
116a…差別對	144a…接地層

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144b…接地層	181…通孔
146a…心材料	182…通孔
146b…心材料	184…通孔
148a…b級材料	186…通孔
148b…b級材料	200…面板
150…底板	202…標記
152…通孔	204…標記
154…軌跡	206…凹痕
156…通孔	208…凹痕
158…通孔	210…電力心
160…軌跡	220…序列並列轉換器
162…通孔	221…序列並列轉換器
164…端頭	222…序列並列轉換器序
166…端頭	224…列並列轉換器
170…傳信通孔	225…序列並列轉換器
171…信號通孔	226…序列並列轉換器
172…填襯	230…中間總成
174…填襯	240…模型
176…填襯	250…流壩
178…填襯	260…淚滴形填襯
180…數位接地通孔	

拾、申請專利範圍

1. 一種電氣路由器底板，包含：

第一種數個卡槽，每一個能與一封包輸入/輸出卡片之底板電氣連接器集偶配，以該封包輸入/輸出耦合來自該封包輸入/輸出之電氣信號至在該底板之對應的傳信通孔集；

第二種數個卡槽，包含至少三個卡槽，每一個能與一交換裝配卡之電氣連接器集偶配，以耦合來自該交換裝配卡之電氣信號至在該底板之對應的傳信通孔集；

多片埋入式高速傳信層，每一片被夾在對應的上方與下方介質材料層間，其分別將該傳信層與上方與下方接地層隔離，每一高速傳信層包含差別軌跡對，每一軌跡對形成二對傳信通孔間點對點之連接，使得該等高速傳信層集合式地包含至少二差別軌跡對以連接每一第一卡槽與每一第二卡槽。

2. 如申請專利範圍第1項所述之路由器底板，每一差別軌跡對以約7至9mil之各別軌跡寬度與一軌跡高度、差別軌跡間隔及與軌跡寬度有關的軌跡對接地層間隔被組配，使得某一特定軌跡之阻抗比單端者在末端上更有差別。

3. 如申請專利範圍第2項所述之路由器底板，其中各別的軌跡寬度約為8mil、該差別軌跡高度約為1.4mil、該等差別軌跡對約為16mil、及該軌跡對接地層間隔約為6至8mil。

4. 如申請專利範圍第2項所述之路由器底板，其中各別的

拾、申請專利範圍

軌跡寬度約為7mil、該差別軌跡高度約為1.4mil、該等差別軌跡對約為17mil、及該軌跡對接地層間隔約為6至8mil。

5. 如申請專利範圍第2項所述之路由器底板，其中某一特定軌跡與單端阻抗大約等於該介質材料之本質阻抗。
- 5 6. 如申請專利範圍第5項所述之路由器底板，其中該軌跡阻抗稍小於該本質阻抗，及該單端阻抗稍大於該本質阻抗。
7. 如申請專利範圍第2項所述之路由器底板，每一卡槽具有一連接器區，包含多列傳信通孔與多列接地通孔交替，該等接地通孔被連接至該等接地層，其中每一高速傳信層具有數個差別軌跡被對路由經過一個以上的連接器區，使得就任一這些軌跡對，該軌跡對在與一列接地通孔相交之對齊處通過一連接器區，使得在該軌跡對趨近一接地通孔處，該軌跡對之該等軌跡在其趨近該接地通孔時分離、通過該通孔的相反側、及在該通孔的該相反側重新接合成一軌跡組配。
- 10 15 20 8. 如申請專利範圍第7項所述之路由器底板，其中在一差別對之該等軌跡通過一接地通孔之相反側時，此二軌跡之每一個為該差別對以大約等於該軌跡對接地層間隔維持與該通孔之隔離。
9. 如申請專利範圍第7項所述之路由器底板，其中被路由經過一連接器區之這些差別軌跡對的某一特定者之對齊處針對該通孔被置於中心，且其中該對之二軌跡在其趨近該通孔時以約90度角分離至該等二軌跡被分離

拾、申請專利範圍

為大於該通孔所需的間隙為止、彼此平行地通過該通孔、及以約90度角重新接合至達成該差別組配為止。

10. 如申請專利範圍第1項所述之路由器底板，其中一差別對之二軌跡的起始分段藉由包括靠近該等二軌跡分段中名義上較短者之信號插入端的一迴路接合而在長度上相匹配。
- 5
11. 如申請專利範圍第10項所述之路由器底板，其中該接合進一步補償在一卡片底板電氣連接器中對應於該等第一與第二軌跡之連接器信號路徑間的路徑長度上之差異。
- 10
12. 如申請專利範圍第1項所述之路由器底板，其中該等第一種與第二種數個卡槽分別被配置於第一與第二機架內，該等第一與第二機架相隔離以形成該等機架間之一差別軌跡路徑選擇區。
- 15
13. 如申請專利範圍第12項所述之路由器底板，其中就大多數的高速傳信層而言，每一層實質地包含所有的差別軌跡對連接每一第一種卡槽至該等第二卡槽的被選擇之一。
- 20
14. 如申請專利範圍第12項所述之路由器底板，進一步包含電力分配層被埋入相鄰的接地層間，每一卡槽在該等卡片上對應於電力連接器之電力通孔被耦合於該電力分配層，該電力通孔就每一卡槽位於該等傳信通孔之外板。
15. 如申請專利範圍第12項所述之路由器底板，進一步包含

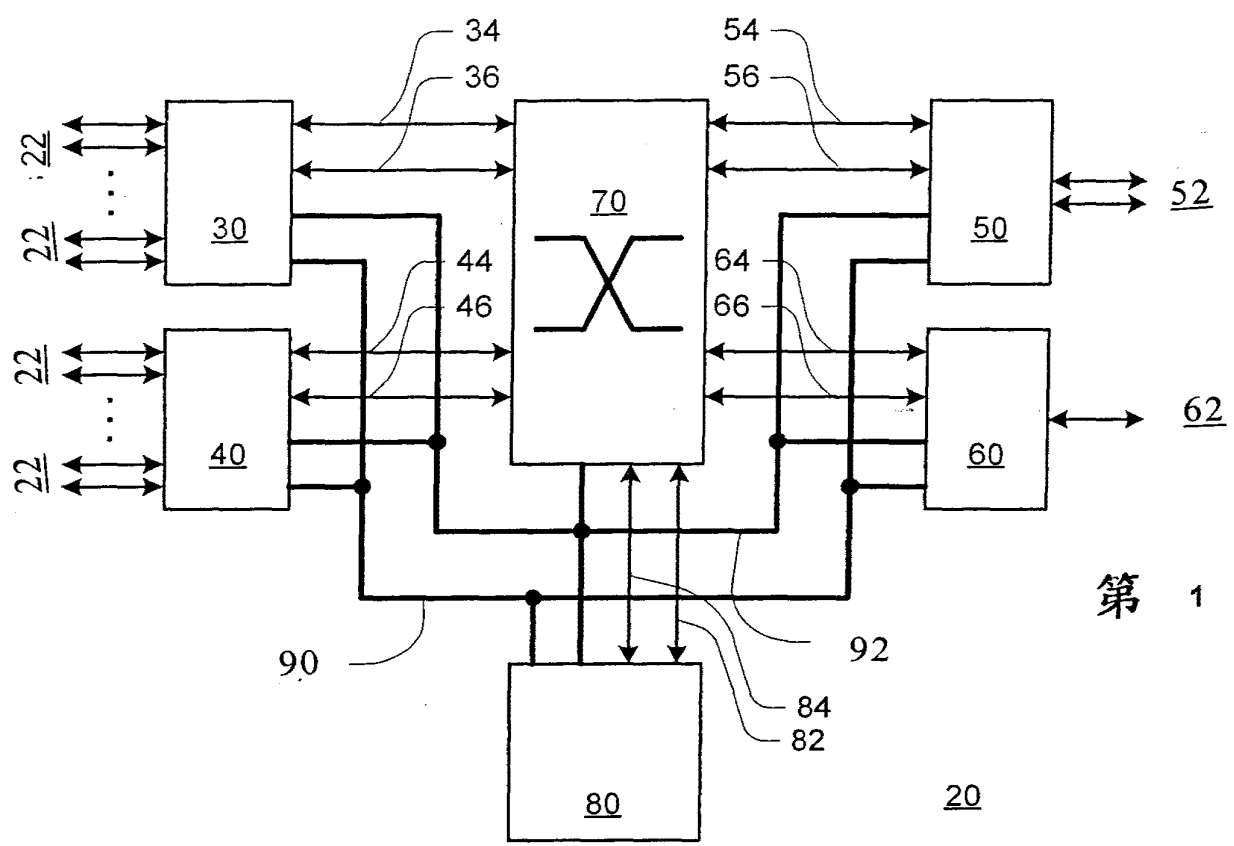
拾、申請專利範圍

一卡槽用於一路徑處理模組，此卡槽比一封包輸入/輸出卡槽或一交換裝配卡槽具有實質較多的傳信通孔，該路徑處理模組卡槽位於卡槽之該第一機架內，實際上是在此機架之中間。

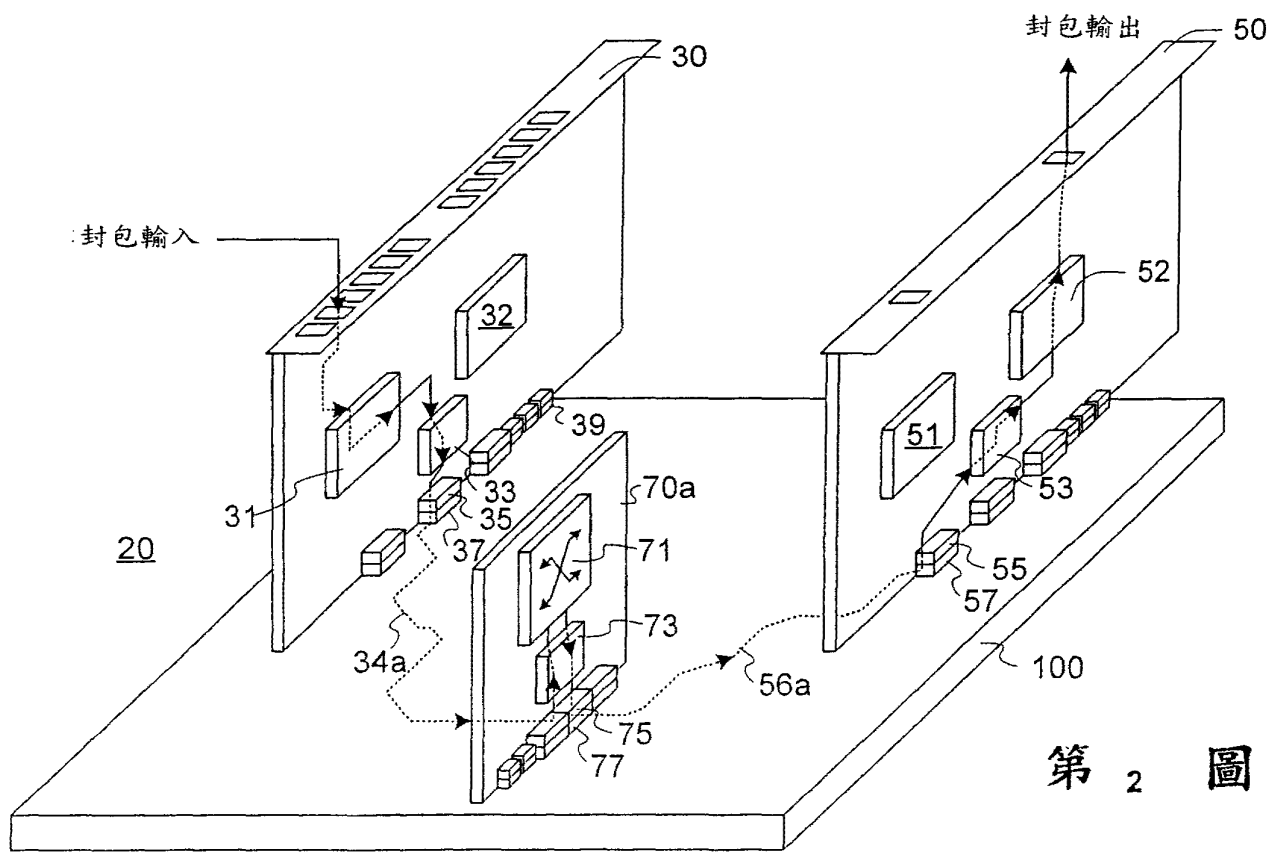
- 5 16. 如申請專利範圍第1項所述之路由器底板，其中該最長的差別對在最底部的高速傳信層上被路由，而以該底板底部高速傳信層被定義成由被連接至這些差別對之卡槽側為最遠的層。
- 10 17. 如申請專利範圍第1項所述之路由器底板，其中該等高速傳信層依據每一傳信層上最長的差別對被配置於該底板內，使得最頂端的傳信層比最底部的傳信層具有較短的最長差別對，而以該底板底部高速傳信層被定義成由被連接至這些差別對之卡槽側為最遠的層。
- 15 18. 如申請專利範圍第1項所述之路由器底板，進一步包含低速傳信軌跡，傳信通孔對軌跡之對應就大多數的差別對被配置，使得高速差別對連接至與於被連接至低速傳信軌跡或未被連接之傳信通孔相鄰的傳信通孔。
- 20 19. 如申請專利範圍第18項所述之路由器底板，其中該等傳信通孔被配置成六個孔之列，使得就大多數的傳信通孔列而言，一系列之每一端部的最外面二孔連接至一高速差別對之軌跡，而最裏面的二通孔則不然。
- 20 20. 如申請專利範圍第18項所述之路由器底板，其中大多數的低速傳信軌跡駐於與該高速傳信層隔離之低速傳信層上。

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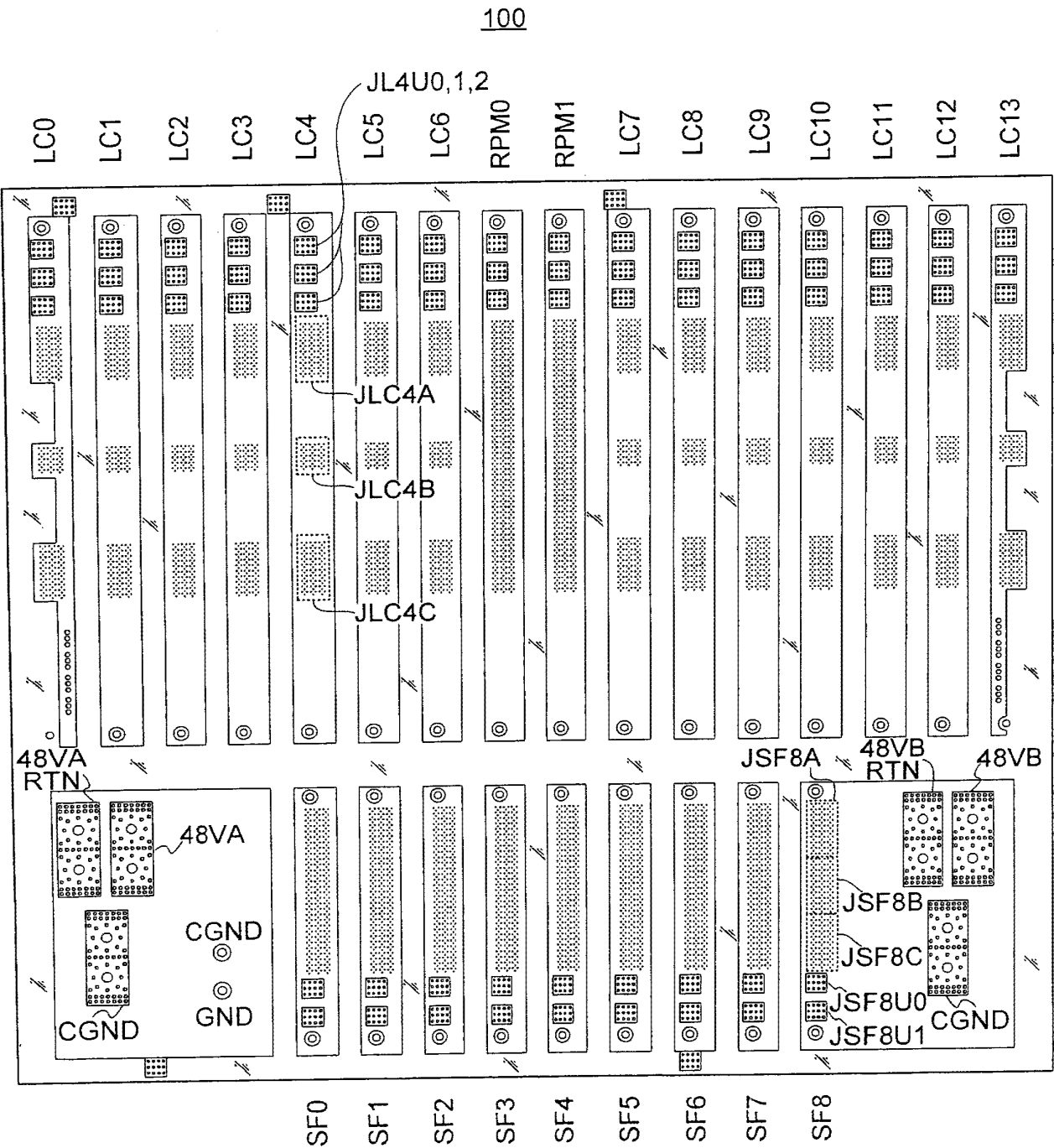
1/18



第 1 圖

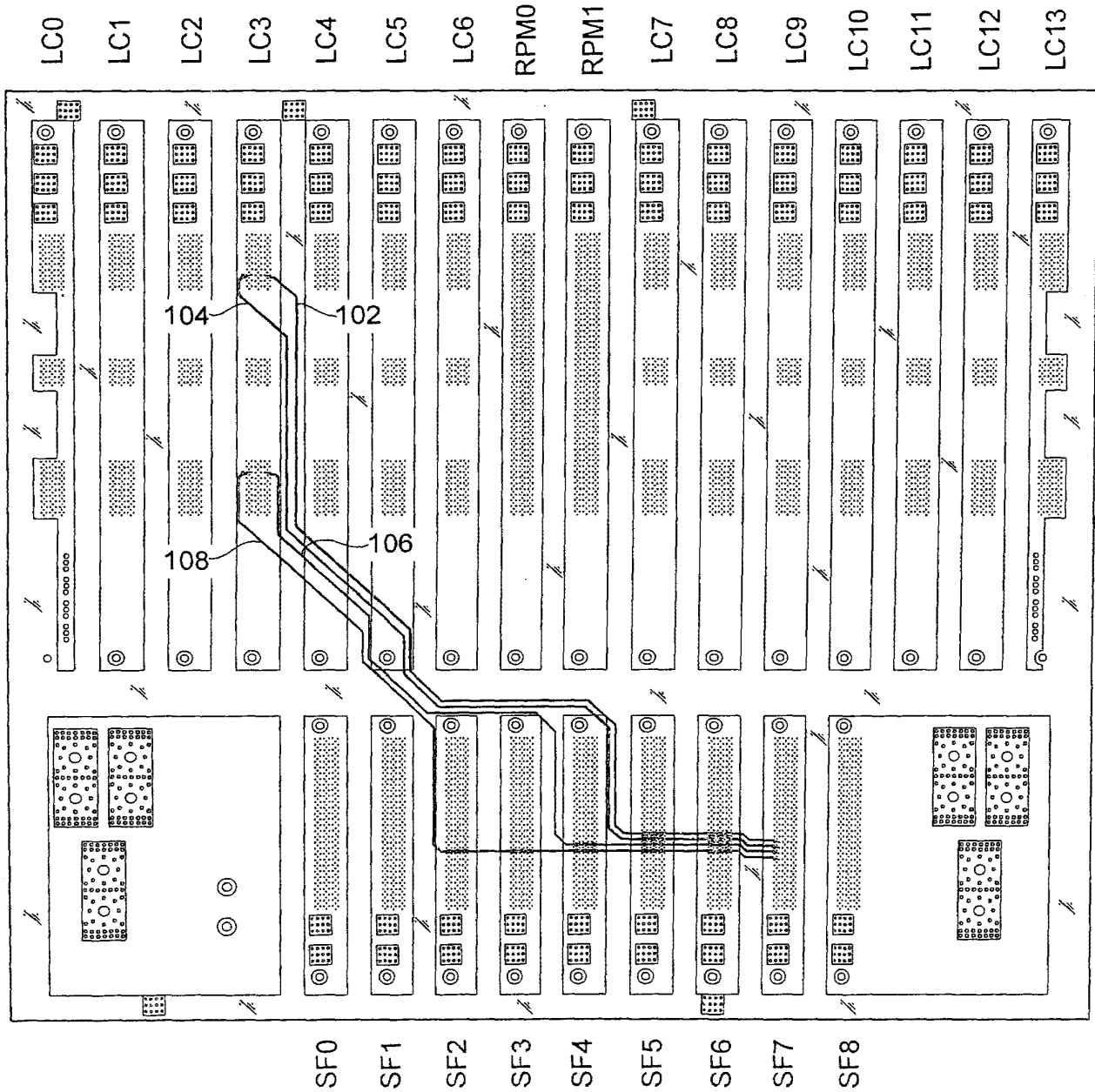


第 2 圖

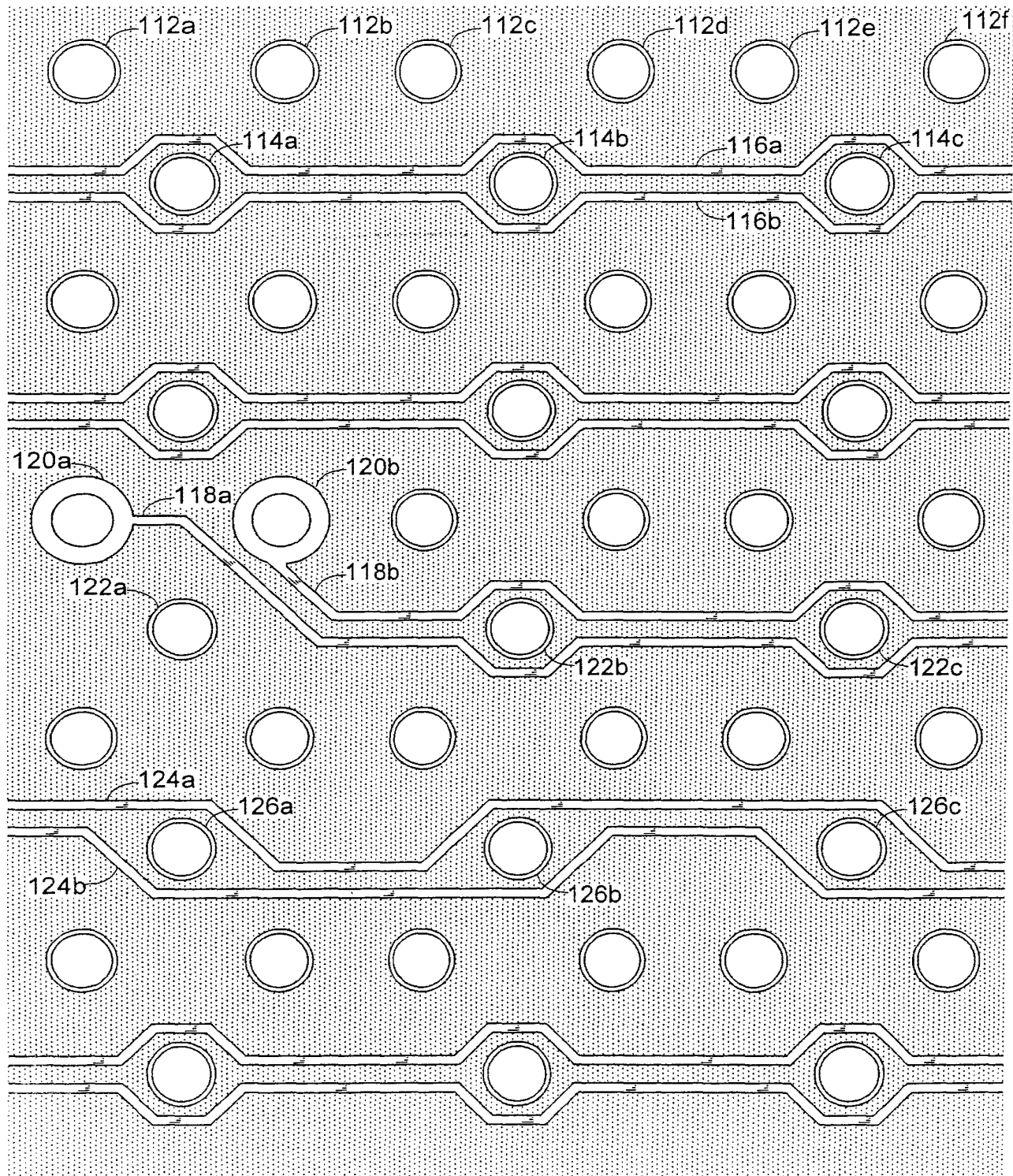


第 3 圖

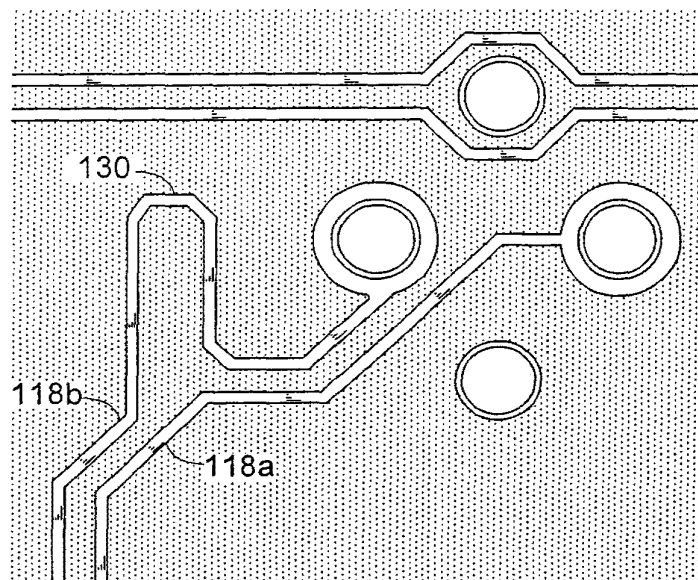
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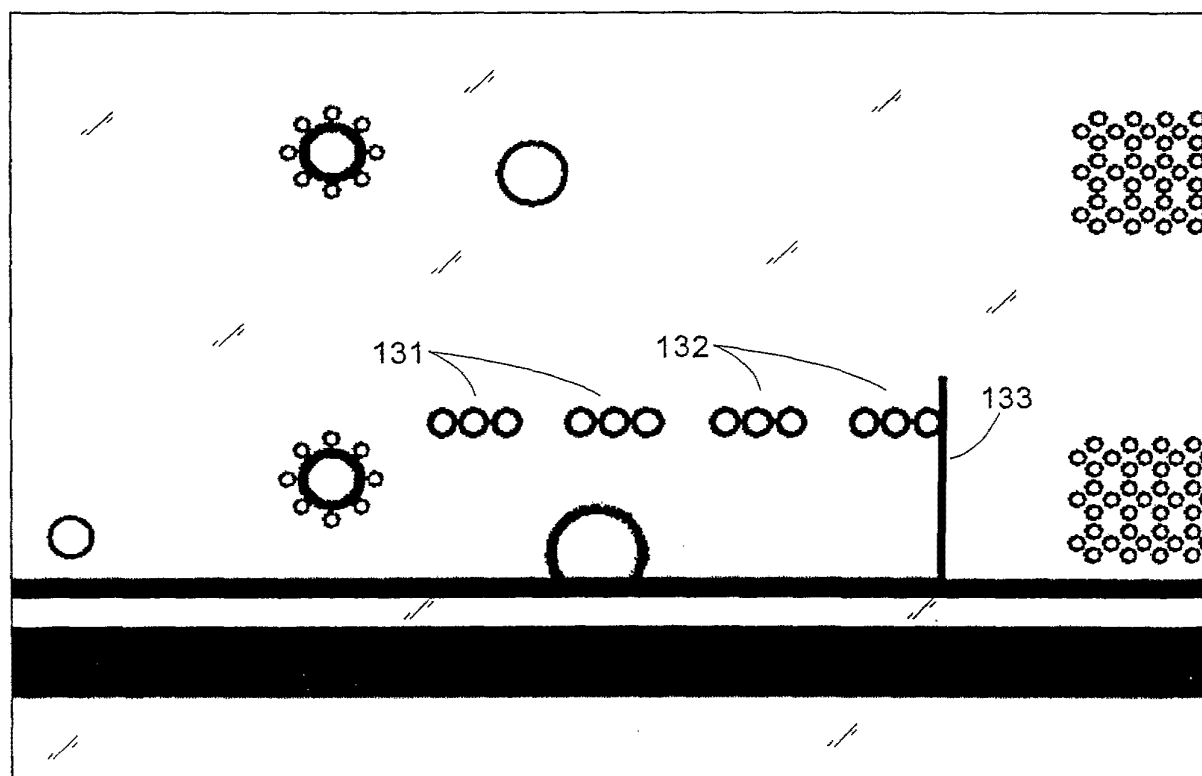
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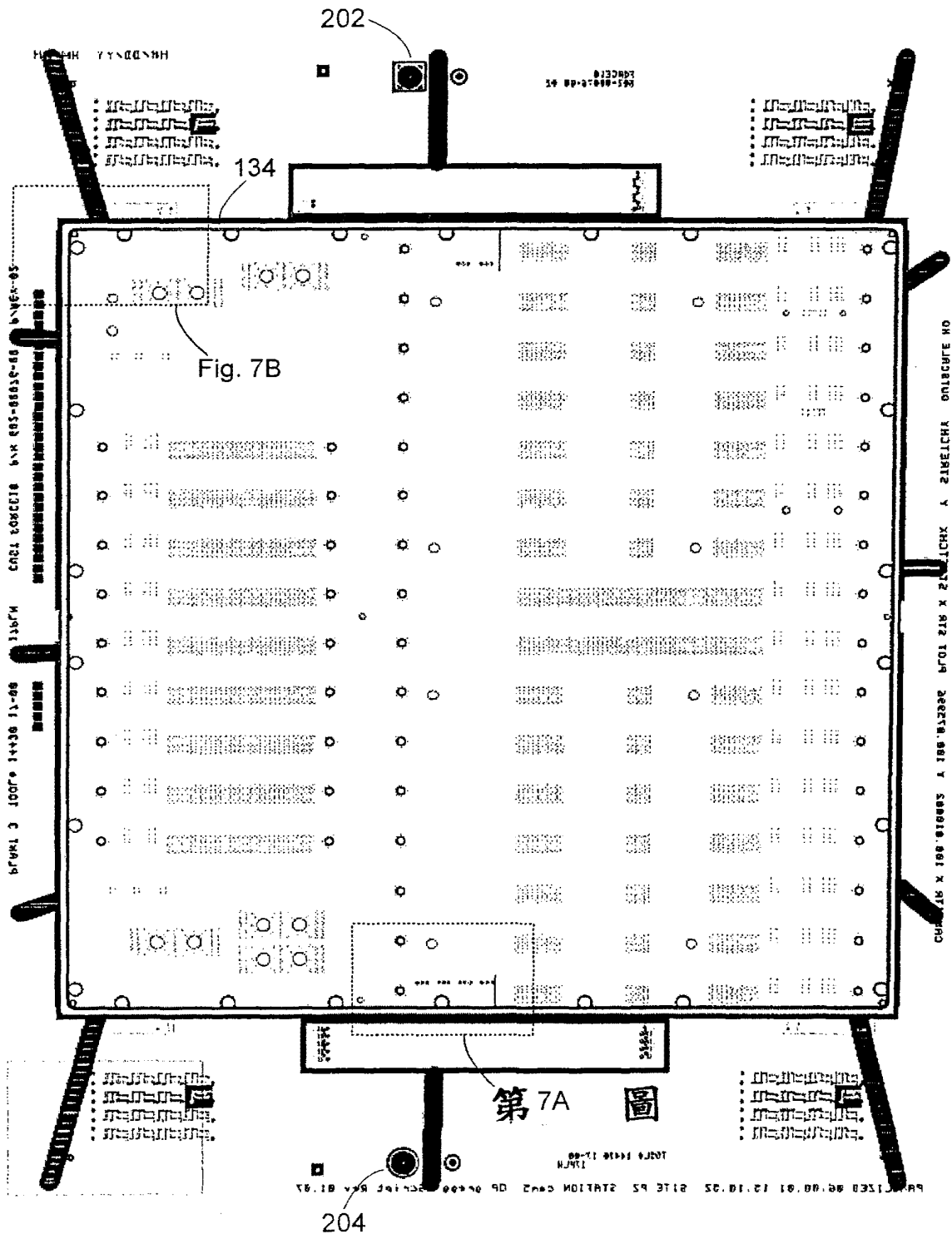
第 5 圖



第 6 圖

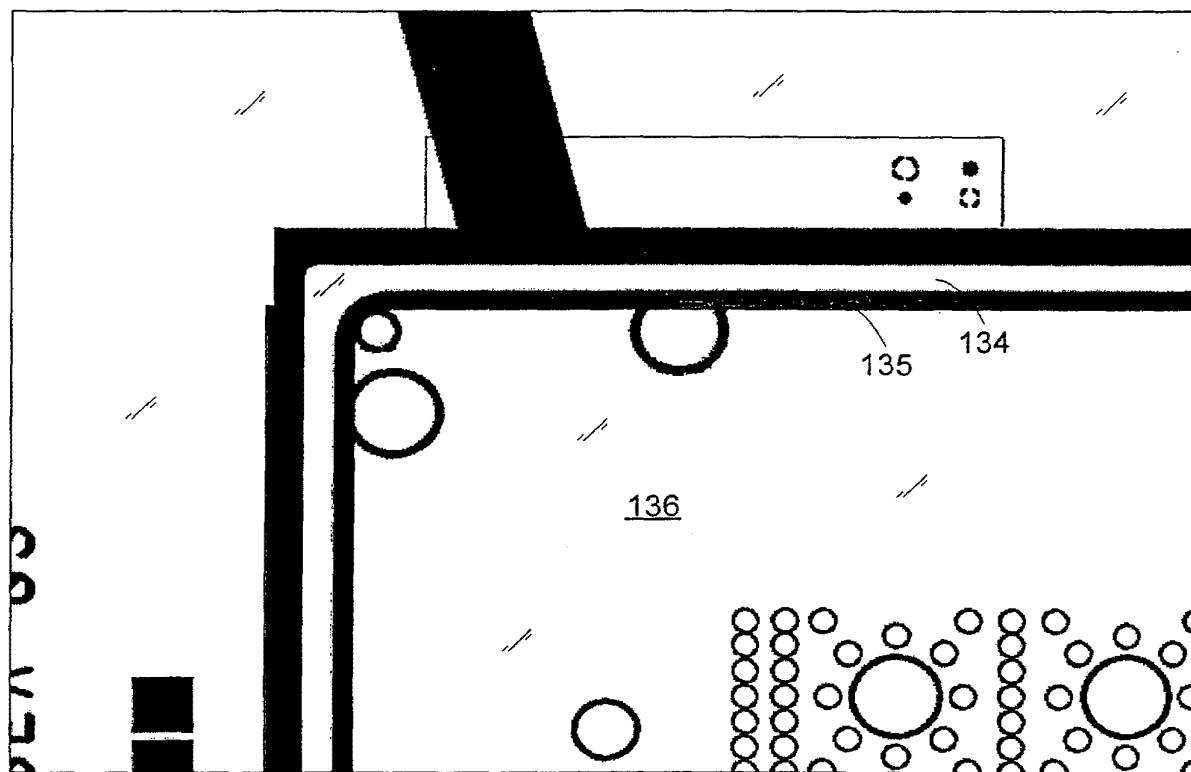


第 7A 圖

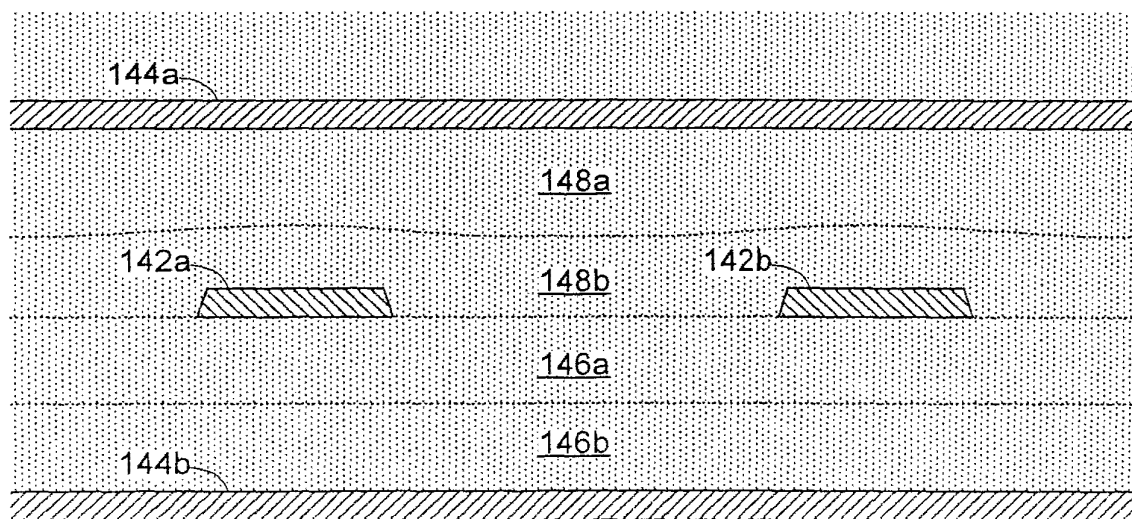


第 7 圖

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第 7B 圖



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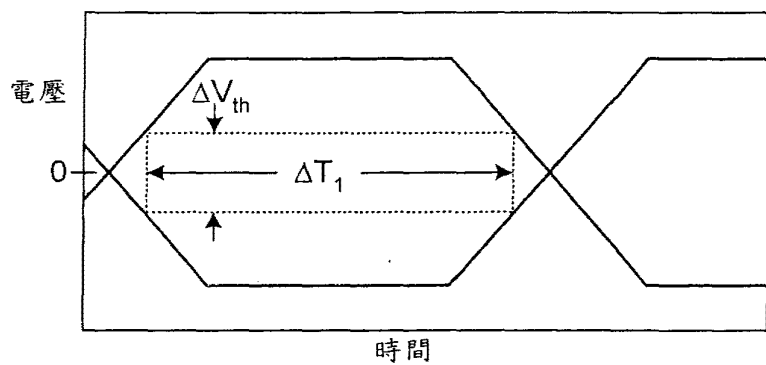
第 10 圖

傳導層			8/18	絕緣層	
層編號	厚度	型式		型式	厚度
L01 --{	2.0	箔片/電鍍		罩子	0.7
	1.2	填襯		B-級	5.4
L02	1.4	GND		心	7.5
L03	1.4	HS1		B-級	6.9
L04	1.4	GND		心	7.5
L05	1.4	HS2		B-級	6.9
L06	1.4	GND		心	7.5
L07	1.4	HS3		B-級	6.9
L08	1.4	GND		心	7.5
L09	1.4	HS4		B-級	6.9
L10	1.4	GND		心	7.5
L11	1.4	HS5		B-級	6.9
L12	1.4	GND		LS 心	5.0
L13	1.4	Signal x1		LS B-級	4.0
L14	1.4	Signal y1		LS 心	5.0
L15	1.4	GND		LS B-級	6.0
L16	5.6	A 48V rtn		LS 心	6.0
L17	5.6	A 48V dc		LS B-級	8.8
L18	5.6	B 48V dc		LS 心	6.0
L19	5.6	B 48V rtn		LS B-級	6.0
L20	1.4	GND		LS 心	5.0
L21	1.4	Signal y2		LS B-級	4.0
L22	1.4	Signal x2		LS 心	5.0
L23	1.4	GND		B-級	6.9
L24	1.4	HS6		心	7.5
L25	1.4	GND		B-級	6.9
L26	1.4	HS7		心	7.5
L27	1.4	GND		B-級	6.9
L28	1.4	HS8		心	7.5
L29	1.4	GND		B-級	6.9
L30	1.4	HS9		心	7.5
L31	1.4	GND		B-級	6.9
L32	1.4	HS10		心	7.5
L33	1.4	GND		B-級	5.4
L34 --{	1.2	填襯		罩子	0.7
	2.0	箔片/電鍍			

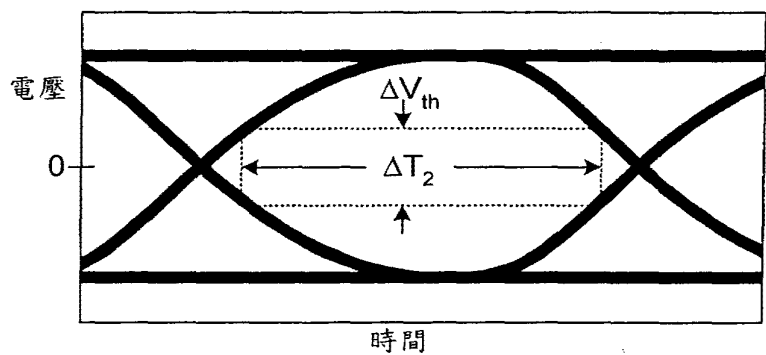
第 8 圖

傳導層			9/18	絕緣層	
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	1.2	填襯		B-級	5.4
L02	1.4	GND		心	7.5
L03	1.4	HS1		B-級	6.5
L04	1.4	GND		心	7.5
L05	1.4	HS2		B-級	6.5
L06	1.4	GND		心	7.5
L07	1.4	HS3		B-級	6.5
L08	1.4	GND		心	7.5
L09	1.4	HS4		B-級	6.5
L10	1.4	GND		心	7.5
L11	1.4	HS5		B-級	6.5
L12	1.4	GND		心	7.5
L13	1.4	Signal x1		B-級	4.0
L14	1.4	Signal y1		心	7.5
L15	1.4	GND		Lam 2 B-級	9.0
L16	5.6	A 48V rtn		Lam 1 B-級	8.5
L17	5.6	A 48V dc		心	6.0
第 9 圖				Lam 1 B-級	8.5
				Lam 2 B-級	12.0
				Lam 1 B-級	8.5
L18	5.6	B 48V dc		心	6.0
L19	5.6	B 48V rtn		Lam 1 B-級	8.5
				Lam 2 B-級	9.0
L20	1.4	GND		心	7.5
L21	1.4	Signal y2		B-級	4.0
L22	1.4	Signal x2		心	7.5
L23	1.4	GND		B-級	6.9
L24	1.4	HS6		心	7.5
L25	1.4	GND		B-級	6.9
L26	1.4	HS7		心	7.5
L27	1.4	GND		B-級	6.9
L28	1.4	HS8		心	7.5
L29	1.4	GND		B-級	6.9
L30	1.4	HS9		心	7.5
L31	1.4	GND		B-級	6.9
L32	1.4	HS10		心	7.5
L33	1.4	GND		B-級	5.4
L34 --{	1.2	填襯		罩子	0.7
	2.0	箔片/電鍍			

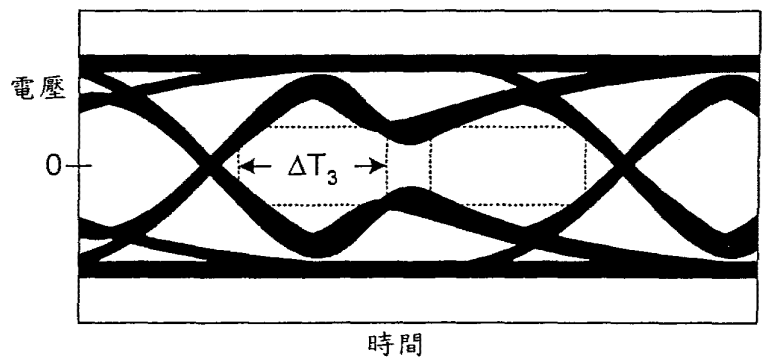
10/18



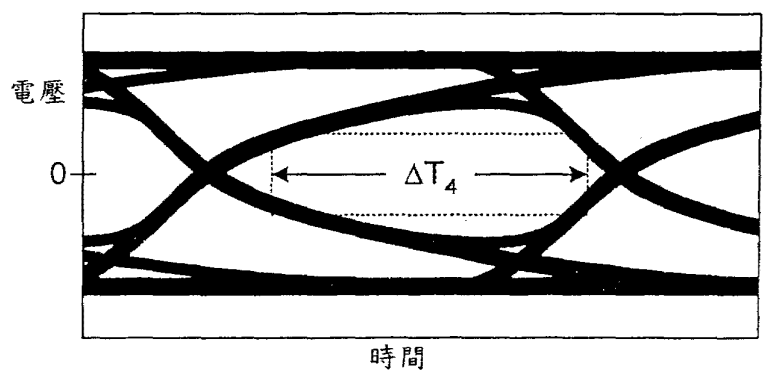
第 11 圖



第 12 圖

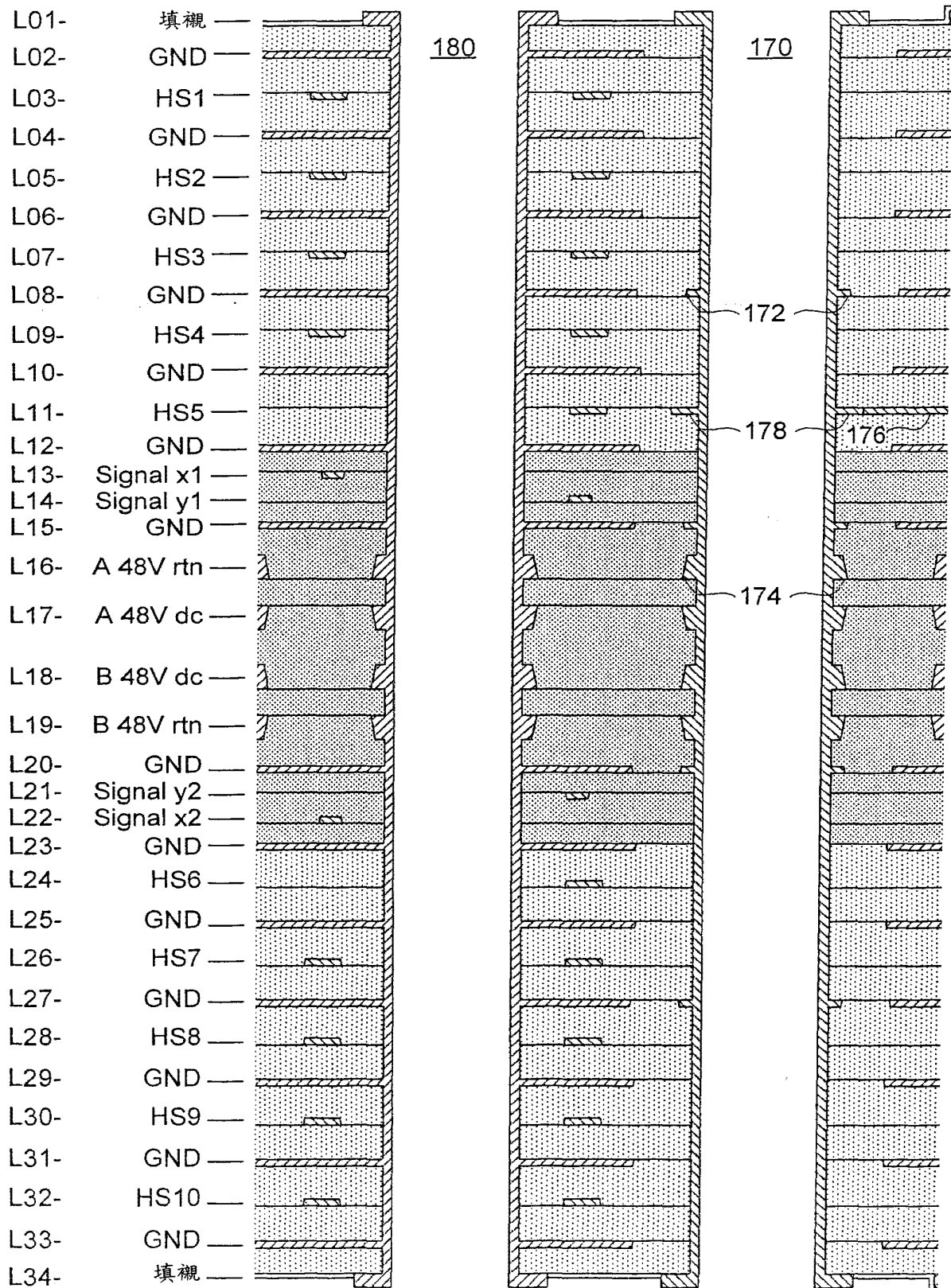


第 13 圖

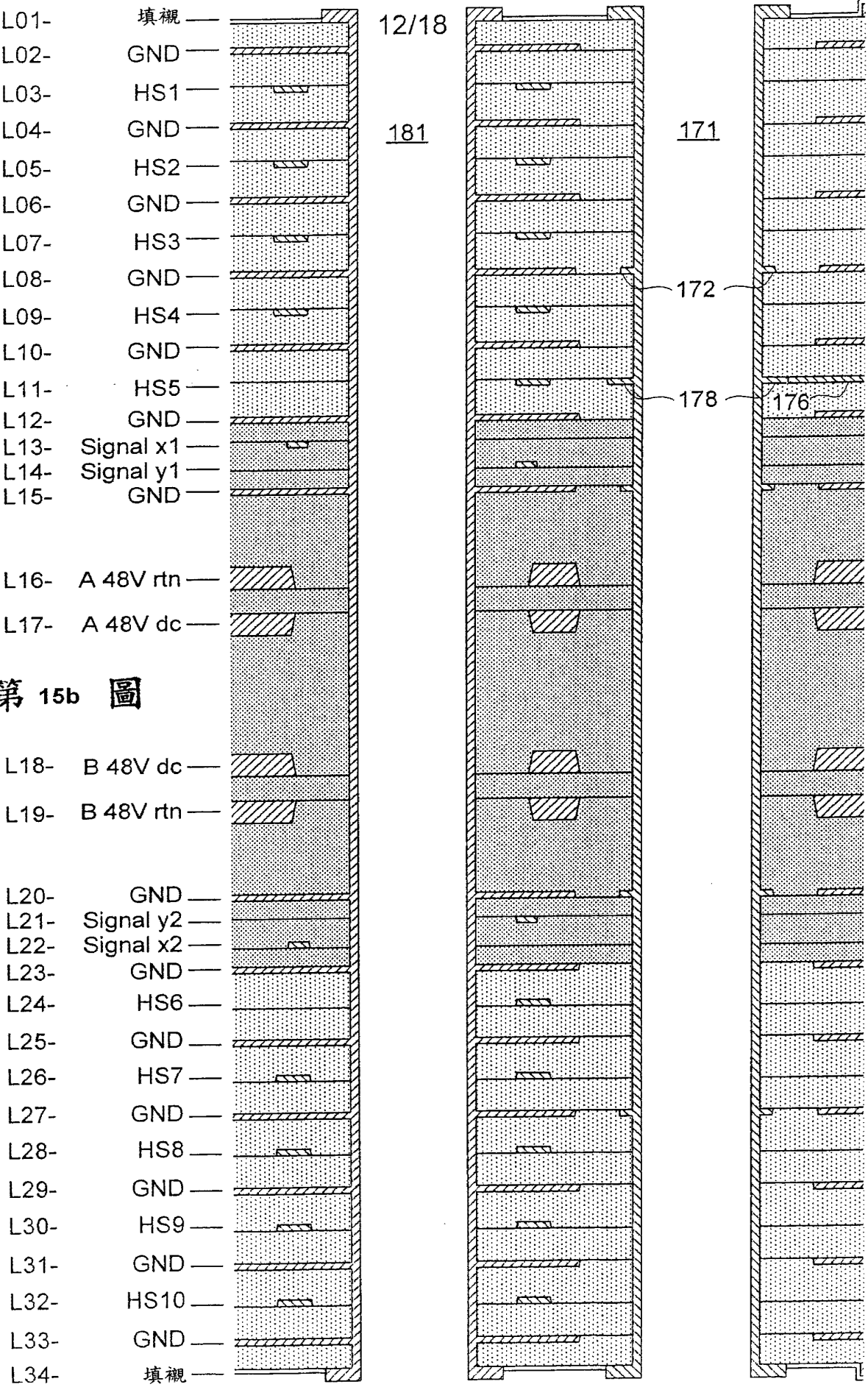


第 14 圖

11/18

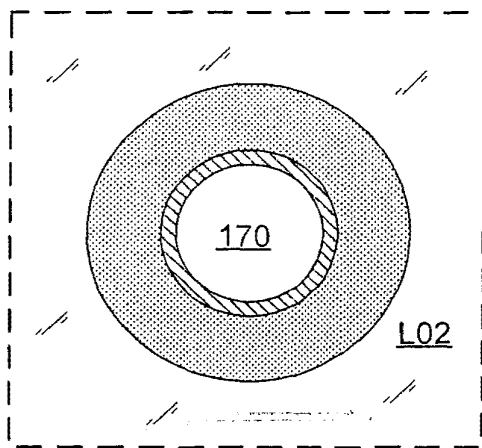


第 15a 圖

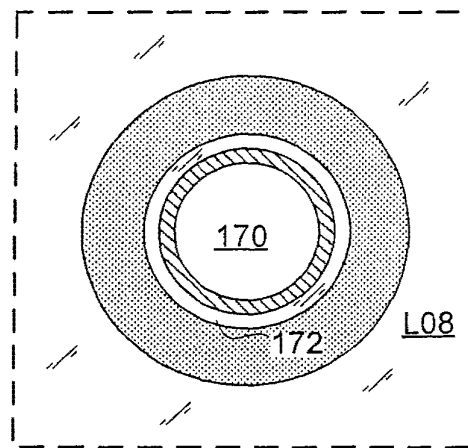


第 15b 圖

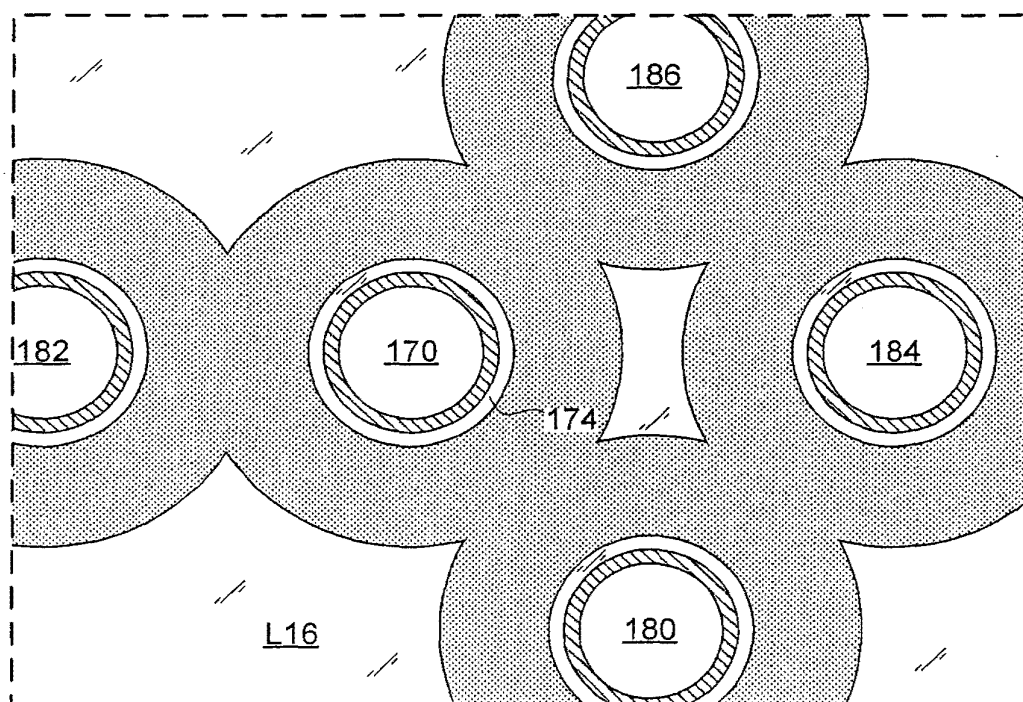
13/18



第 16 圖

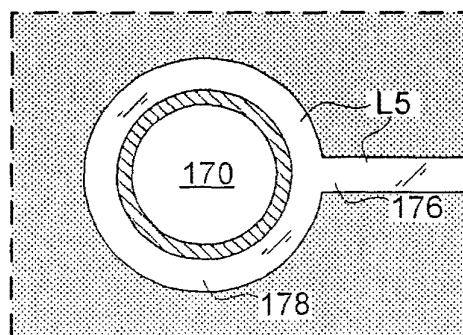


第 17 圖



第 18 圖

第 19 圖



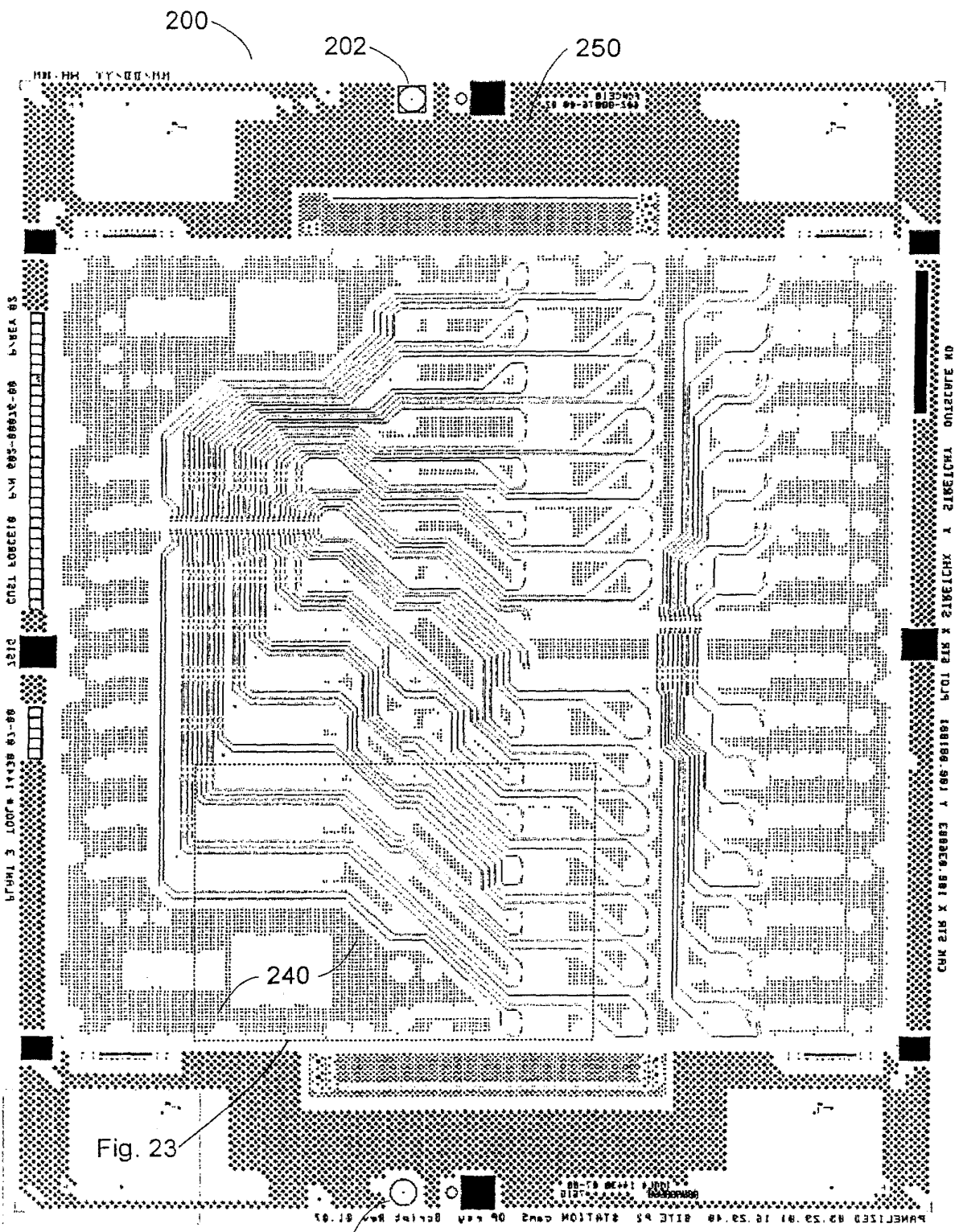
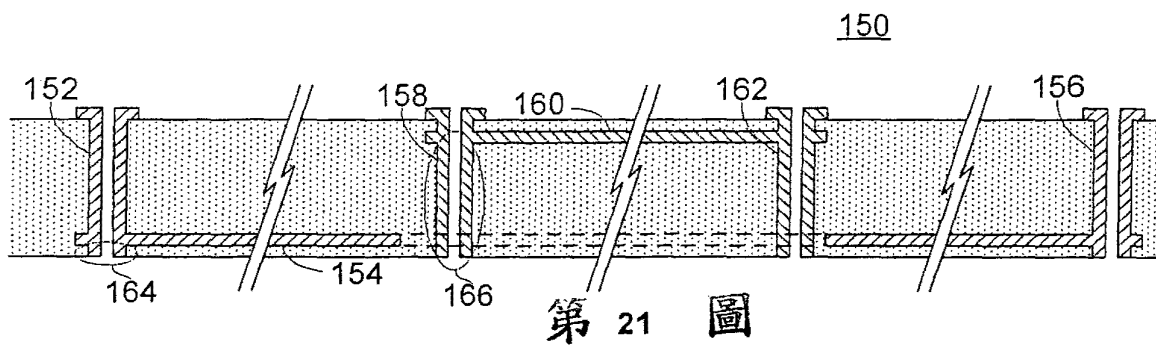
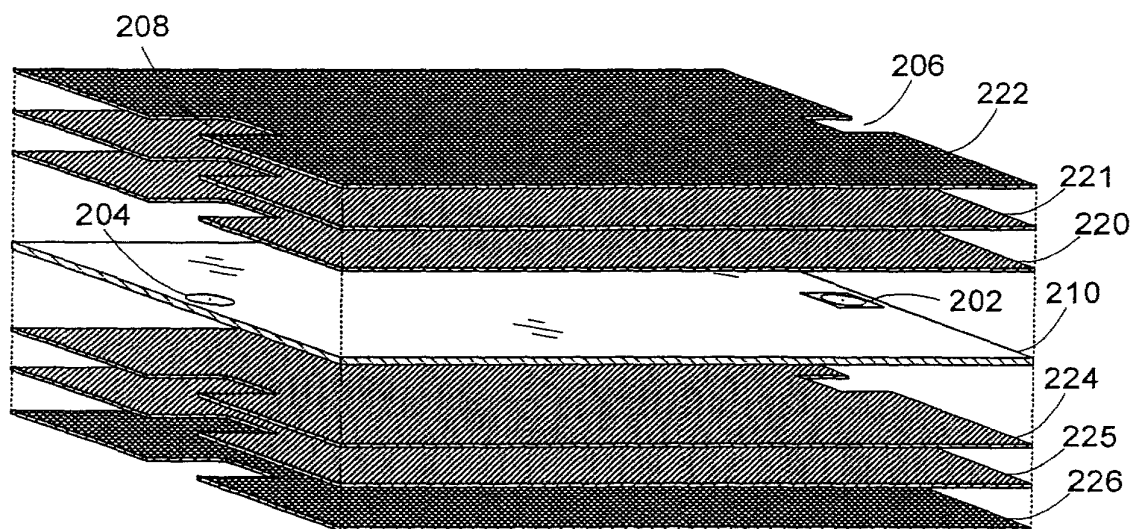
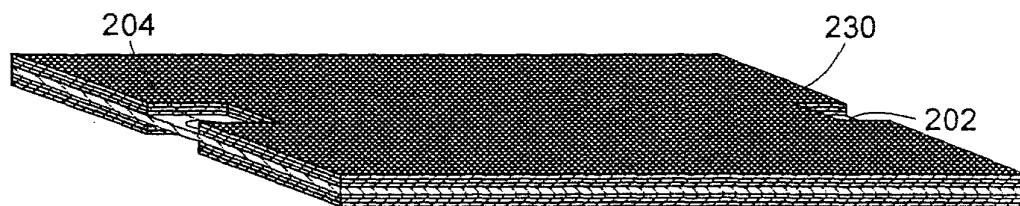
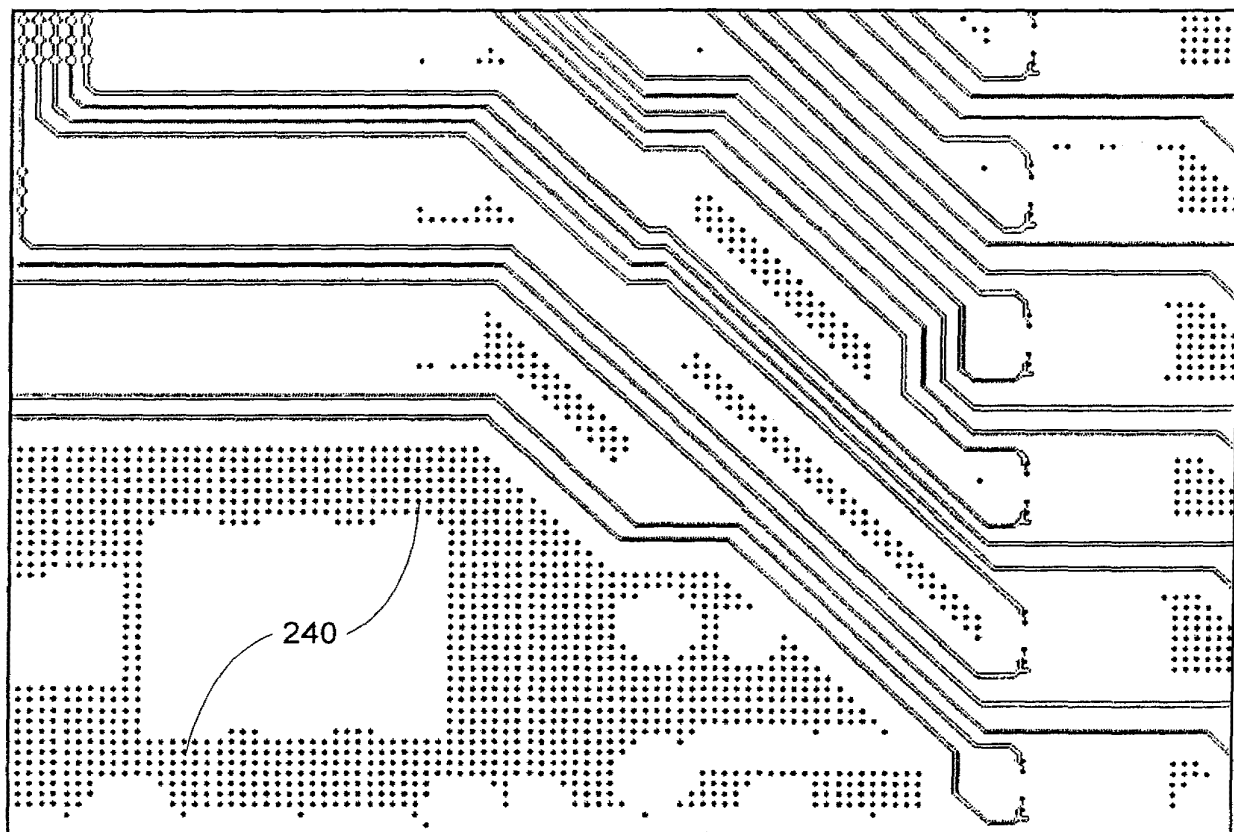


Fig. 23

204 第 20 圖

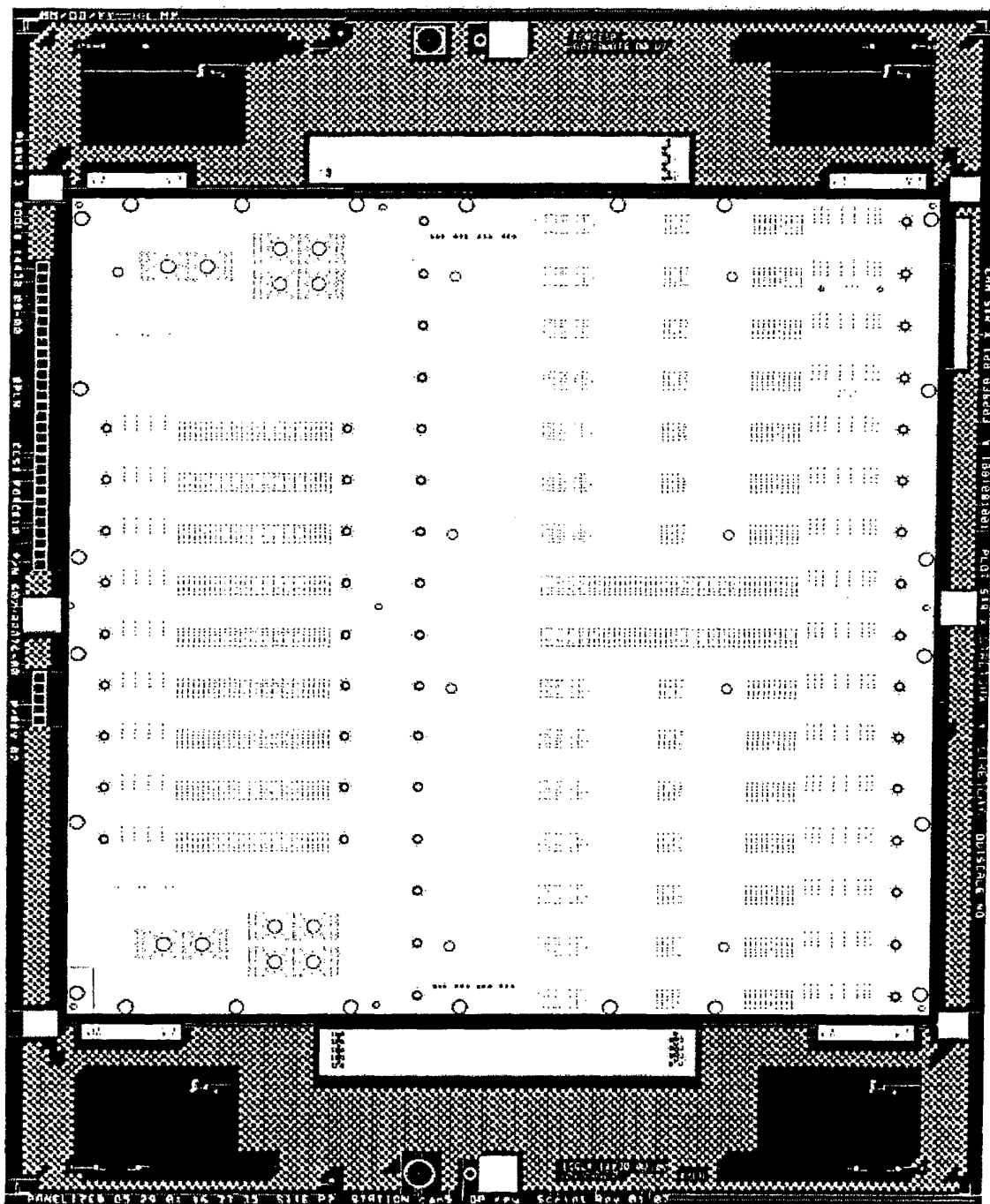
15/18



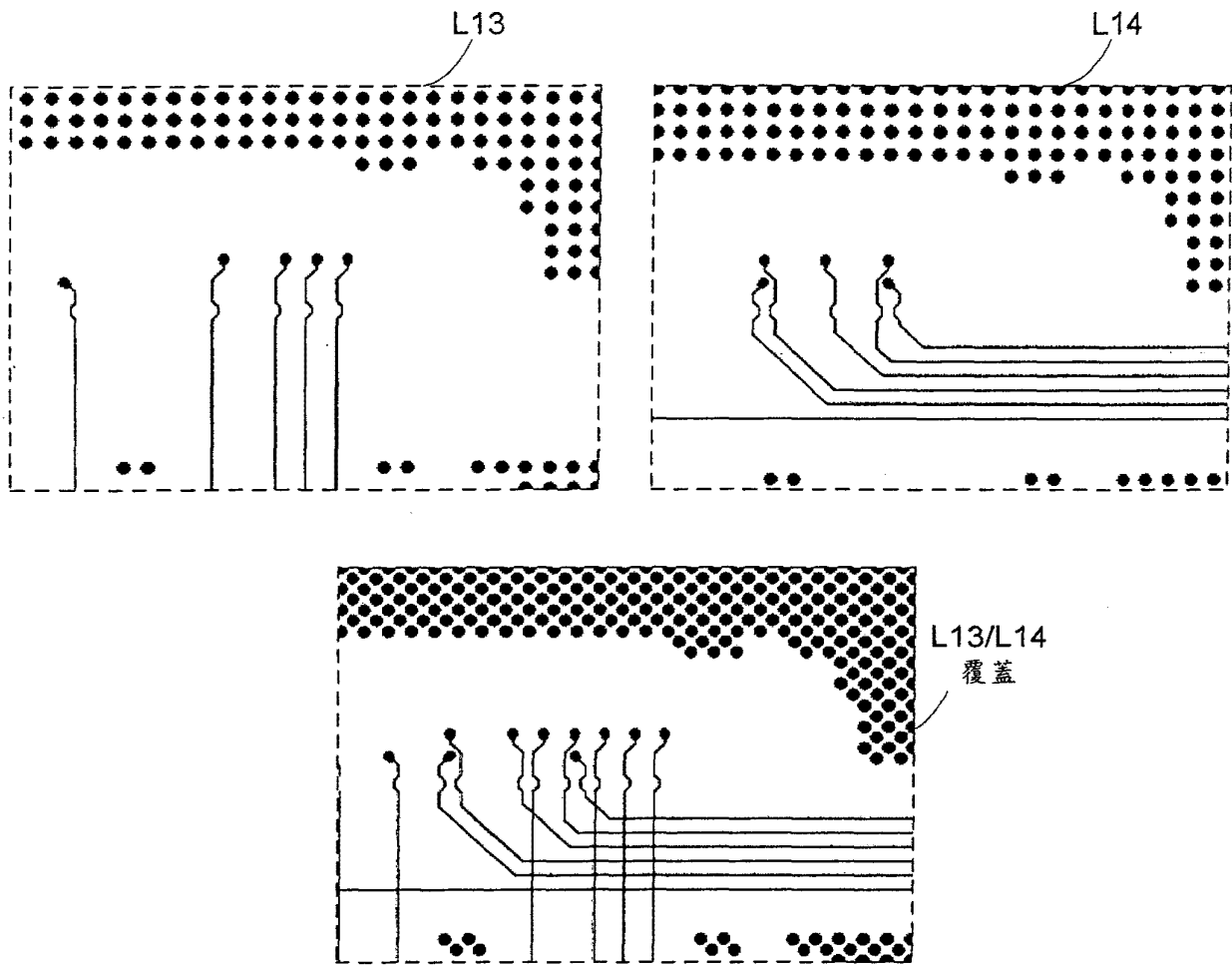


第 23 圖

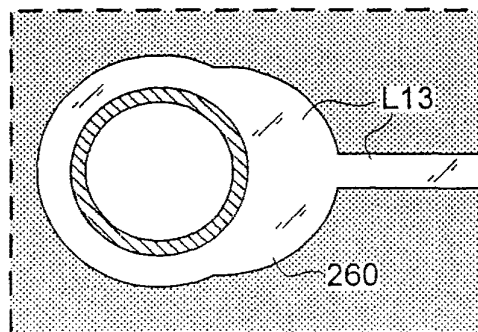
17/18



第 24 圖



第 25 圖



第 26 圖



Espacenet

Bibliographic data: TW200843279 (A) — 2008-11-01

Power distribution system including a control module and a method of using the system

No documents available for this priority number.

Inventor(s): BRUNDRIDGE MICHAEL A [US] ± (BRUNDRIDGE, MICHAEL A)

Applicant(s): DELL PRODUCTS LP [US] ± (DELL PRODUCTS, L. P)

Classification: - international: H02J3/06
- cooperative: G06F11/2015; G06F9/50

Application number: TW20080100701 20080108

Priority number (s): US20070621366 20070109

Also published as: TW1353702 (B) GB2445665 (A) GB2445665 (B)
US2008168282 (A1) US7721122 (B2) more

Abstract of TW200843279 (A)

A method of employing a power supply grid can include transmitting an identification initiation command from a control module to a first power supply unit to initiate a corresponding identification command. The method can also include transmitting an identification command from the first power supply unit to other power supply unit(s) that are supplied with power using a power supply phase in common with the first power supply. The method can further include transmitting identification acknowledgement signal(s) from the other power supply unit(s) to the control module in response to the first corresponding identification command. In one embodiment, the method can include mapping which power supply units correspond to various power supply grids. In other embodiments, control modules and power distribution systems can be operable to perform portions of the methods.

Last updated: 11.12.2013 Worldwide Database 5 8.15. 93p

發明專利說明書

(本說明書格式、順序及粗體字，請勿任意更動，※記號部分請勿填寫)

※ 申請案號：97100701

※ 申請日期：97.1.8

※IPC 分類：H02J 3/06(2006.01)

一、發明名稱：(中文/英文)

包括有控制模組之電力分配系統及其使用方法

POWER DISTRIBUTION SYSTEM INCLUDING A CONTROL MODULE AND A METHOD OF USING
THE SYSTEM

二、申請人：(共 1 人)

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戴爾產品有限公司 / DELL PRODUCTS, L. P.

代表人：(中文/英文)

蓋拉納 亨利 / GARRANA, HENRY

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美國 / U. S. A.

三、發明人：(共 1 人)

姓 名：(中文/英文)

布倫德里奇 麥可 A. / BRUNDRIDGE, MICHAEL A.

國 籍：(中文/英文)

美國 / U. S. A.

四、聲明事項：

☐ 主張專利法第二十二條第二項 ☐ 第一款或 ☐ 第二款規定之事實，其事實發生日期為：。

☒ 申請前已向下列國家（地區）申請專利：

【格式請依：受理國家（地區）、申請日、申請案號 順序註記】

☒ 有主張專利法第二十七條第一項國際優先權：

1. 美國、 2007/01/09、 11/621,366

☐ 無主張專利法第二十七條第一項國際優先權：

☐ 主張專利法第二十九條第一項國內優先權：

【格式請依：申請日、申請案號 順序註記】

☐ 主張專利法第三十條生物材料：

☐ 須寄存生物材料者：

國內生物材料 【格式請依：寄存機構、日期、號碼 順序註記】

國外生物材料 【格式請依：寄存國家、機構、日期、號碼 順序註記】

☐ 不須寄存生物材料者：

所屬技術領域中具有通常知識者易於獲得時，不須寄存。

九、發明說明：

【發明所屬之技術領域】

發明領域

此揭露一般是關於電力分配系統，且尤其是關於包括
5 有控制模組之電力分配系統及其使用方法。

【先前技術】

發明背景

隨著資訊的價值和使用持續增長，個人和商家在尋求
更多用以處理和儲存資訊的方法。一個選擇是一資訊處置
10 系統。一般地，一資訊處置系統為了商業、個人或其他目的而處理、編譯、儲存和/或溝通資訊或資料。因為技術及
資訊處置的需要和要求在不同應用間可能不同，所以資訊
處置系統還可就以下而言而不同：何種資訊被處置，該資
訊如何被處置，多少資訊被處理、儲存或溝通，及該資訊
15 可被多麼快和有效地被處理、儲存或溝通。資訊處置系統
中的該等變化允許資訊處置系統要為通用的，或者要被組
配用於一特定使用者或特定用途，諸如金融交易處理、航
空訂位元、企業資料或全球通訊。此外，資訊處置系統可
包括可被組配以處理、儲存和溝通資訊的各種硬體和軟體
20 元件，且可包括一個或多個電腦系統、資料儲存系統和網路系統。

一資訊處置系統可包括一組刀片伺服器(blade server)，其可被置於一底盤內。該等刀片伺服器的電源可
包括3相電源，其自該底盤的前面被載入。該3相電源要求

經由一連接模組正確地連接一電源板(power supply panel)的三個引入電源相和該等電源的相對應終端。不正確被佈線的電源將不工作，因此，該等電源需要正確地被佈線以使得該等電源可操作。例如，若該底盤被連接到兩個不同的電源板，與每一電源板相關聯的該等三個電源將根據該等3相電源的佈線要求而被知道。

另外，該等3相電源可被單相電源所代替，其較3相電源來說更加廉價。自一電源板引入電力可以三個引入電源相的形式，正如關於該等3相電源所描述的。與該等3相電源不同，該等單相電源僅被連接到該等引入電源相中的兩個。例如，若該等引入電源相包括相位A、相位B和相位C，那麼該等電源中的一個可被連接到相位A和B，該等電源中的另一個可被連接到相位A和C，且該等電源中的又一個可被連接到相位B和C。

該底盤的一電力供應格(grid)可包括 $N+1$ 個電源，用於電源冗餘(redundancy)。該電源冗餘確保比操作該等刀片伺服器所需電源的最小數目至少多一個的電源是可操作的。該底盤的電力供應格還可包括 $N+N$ 個冗餘，用於電源板冗餘。這意謂著被連接到一電源板的每一電源都具有被連接到一不同的電源板的一相對應電源，且因此，被連接到一對電源板的電源的數目相同。

隨著引入電源數目的增加，出現一問題，尤其因為所需或所希望的冗餘。第二組引入電源相還可包括三個相位。各種單相電源到相對應組引入電源相之映射，被用於

維護、電力開啟/切斷、故障或其他非預期的條件，或其他類似物。一手動映射有出錯傾向。對於當前正在運作的一資訊處置系統來說，終止來自一組引入電力相的引入電力來決定該映射也許不是一可接受的選擇。

5 【發明內容】

發明概要

依據本發明之一實施例，係特地提出一種使用一電力供應格之方法，包含以下步驟：自一控制模組發送一第一識別啟動命令，其被一第一電力供應單元接收，以啟動一
10 第一相對應識別命令，其中該第一電力供應單元具有一第一電力供應單元識別符；自該第一電力供應單元發送該第一相對應識別命令，其被一第二電力供應單元接收，其中該第一相對應識別命令由一第一電源相運送；及自該第二電力供應單元發送被該控制模組接收的一第一識別確認信
15 號，以回應於該第一相對應識別命令，其中該第一識別確認信號包括該第二電力供應單元之一第二電力單元識別符。

圖式簡單說明

本技術領域技工瞭解，圖式中之元件為了簡單和清楚地
20 地被說明，並不必按比例來繪製。例如圖式中一些元件的尺寸可相對於其他元件而被擴大或縮小，以幫助提高對本發明實施例的理解。併入本揭露之教示的實施例關於這裏所呈現的該等圖式而被顯示並被描述。

第1圖包括一資訊處置系統之一功能方塊圖，該資訊處

置系統包括一電力分配系統的。

第2圖包括可被使用在第1圖之該資訊處置系統中的一電力分配系統之一功能方塊圖。

第3圖包括可被使用在第2圖之該電力分配系統中的一
5 控制模組之一功能方塊圖。

第4圖包括可被使用在第2圖之該電力分配系統中的一電力供應單元之一功能方塊圖。

第5和6圖包括一種映射電力供應單元到該電力分配系統內的不同電力格的方法之一流程圖。

10 在不同圖式中所使用的相同參考符號指示相似或相同項目。

【實施方式】

較佳實施例之詳細說明

以下結合該等圖式之描述被提供以幫助理解這裏所揭露之教示。以下討論將集中於該等教示之特定實施技術和
15 實施例。此焦點被提供以幫助描述該等教示，而不應該被解釋為對該等教示之範圍或可應用性的限制。然而，其他教示無疑可被使用於此應用中。該等教示也可被使用於其他應用和數種不同類型的架構中，諸如分配計算架構、客
20 戶/伺服器架構或中間軟體架構和關聯元件。

為了此揭露之目的，一資訊處置系統可包括操作以計算、分類、處理、發送、接收、擷取、產生、切換、儲存、顯示、表明(manifest)、偵測、記錄、再現、處置或使用任何形式的資訊、智慧或資料用於商業、科學、控制、娛樂

或其他目的的任何工具或工具的聚合。例如，一資訊處置系統可以是一個人電腦、一PDA、一消費電子裝置、一網路伺服器或儲存裝置、一交換路由器、無線路由器或其他網路通訊裝置，或者任何其他適當的裝置，且可在大小、

5 形狀、性能、功能和價格方面不同。該資訊處置系統可包括記憶體(揮發性(例如隨機存取記憶體等)、非揮發性(唯讀記憶體、快閃記憶體等)或其等之任何組合)、一個或多個處理資源，諸如一中央處理單元(CPU)、硬體或軟體控制邏輯，或其等之任何組合。該資訊處置系統之附加元件不但

10 可包括一個或多個儲存裝置、一個或多個用於與外部裝置通訊的通訊埠，而且各種輸入和輸出(I/O)裝置，諸如一鍵盤、一滑鼠、一視訊顯示器，或其等之任何組合。該資訊處置系統還可包括一個或多個操作以在各種硬體元件之間傳輸溝通的匯流排。

15 雖然被稱為一“裝置”，但該裝置可以硬體、韌體、軟體或其等之任何組合來組配。例如，該裝置可以是硬體，諸如(例如)一積體電路(諸如，一特定應用積體電路(ASIC)、一現場可規劃邏輯閘陣列(FPGA)、一結構化ASIC或嵌在一較大晶片上的一裝置)、一卡(諸如，一週邊元件介

20 面(PCI)卡、一PCI-快速(PCI-express)卡、一個人電腦記憶卡國際協會(PCMCIA)卡，或其他此類擴展卡)，或一系統(諸如，一主機板、一系統單晶片(system-on-a-chip)(SoC)或一獨立(stand-alone)裝置)。同樣地，該裝置可以是韌體(諸如，運作在一嵌入式裝置、一奔騰(Pentium)級或PowerPC™品

牌處理器，或其他此類裝置上的任何軟體)或軟體(諸如，能夠在相環境中操作的任何軟體)。該裝置還可以是任何前述硬體、韌體或軟體之範例的組合。

除非另有明確說明，否則彼此進行通訊的裝置或程式
5 不必相互進行連續通訊。此外，互相進行通訊的裝置或程式可直接或間接地進行通訊，經由一個或多個中間媒體。

下文中所討論的實施例部分地描述管理網路元件之間的所有或部分交互作用的分配計算解決方案。在此背景中，一交互作用可以是企圖發送資訊、發送資訊、請求資訊、接收資訊、接收對資訊的一請求或其等之任何組合。
10 同樣地，一交互作用可以是單向的、雙向的、多向的或其等之任何組合。在某些環境中，一交互作用可以是相對複雜並包含兩個或更多網路元件。例如，一交互作用可以是在一客戶和一伺服器之間的“一交談”或相關通訊的系列—每一網路元件彼此之間發送並接收資訊。無論該交互作用採用何種形式，所包含的該等網路元件不需要採用任何特定形式，一網路元件可以是一節點、一件硬體、軟體、韌體、中間軟體、一計算系統的某些其他元件，或其等之任何組合。

20 在以下的描述中，描繪技術的一流程圖可以一系列連續的動作來描述。該等動作的順序和執行該等步驟的人員可自由地被變化，而並不脫離該等教示之範圍。動作可以用複數種方法被添加、刪除或變化。同樣地，該等動作可被重新排序或被循環。進一步地，雖然程序、方法、演算

法或類似物可以一連續的順序被描述，但此等程序、方法、演算法或其等之任何組合可被操作以可選擇的順序被執行。進一步地，具有一程序、方法或演算法的某些動作可在至少一時間點同時被執行(例如，並行被執行的動作)，還
5 可被整體地、部分地或其等之任何組合地被執行。

如這裏所使用的，術語“包含(comprise)”、“包含(comprising)”、“包括(include)”、“包括(including)”、“具有(has)”、“具有(having)”或其等之任何其他變化，企圖涵蓋一非排除(non-exclusive)包括。例如，包含一特徵列表的一
10 程序、方法、物品或設備不必僅限於此等特徵，卻可包括其他未明確被列出或此類程序、方法、物品或設備中固有的特徵。進一步地，除非明確地陳述相反，否則“或”指的是一包括的或，而非一排斥的或。例如，一條件A或B藉由以下中的任何一個而被滿足：A為真(或出現)且B為假(或未
15 出現)，A為假(或未出現)且B為真(或出現)，以及A和B都為真(或出現)。

同樣，“一(a)”或“一(an)”的使用被用以描述這裏所描述的元件(element)或元件(component)。這樣做僅僅為了方便並給出本發明之範圍的一般意義。除非清楚地有不同的意
20 義，否則此描述應該被閱讀以包括一個或至少一個，且單數型同樣包括複數型，或反之亦然。例如，當一單一裝置在此被描述時，多於一個的裝置可被使用取代一單一裝置。同樣地，當多於一個的裝置在此被描述時，一單一裝置可取代那一個裝置。

除非另有定義，否則在此所使用的所有技術和科學的術語與此發明所屬之技藝中具有通常知識者的一般理解具有相同意義。雖然相似或等效於這裏所描述的方法和材料可被使用在實現或測試本發明之實施例中，但適當的方法和材料被描述於下。除非一特定部分被引證，否則這裏所提及的所有公開案、專利申請案、專利和其他參考全部以參考方式被併入本文。凡有抵觸的，以本說明書(包括定義)為準。此外，該等材料、方法和範例僅為說明性的，且並不意指限制。

就未被描述於此的範圍來說，有關特定材料、處理動作和電路的許多細節是習知的，且可在計算、電子和軟體技藝內的教科書和其他資源中找到。

依據一個層面，一種使用一電力供應格之方法可包括以下步驟：自一控制模組發送一第一識別啟動命令被一第一電力供應單元接收，用以啟動一第一相對應識別命令，其中該第一電力供應單元具有一第一電力供應單元識別符。該方法還可包括自該第一電力供應單元發送該第一相對應識別命令被一第二電力供應單元接收，其中該第一相對應識別命令由一第一電源相運送。該方法可進一步包括以下步驟：自該第二電力供應單元發送被該控制模組接收的一第一識別確認信號，以回應該第一相對應識別命令，其中該第一識別確認信號包括該第二電力供應單元的一第二電力單元識別符。

依據另一層面，一控制模組可包括一格處理器和一通

訊模組。該格處理器可操作以使用出現在一電力格內的三個可用相位中之一特定相位啟動一識別程序，並處理該等三個可用相位中之該特定相位上所接收之電力供應單元識別符。該通訊模組可操作以發送一識別啟動命令到一第一電力供應單元，用以該第一電力供應單元發送一第一相對應識別命令，該第一相對應識別命令由一第一電源相運送。該通訊模組可進一步操作以自一第二電力供應單元接收一第一識別確認信號，其中該第一識別確認信號包括一第二電力供應單元識別符。

10 依據一進一步的層面，一電力分配系統可包括一控制模組和一第一電力供應單元，該控制模組包括一第一通訊模組且該第一電力供應單元被耦接到該控制模組。該第一電力供應單元可包括一第二通訊模組，其操作以接收由該控制模組所發送之一第一命令，並發送由一電源相所運送之一相對應識別命令。該電力分配系統可進一步包括被耦接到該控制模組之一第二電力供應單元。該第二電力供應單元可包括一第三通訊模組，其操作以自該第一電力供應單元接收該相對應識別命令，並發送一識別確認信號到該控制模組，回應於接收該相對應識別命令。

20 第1圖說明一資訊處置系統的一示範性實施例之一功能方塊圖，其一般地被設計成100。在一種形式中，該資訊處置系統100可以是一電腦系統，諸如一伺服器。如第1圖中所示，該資訊處置系統100可包括被耦接到一第一主機匯流排(host bus)104之一第一實體處理器102，且可進一步包

括被耦接到一第二主機匯流排108之附加處理器，一般地被設計作為第n實體處理器106。該第一實體處理器102可經由該第一主機匯流排104被耦接到一晶片組110。進一步地，該第n實體處理器可經由該第二主機匯流排108被耦接到該晶片組110。該晶片組110可支援多個處理器，且可允許多個處理器同時處理並支援資訊處置系統100內的資訊交換於多個處理操作期間。

依據一個層面，該晶片組110可被稱作一記憶體集線器或一記憶體控制器。例如，該晶片組110可包括一加速集線器架構(AHA)，其使用一專用匯流排用以在第一實體處理器102和該第n實體處理器106之間傳遞資料。例如，包括一AHA致能晶片組的該晶片組110可包括一記憶體控制集線器和一I/O控制集線器。作為一記憶體控制集線器，該晶片組110可起到以下作用：提供使用第一匯流排104以存取第一實體處理器102，及使用該第二主機匯流排108以存取第n實體處理器106。該晶片組110還可提供一記憶體介面用於使用一第三主機匯流排114以存取記憶體112。在一特定實施例中，該等主機匯流排104、108和114可以是個別的匯流排或相同匯流排之部分。該晶片組110還可提供匯流排控制，且可處置該等主機匯流排104、108和114之間的傳遞。

依據另一層面，一般地，該晶片組110可被認為是一特定應用晶片組，其提供與各種匯流排的連接性，並結合其他系統功能。例如，該晶片組110可使用一Intel[®]品牌集線器架構(IHA)晶片組而被提供，其還可包括兩部分，一圖形

(Graphics)和AGP記憶體控制集線器(GMCH)以及一I/O控制集線器(ICH)。例如，自加州的聖塔克拉拉市的Intel公司可得的一Intel 820E和815E晶片組，或其等之組合，可提供至少該晶片組110的一部分。該晶片組110還可被封裝作為一ASIC。

在以下的描述中，對硬體、韌體或軟體實施例的一實體描述關於第1至4圖被描述。大量實體描述將包括耦接、連接及某些功能性描述。一方法描述就第1至4圖中所描述之該等元件關於第5和6圖被描述。

該資訊處置系統100還可包括一視訊圖形介面122，其可使用第四主機匯流排124被耦接到該晶片組110。在一種形式中，該視訊圖形介面122可以是一加速圖形埠(AGP)介面，用以在一視訊顯示單元126內顯示內容。其他圖形介面同樣可以被使用。該視訊圖形介面122可提供一視訊顯示輸出128到該視訊顯示單元126。該視訊顯示單元126可包括一個或多個類型的顯示器，諸如一平板顯示器(FPD)或其他類型顯示裝置。

該資訊處置系統100還可包括一I/O介面130，其可經由一I/O匯流排120被連接到該晶片組110。該I/O匯流排120和該I/O介面130可包括工業標準匯流排或專屬匯流排和各自的介面或控制器。該I/O匯流排120還可包括一週邊元件互連(PCI)匯流排或一高速PCI-快速(PCI-Express)匯流排。在一實施例中，一PCI匯流排可被操作於約66Mhz，且一PCI-快速匯流排可被操作於約128Mhz。PCI匯流排和PCI-快速匯

流排可被提供以符合工業標準，用於各種PCI致能 (PCI-enabled)硬體裝置之間的連接和通訊。其他匯流排也可與包括其他工業標準匯流排或專屬匯流排的該I/O匯流排120聯合被提供，或獨立被提供，諸如工業標準架構(ISA)、
5 小型電腦串列介面(SCSI)、內部積體電路(I²C)、系統封包介面(SPI)或通用串列匯流排(USBs)。

在另一實施例中，該晶片組110可以是使用一北橋/南橋(Northbridge/Southbridge)晶片組組態之一晶片組(圖中未說明)。例如，該晶片組110之一北橋部分可與該第一實體
10 處理器102進行通訊，且可控制與該記憶體112的交互作用、該第四匯流排120可操作成一PCI匯流排，以及該視訊圖形介面122的活動。該北橋部分還可使用第一匯流排104以及被耦接到該第n實體處理器106的該第二匯流排108來與該第一實體處理器102進行通訊。該晶片組110還可包括
15 該晶片組110之一南橋部分(圖中未說明)，且可處置該晶片組110之I/O功能。該南橋部分可管理基本形式的I/O，諸如用於該資訊處置系統100的USB、串列I/O、音訊輸出、整合式驅動電子裝置(IDE)，及ISA I/O。

該資訊處置系統100可進一步包括被耦接到該第四匯
20 流排120之一磁碟控制器132。該磁碟控制器132可被用以連接一個或多個磁碟機，諸如一硬碟機(HDD)134和一光碟機(ODD)136，如，一讀/寫光碟(R/W-CD)、一讀/寫數位視訊光碟(R/W-DVD)、一讀/寫迷你數位視訊光碟(R/W mini-DVD)或其他類型的光碟機。

該資訊處置系統100還可包括系統電力140，其可經由電力層(power plane)142被耦接到該晶片組110。雖然圖中未說明，但其他元件，諸如該等處理器(第一處理器102到第n處理器106)、該視訊顯示單元126、該視訊圖形介面122、

5 該記憶體112和該磁碟控制器132可被耦接到該系統電力140。命令、通訊或其他信號可被發送到該系統電力140或自該系統電力140被接收，藉由先前所描述的元件之任何一個或其組合。該系統電力140可以是以該資訊處置系統100內之一電力子系統的形式。該系統電力140還可經由電力電

10 纜144被耦接到一電力分配系統150。如第1圖中所說明的，電力可自該電力分配系統150被發送到系統電力140。

該系統電力140可以是一較大電力格之部分，其可被內部、外部或遠端提供到該資訊處置系統100。在一形式中，該系統電力140可以是一底盤之部分，操作以提供電力給多

15 個系統、元件或其等之組合。在另一形式中，一冗餘系統電力同樣可被提供。系統電力還可經由使用多個電力供應單元來實現，且不必被限制於一單一電力來源。

該資訊處置系統100可進一步包括系統管理器160，其可經由一第一通訊匯流排162被耦接到該晶片組110，諸如

20 一控制匯流排。雖然圖中未說明，但其他元件，諸如該等處理器(第一處理器102到第n處理器106)、該視訊顯示單元126、該視訊圖形介面122、該記憶體112和該磁碟控制器132可被耦接到該系統管理器160。命令、通訊或其他信號可被發送到該系統管理器160或自該系統管理器160被接收，藉

由先前所描述的元件之任何一個或其組合。該系統管理器160可以是以該資訊處置系統100內之一電力子系統的形式。該系統管理器160還可經由一第二通訊匯流排164被耦接到該電力分配系統150。該第一和第二通訊匯流排162和
5 164可以是一I²C匯流排、一系統管理(SM)匯流排、另一適當的通訊媒體，或其等之任何組合。

在一特定實施例中，虛線右邊的所有元件和子系統可被附接到一刀片或其可以是一刀片之部分。該電力分配系統150可被附接到一底盤、框架、外殼或其等之任何組合。
10 該刀片可被附接到該底盤。其他實施技術可被使用。在閱讀此說明書之後，本技術領域技工將瞭解，該資訊處置系統及其電力來源可按其特定需要或希望被組配。

第2圖包括一電力分配系統250之一功能方塊圖。在一實施例中，該電力分配系統250可以是提供電力給該系統電力140的該電力分配系統150，如第1圖中所說明。該電力分配系統250可包括被耦接到外部電力220和240之一底盤200(虛線)。該外部電力220和240可來自該電力分配系統250位於其中的一設備處的不同的電源板。該外部電力220和240可彼此獨立，諸如，若該外部電力220或240不運作了，
15 另一個外部電力繼續運作。在一特定實施例中，每一外部電力220和224可提供3相電力給該電力分配系統250。外部電力220之相位可包括相位A、B和C，且外部電力240之相位也可包括相位A、B和C，一般以相位D、E和F來說明。該等外部電力220和240之正常電壓可以是120V、240V、
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480V或另一適當的電壓值。該等外部電力220和240之頻率可以是50hz、60hz或另一適當的頻率值。實質上，該等外部電力220和240關於前述或其他特徵來說可以是彼此相同的或彼此不同的。在閱讀此說明書之後，本技術領域技工
5 將瞭解除了在此被描述的參數之外的參數。因此，該等數值僅僅是說明性的，而並不限制本發明之範圍。

該等外部電力220和240可分別被耦接到隔離方塊221和241。該等隔離方塊221和241幫助降低來自正在被傳送到該等外部電力220和240的，由該電力分配系統250內的不同
10 相位所運送的各自的射頻信號或其他高頻或低頻雜訊。該等隔離塊221和241的每一個可包括一電容性元件、另一元件、另一組態或其等之任何組合，其可移除實質上所有的將被路由經過電力分配單元228和248的通訊信號，在該等信號到達該等外部電力220和240之前。簡言之，電力可進
15 入該電力分配系統250，而該電力分配系統250中之通訊信號不能自該電力分配系統250被傳送到該等外部電力220和240。

該等外部電力220和240還分別被耦接到電力分配單元(PDU)228和248。在一特定實施例中，來自該外部電力之該
20 電力的3個相位在該等PDU 228和248的每一個中被分離到不同的終端連接中。在該說明實施例中，該PDU 228被耦接到電力供應單元(PSU)222、224和226，且該PDU 248被耦接到PSU 242、244和246。該耦接可使用一通用電力匯流排和一通用I/O介面來實現。顯然地，另一類型的電力匯流排、

另一類型的介面或其等之任何組合可被使用。在一特定實施例中，該等PSU 222、224、226、242、244和246中之每一個都是一單相電力供應單元。在另一特定實施例中，任何PSU或PSU之組合可被一3相電力供應單元所取代。

- 5 當該等PSU是單相PSU時，該等PSU 222、224、226、242、244和246中之每一個都包括一對被耦接到來自其各自PDU之不同相位組合的電源線。例如，該PSU 222可經由該PDU 228被耦接到該外部電力220的該A和B相位。同樣地，該PSU 224可被耦接到該A和C相位，且該PSU 226可被耦接到該B和C相位。該PSU 242可經由該PDU 248被耦接到該外部電力240之該D和E相位。同樣地，該PSU 244可被耦接到該D和F相位，且該PSU 246被耦接到該E和F相位。雖然該等相位指定(designation)被一般地說明於第2圖中，然而在其他實施例中，不同的相位可被使用。在一種形式中，該A、B和C相位可分別等效於該D、E和F相位。在另一形式中，該A和D相位可以是相同或不同的相位角，相位B和相位E可以是相同或不同的相位角，且該C和F相位可以是相同或不同的相位角。還有另一實施例中，更多或更少的PSU可被耦接到每一個該等PDU或所有該等PDU。在該所說明實施例中，一電力格包括該PDU 228和PSU 222、224和226。

在一特定實施例中，該電力分配系統250或其相對應資訊處置系統可具有N+N個電力格冗餘和N+1個PSU冗餘政策。該N+N個電力格冗餘可允許兩個分離外部電源來源為每一外部電源來源的相同數目的PSU提供電力。換句話

- 說，每一互補對電力格具有相同的PSU。例如，另一電力格可包括該PDU 248及PSU 242、244和246，且提供適當的冗餘用於其他電力格。該N+1個PSU冗餘政策可允許一附加的PSU在當前使用所必需可得的範圍之外。因此，當該N+N
- 5 和N+1個冗餘政策被使用時，該電力分配系統250可具有至少4個PSU。若該政策未被使用時，對於少於4個PSU來說，該電力分配系統150仍可被使用。多於兩個的外部電力來源可被使用，且該等外部電力來源可提供交流電流或直流電流。
- 10 在該所說明實施例中，該電力分配系統250進一步包括一控制模組202，其可以是至少作為一底盤管理控制器、一基礎板(baseboard)管理控制器、一整合管理控制器、一服務處理器或其等之任何組合的一部分。該控制模組202可被耦接到該等PSU 222、224、226、242、244和246。在一特
- 15 定實施例中，該控制模組202可以是被用於操作該電力分配系統250的一微處理器或一組微處理器之部分。該控制模組202和該等PSU可經由一I²C匯流排、一SM匯流排、另一適當的通訊媒體控制匯流排，或其等之任何組合被耦接到該等PSU。
- 20 在一實施例中，該電力分配系統250可被耦接到該系統管理器160、系統電力140或其等之任何組合。該系統管理器可被耦接到該控制模組202、PSU內的處理器，或其等之任何組合。任何單一PSU或PSU之組合可提供電力給該系統電力140。

第3圖包括一可被用於控制模組202的控制模組302之一功能方塊圖。與該電力分配系統之其他部分的連接和耦接並沒有被說明在該第3圖中，以簡單化對該控制模組302的理解。該控制模組302包括一偵測模組312、一通訊模組314、一格處理器316和一記憶體324。該偵測模組312可操作以偵測被耦接到該控制模組302之PSU(第3圖中未說明)。該偵測模組312可自該PSU獲取一PSU識別符，或分配一PSU識別符給每一個不具有或提供一PSU識別符給該偵測模組312的PSU。該通訊模組314可操作以自該控制模組302發送信號到該等PSU，並自該等PSU接收信號給該控制模組302。該通訊模組314還可操作以自該控制模組302發送信號到一系統管理器(例如，該系統管理器160)，並自該系統管理器接收信號給該控制模組302。

該格處理器316可操作以使用一電力格內出現的三個可用相位之特定相位來啟動識別程序。該格處理器316還可操作以處理資料或其他資訊，處理自該等PSU所接收的，在該等三個可用相位之該等特定相位上所接收的PSU識別符。該格處理器可進一步操作以處理自該系統管理器、該記憶體324或其二者所接收之資料或其他資訊。該格處理器316又進一步可操作以根據該通訊模組314所發送或接收之通訊，映射哪些PSU與一電力格相關聯。例如，該格處理器316可操作以決定哪個(些)PSU與其(等)相對應的電力格相關聯。該記憶體324可操作以暫時地或持續地保持資料或其他資訊。在一實施例中，該記憶體324可包括一緩衝器，

用以接收來自該(等)PSU、該系統管理器，或其等之任何組合的資訊。在另一實施例中，該記憶體324可包括可被該格處理器316所使用的資料或其他資訊，諸如指令。還有另一實施例中，該記憶體324可包括服務不同功能的不同部分。

- 5 第4圖包括可被用於這裏所描述的任何或所有該等 PSU 的一 PSU 422之一功能方塊圖。該通訊模組414可操作以自該 PSU 422發送信號到該控制模組(例如，控制模組 202)，並自該控制模組接收信號給該 PSU 422。該通訊模組 414還可操作以自該 PSU 422發送信號到一系統管理器(例如，該系統管理器160)，並自該系統管理器接收信號給該 PSU 422。該 PSU 處理器416可操作以處理自該控制模組、該系統管理器、記憶體424，或其等之任何組合所接收之資料或其他資訊。例如，該 PSU 處理器416可操作以執行被用於實行稍後於此說明書中更詳細地被描述之方法的指令。
- 10 該 PSU 處理器416可進一步操作以決定來自 PSU 422的多少電力要被提供給該系統電力(例如，該系統電力140)。該記憶體424可操作以暫時地或持續地保持資料或其他資訊。在一實施例中，該記憶體424可包括一緩衝器，用以接收來自該控制模組、該系統管理器，或其等之任何組合的資訊。
- 15 在另一實施例中，該記憶體424可包括可被該 PSU 處理器 416所使用的資料或其他資訊，諸如指令。還有另一實施例中，該記憶體424可包括服務不同功能的不同部分。
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就該控制模組302、該 PSU 422或其二者而言，無論是被發送或是被接收之信號可簡單的是一單一信號(例如，一

單一基準位元)或是以一位元組、一字、一更多複雜通訊或其他資訊形式的信號之集合。在另一實施例中，更多、更少或不同的模組可被使用。一個模組的功能可與另一模組的功能相組合，或可被分開到不同模組之間。例如，在該

5 控制模組302、該PSU 422或其二者之內，該通訊模組可包括一個可操作以發送信號的通訊模組，及另一用以接收模組的通訊模組。多於一個的通訊模組可被用於不同的匯流排或介面。例如，該PSU 422內的該通訊模組414可包括一個可操作以與一控制模組進行通訊的通訊模組，及另一用以與其他PSU進行通訊的通訊模組。該格處理器316可以是

10 監視或控制該控制模組302要控制的該等電力格的一較大模組之部分。該等模組可包括以硬體、韌體、軟體或其等之任何組合之邏輯。

第5和6圖說明使用一種可與一個或多個資訊處置系統

15 (例如，該資訊處置系統100)一起被使用的一電力分配系統(例如，該電力分配系統250)之方法的一流程圖。該方法可全部地或部分地被第2圖中所說明的該電力分配系統250、第1圖中所描述的該資訊處置系統100，或可操作以使用如第5和6圖中所說明之方法的任何其他類型的資訊處置或電

20 力分配系統來使用。此外，該方法可以可操作以提供第5和6圖之所有或部分方法的各種類型的編碼邏輯被實施，包括軟體、韌體、硬體或其他形式的數位儲存媒體或邏輯，或其等之任何組合。儘管如第5和6圖中所說明之方法的大部分關於第2圖被描述，但在閱讀此說明書之後，本技術領域

技工將瞭解，許多其他組態可被使用。因此，該等圖式(諸如，第2、5和6圖)是要幫助理解特定實施例，而非限制本發明之範圍。

在第5圖中方塊502處，該資訊處置系統電力開啟且該
5 控制模組啟動。在方塊504處，該方法可包括藉由該控制模
組偵測PSU的出現。在一實施例中，該控制模組內之一偵
測模組偵測該等PSU。參考第2圖，該控制模組202內之該
偵測模組將偵測PSU 222、224、226、242、244和246。該
等PSU的識別符可此時被發送到該控制模組202或由該控
10 制模組202獲取，或可稍後被發送到該控制模組202或由該
控制模組202獲取。然而，在該流程中之此點處，該控制模
組202可能並不知道哪些PSU可得以被耦接到哪些電力格。

在一實施例中，該控制模組202可具有或自一具有關於
該等被偵測PSU之資訊的組態檔案獲取資訊。該組態檔案
15 可包括哪個PSU佔用該電力分配系統內的哪個槽或其他位
置。在一特定實施例中，接收第一識別啟動命令的該首先
選定的PSU可以是佔用該電力分配系統內的第一槽或最低
槽之PSU，且接收下一個識別啟動命令的該下一個選定的
PSU可以是該電力分配系統內的下一個未被映射的槽或當
20 下的最低槽之PSU。還有另一實施例中，該順序可被反向(例
如，自佔用該電力分配系統內的最後槽或最高槽開始)，或
自未被映射的PSU中隨機地來選擇。

該方法還可包括以下步驟：在方塊522處，發送一識別
啟動命令，以藉由一特定的未被映射的PSU啟動一相對應

識別命令。參考第2圖，該控制模組202可發送該識別啟動命令到該PSU 222以啟動該相對應識別命令。在另一實施例中，一不同的PSU可被選取。在一特定實施例中，該控制模組202之通訊模組和該PSU 222之通訊模組可被使用。

- 5 該方法可進一步包括以下步驟：在方塊524處，發送由該特定的未被映射的PSU之該等相位所運送的該相對應識別命令。參考第2圖，回應於接收到來自該控制模組202的該識別啟動命令而啟動該相對應識別命令，該PSU 222可發送該相對應識別命令，其由被耦接到該PSU 222之該等相位
- 10 所運送(更特定地，由相位A和相位B所運送)。由相位A所運送的該相對應識別命令可被路由經過該PDU 228到達該PSU 224，且由相位B所運送的該相對應識別命令可被路由經過該PDU 228到達該PSU 226。在一特定實施例中，該PSU 222的通訊模組可發送該相對應識別命令，且該等PSU 224
- 15 和226之通訊模組可接收該相對應識別命令。

- 該方法可又進一步包括以下步驟：在第6圖中方塊626處，自該(等)其他的PSU發送識別確認信號，回應於該相對應識別命令。參考第2圖，在接收到來自該PSU 222的該相對應識別命令之後，該等PSU 224和226可發送識別確認信
- 20 號給該控制模組202。在一特定實施例中，該等PSU 224和226的通訊模組可發送該等識別確認信號，且該控制模組202的接收模組可接收該等識別確認信號。該方法更進一步包括以下步驟：在方塊628處，使用該特定的未被映射的PSU映射該(等)其他的PSU以在相同的電力格上。該控制模

組202發送該識別啟動命令到PSU 222並接收來自PSU 224和226的識別確認信號。在一特定實施例中，該控制模組202的格處理器決定該等PSU 222、224和226在相同的電力格上。

- 5 該等命令、信號或其等之任何組合之特定協定並非關鍵。該等命令、信號或其等之任何組合之協定可以是通用電力匯流排(UPB)信號、X10信號、電力線寬頻信號、消費電子匯流排(CEBUS)信號、其他適當的通訊協定，或其等之任何組合。更特定地，任何可被用以在一被選PSU和其
- 10 他PSU之間發送命令、信號或其等之任何組合的協定可被使用。可被用以在該控制模組和被耦接到該控制模組的該等PSU之間發送命令、信號或其等之任何組合的協定可以使用任何前述協定或通常被用於資訊處置系統之間或之中的其他協定。相同的協定或不同的協定可被用於該方法的不同部分。
- 15

- 在該等不同相位之間，該等命令、信號或其等之任何組合的特定順序並非關鍵。該相對應識別命令自該PSU 222發送並被該PSU 226接收，在該相對應識別命令被PSU 224接收之前，或反之亦然。同樣地，該識別確認信號可自該
- 20 PSU 224被發送並被該控制模組202接收，在該識別確認信號自該PSU 226被發送或被該控制模組202接收之前，或反之亦然。還有另一實施例中，該相對應識別命令可被該PSU 224接收且該識別確認信號可由該PSU 224發送，在該相對應識別命令被發送到該PSU 226或被該PSU 226接收之前，

或反之亦然。

從PSU 222到PSU 224和226的該相對應識別命令可以幾乎任何相位角被發送。在一特定實施例中，該相對應識別命令可以 0° 或接近 0° 或者 180° 的倍數的相位角被發送。然而，該相對應識別命令可以其他相位角被發送，包括 90° 、 270° 等。由該相位A和相位B所運送的該相對應識別命令可實質上同時或在不同時間出現。

在第5圖之方塊522處之該控制模組發送該信號和在第6圖之方塊626處之該控制模組接收該相對應識別信號之間的一暫停時期(time-out period)可被使用。該暫停時期可以是幾乎任何時間，且在一實施例中小於一分鐘。在另一實施例中，該暫停時期可以是9秒、5秒、2秒或另一適當的時間。在一實施例中，該時間可以小於1秒且短到幾毫秒。該控制模組可包括一時間機制，可以被該格處理器之部分或該格處理器所使用。在該暫停時期之後，該格處理器決定任何未接收該相對應識別命令或未發送該識別確認信號返回給該控制模組的PSU不是該特定電力格之部分、是不可操作的、離線的、處於初始化狀態的，或因其他無法利用的。

該方法還包括以下步驟：在決定642處，決定是否有任何仍未被映射的PSU。參考第2圖，PSU 242、244和246尚未被映射到一電力格(判定方塊642的“是”分支)。該方法可更進一步包括以下步驟：在方塊644處，選擇另一未被映射的PSU用於該映射順序。

該方法返回到第5圖之方塊522處，並對餘下可得的該等PSU重複方塊522、524、626、628和判定方塊642中的識別順序。例如，該控制模組202可發送一識別啟動命令到PSU 242，該PSU 242接著發送由相位D和相位E所運送的該相對應識別命令，該相對應識別命令被PSU 244和246接收。依該等PSU 244和246之可用性而定，PSU 244和246中每一個可發送一識別確認信號到該控制模組202。在一特定實施例中，該控制模組內的格處理器可決定PSU 242、244和246是相同的電力格之部分，不同於PSU 222、224和226之電力格。照這樣，當該PSU 242是所選定的PSU時，該控制模組202可能未接收到來自該等PSU 222、224和226的一相對應識別信號。在判定方塊642處，在所有PSU都已經被映射之後(菱形方塊642的“否”分支)，該方法結束。

在閱讀本說明書之後，本技術領域技工瞭解，不同的組配細節可被使用。例如，當執行該映射順序時，主從(slave/master)組態可被使用。在一特定實施例中，該選定的PSU可以是一主動者，而該等其他的PSU可以是該選定PSU 222之從動者。在另一實施例中，對該選定PSU 222的該識別啟動命令還可包括用於選擇PSU 222以使其進入一廣播模式之指令，且該控制模組202還可發送信號到該等其他的PSU(無論在相同或不同的電力格上)，以使其等進入一聆聽模式。要注意，該廣播/聆聽模式和主從指定是可選擇的。

在該等PSU已經被映射到該等電力格之後，關於該電

力格的資訊可被該電力分配系統、該(等)資訊處置系統或其等之任何組合所使用。在一特定實施例中，一資訊處置系統可具有一N+N個電力格冗餘政策，而且因此，可能需要至少兩個PSU於兩個不同的電力格的每一個上(總共至少4
5 個PSU)。該電力分配系統的控制模組或該資訊處置系統的系統管理器可使用該資訊，以決定在不同的電力格上是否有足夠的PSU是可用的以滿足該政策。在另一特定實施例中，一資訊處置系統可具有一N+1個PSU冗餘政策。該電力分配系統的控制模組或該資訊處置系統的系統管理器可使
10 用該資訊，以決定是否足夠的PSU是可用的以滿足該政策。

在又另一實施例中，該電力格資訊，包括該PSU映射可被該電力分配系統之控制模組或該資訊處置系統之系統管理器所使用以決定哪些PSU要啟動或停用，或者，若被啟動的話，該等PSU個別或全體要產生多少電力。該資訊
15 處置系統之系統電力可自該等PSU接收適當量的電力。在另一實施例中，多數個資訊處置系統可被耦接到該電力分配系統。該資訊處置系統之該等系統管理器可提供該電力分配系統之控制模組關於所需電力和電力冗餘政策的資訊或其他資料，若有的話。該電力分配系統之控制模組可處
20 理該資訊或其他資料以允許更多可靠電力被提供給由該電力分配系統供電的該等資訊處置系統。

在一實施例中，該控制模組可彼此獨立地管理該等電力格。該控制模組還可發送關於該電力分配系統之驗證和管理的資訊或關於該電力分配系統的其他適當的資訊到一

系統管理器。同樣地，該控制模組可使該電力分配系統內的該等電力格能夠被管理、修改或兩個皆可。

如在此所描述之該等概念可被擴展到其他修改。該方法並不被電力格、PDU、PSU的數目，或外部電力來源的數目所限制。多於兩個的外部電力來源可被使用，且該等外部電力來源可提供交流電流或直流電流。此外，耦接可以是直接或間接的，且可包括連接(例如，由導體連接，不用任何中介切換器或其他電子元件)。

在一實施例中，該電力分配系統之控制模組可同時發送多數個識別啟動命令到不同的PSU，或者可在關於一較早識別啟動命令的一映射順序已經完成之前發送一較晚識別啟動命令到一PSU。在此特定實施例中，用於選擇PSU的一預定次序可被使用。例如，識別啟動命令可自該控制模組被發送，並被耦接到該電力分配系統之最低或第一槽的該等PSU接收(例如，被該等PSU 222和242接收)。

如這裏所描述之該等系統和方法是有用的、可擴展的且不易產生人為錯誤的。電力供應單元可被互換，而不必擔心手動地映射PSU或特定的佈線方案以連接到一資訊處置系統之特定的電力格。該等電源可被外掛或者被耦接到該控制模組和一PDU。當該系統被開啟電源時，一電力分配系統之該控制模組可執行一種自動地偵測PSU並映射該等PSU到其等相對應的電力格之方法。

許多不同的層面和實施例是可能的。該等層面和實施例中的一些被描述於下。在閱讀此說明書之後，本技術領

域技工將瞭解該等層面和實施例僅是說明性的，而並不限制本發明之範圍。

在一第一層面中，一種使用一電力供應格之方法可包括以下步驟：自一控制模組發送一第一識別啟動命令被一
5 第一電力供應單元接收，用以啟動一第一相對應識別命令，其中該第一電力供應單元具有一第一電力供應單元識別符。該方法還可包括以下步驟：自該第一電力供應單元發送該第一相對應識別命令被一第二電力供應單元接收，其中該第一相對應識別命令由一第一電源相運送。該方法
10 可進一步包括以下步驟：自該第二電力供應單元發送被該控制模組接收的一第一識別確認信號，以回應該第一相對應識別命令，其中該第一識別確認信號包括該第二電力供應單元之一第二電力單元識別符。

在該第一層面之一實施例中，該方法可進一步包括以下
15 步驟：自該第一電力供應單元發送該第一相對應識別命令被一第三電力供應單元接收，其中該第一相對應識別命令由一第二電源相運送。該方法可又進一步包括以下步驟：自該第三電力供應單元發送被該控制模組接收的一第二識別確認信號，以回應第一相對應識別命令，其中該第
20 二識別確認信號包括該第三電力供應單元之一第三電力單元識別符。在一特定實施例中，該方法可進一步包括以下步驟：映射該第一電力供應單元、該第二電力供應單元和該第三電力供應單元到一第一電力格。在一更特定實施例中，該第一電力供應單元、該第二電力供應單元和該第三

電力供應單元的每一個可包括一單相電力供應單元。

在該第一層面之另一實施例中，發送該第一相對應識別命令可包括：路由該第一相對應識別命令經過一電力分配單元。在一特定實施例中，該方法可進一步包括以下步驟：在該第一電力供應單元和該第二電力供應單元處接收來自一外部電力來源之電力，經由該電力分配單元。

該第一層面還有另一實施例中，該方法可進一步包括以下步驟：並不自一第三電力供應單元接收任何識別確認信號。該方法還可進一步包括以下步驟：自該控制模組發送一第二識別啟動命令被一第三電力供應單元接收，用以啟動一第二相對應識別命令，其中該第三電力供應單元具有一第三電力供應單元識別符，自該第三電力供應單元發送該第二相對應識別命令被一第四電力供應單元接收，其中該第二相對應識別命令由一第三電源相運送，及自該第四電力供應單元發送被該控制模組接收的一第二識別確認信號，以回應該第二相對應識別命令，其中該第二識別確認信號包括該第四電力供應單元之一第四電力單元識別符。在一特定實施例中，該方法可進一步包括以下步驟：映射該第一電力供應單元和該第二電力供應單元到一第一電力格，且映射該第三電力供應單元和第四電力供應單元到不同於該第一電力格的一第二電力格。在一更特定的實施例中，該方法可進一步包括以下步驟：偵測哪些電力供應單元被耦接到該控制模組，及決定是否所有已經被該控制模組偵測到的電力供應單元都已經被映射。

在一第二層面中，一控制模組可包括一格處理器和一通訊模組。該格處理器可操作以啟動一識別程序，使用出現在一電力格內的三個可用相位之一特定相位，並處理在該等三個可用相位之該特定相位上所接收之電力供應單元識別符。該通訊模組可操作以發送一識別啟動命令到一第一電力供應單元，用以該第一電力供應單元發送要由一第一電源相運送之一第一相對應識別命令。該通訊模組可進一步操作以自一第二電力供應單元接收一第一識別確認信號，其中該第一識別確認信號包括一第二電力供應單元識別符。

在該第二層面之一實施例中，該格處理器可進一步操作對由該通訊模組所發送或接收之通訊，以映射哪些電力供應單元與一電力格相關聯。在一特定實施例中，該通訊模組可進一步包括一偵測模組，其可操作以偵測哪些電力供應單元被耦接到該控制模組，其中該格處理器進一步操作以決定一被偵測電力供應單元是否未被映射。在另一實施例中，該識別啟動命令還可對該第一電力供應單元命令該第一電力供應單元以發送要由一第二電源相運送之一第二相對應識別命令，且該通訊模組可進一步操作以自一第三電力供應單元接收一第二識別確認信號，其中該第二識別確認信號包括一第三電力供應單元識別符。在另一特定實施例中，該第一電源相和該第二電源相是不同的相位。

在一第三層面中，一電力分配系統可包括一具有一第一通訊模組之控制模組和一被耦接到該控制模組之第一電

力供應單元。該第一電力供應單元可包括可操作以接收由該控制模組發送的一第一命令且發送由一電源相運送的一相對應識別命令之一第二通訊模組。該電力分配系統可進一步包括被耦接到該控制模組之一第二電力供應單元。該

5 第二電力供應單元可包括可操作以自該第一電力供應單元接收該相對應識別命令，並發送一識別確認信號到該控制模組以回應接收該相對應識別命令之一第三通訊模組。

在該第三層面之一實施例中，該電力分配系統可進一步包括被耦接到該第一電力供應單元和該第二電力供應單元之一第一電力分配單元，其中該第一電力分配單元可操作以允許該相對應識別命令被路由經過該第一電力分配單元。在一特定實施例中，該電力分配系統可進一步包括被耦接到該控制模組之一第三電力供應單元、被耦接到該控制模組之一第四電力供應單元，以及被耦接到該第三電力

10 供應單元和該第四電力供應單元之一第二電力分配單元。在一更特定實施例中，該第一電力供應單元、第二電力供應單元和該第一電力分配單元與一第一電力格相關聯，且該第三電力供應單元、該第四電力供應單元和該第二電力分配單元與一第二電力格相關聯。在一更加特定的實施例

15 中，該電力分配系統可進一步包括一N+N組態。在另一實施例中，該電力分配系統可進一步包括一資訊處置系統，該資訊處置系統包括一可操作以接收自包括該第一電力供應之一電力格的輸入電力之輸入電力來源，及可操作以使用該輸入電力的電子元件。

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在此所描述的該等實施例之說明書和圖解企圖提供對各種實施例結構的一般理解。該說明書和圖解並不企圖作為使用這裏所描述的結構和方法之設備和系統的所有元件和特徵之詳盡且全面的描述。在檢閱該揭露之後，許多其他實施例對於該技藝中具有通常知識者來說可能是顯然的。其他實施例可被使用或自該揭露中獲得，藉此一結構替換、邏輯替換或其他改變可被進行，而並不脫離本發明之範圍。因此，本揭露要被視為說明性的而非限制性的。

為了清楚，以分離的實施例為背景在此所描述的某些特徵也可被提供於單一實施例之組合中。相反地，為了簡潔，以單一實施例為背景在此所描述的各種特徵也可分離地或在子組合中被提供。進一步，指定範圍內的參考值包括該範圍內的每一(each)值和全部(every)值。

利益、其他優勢及問題的解決方案已經在上文中關於特定的實施例被描述。然而，該等利益、優勢、問題的解決方案，以及可引起任何利益、優勢或解決方案發生或變得更加明顯的任何特徵，並不被解釋為任何或所有申請專利範圍的關鍵、必須或本質的特徵。

上文所揭露之標的要被認為是說明性的而並非限制性的，且該等附加申請專利範圍企圖涵蓋落入本發明之範圍內的任何或所有此類修改、提高和其他實施例。因此，為了最大化法律所允許的範圍，本發明之範圍要由以下申請專利範圍之最廣泛可允許的解譯及其等效物來決定，且不應被前述詳細描述所限定或限制。

【圖式簡單說明】

第1圖包括一資訊處置系統之一功能方塊圖，該資訊處置系統包括一電力分配系統的。

第2圖包括可被使用在第1圖之該資訊處置系統中的一電力分配系統之一功能方塊圖。

第3圖包括可被使用在第2圖之該電力分配系統中的一控制模組之一功能方塊圖。

第4圖包括可被使用在第2圖之該電力分配系統中的一電力供應單元之一功能方塊圖。

第5和6圖包括一種映射電力供應單元到該電力分配系統內的不同電力格的方法之一流程圖。

【主要元件符號說明】

100…資訊處置系統	128…視訊顯示輸出
102…第一實體處理器	130…I/O介面
104…第一主機匯流排	132…磁碟控制器
106…第n實體處理器	134…硬碟機(HDD)
108…第二主機匯流排	136…光碟機(ODD)
110…晶片組	140…系統電力
112…記憶體	142…電力層
114…第三主機匯流排	144…電力電纜
120…I/O匯流排	150…電力分配系統
122…視訊圖形介面	160…系統管理器
124…第四主機匯流排	162…第一通訊匯流排
126…視訊顯示單元	164…第二通訊匯流排

200...底盤	316...格處理器
202...控制模組	324...記憶體
220、240...外部電力	422...PSU
221、241...隔離方塊	414...通訊模組
222、224、226...電力供應單元(PSU)	416...PSU處理器
228、248...電力分配單元(PDU)	424...記憶體
242、244、246...電力供應單元(PSU)	502~524...方塊
250...電力分配系統	626、628...方塊
302...控制模組	642...決定、菱形
312...偵測模組	644...方塊
314...通訊模組	

五、中文發明摘要：

一種使用一電力供應格之方法可包括以下步驟：自一控制模組發送一識別啟動命令到一第一電力供應單元，以啟動一相對應識別命令。該方法還可包括以下步驟：自該第一電力供應單元發送一識別命令到其他使用與該第一電力供應相同的一電源相而被供應電力的電力供應單元。該方法可進一步包括以下步驟：自該(等)其他電力供應單元發送識別確認信號到該控制模組，以回應該第一相對應識別命令。在一實施例中，該方法可包括以下步驟：映射哪些電力供應單元相對應到不同的電力供應格。在其他實施例中，控制模組和電力分配系統可操作以執行該等方法之部分。

六、英文發明摘要：

A method of employing a power supply grid can include transmitting an identification initiation command from a control module to a first power supply unit to initiate a corresponding identification command. The method can also include transmitting an identification command from the first power supply unit to other power supply unit(s) that are supplied with power using a power supply phase in common with the first power supply. The method can further include transmitting identification acknowledgement signal(s) from the other power supply unit(s) to the control module in response to the first corresponding identification command. In one embodiment, the method can include mapping which power supply units correspond to various power supply grids. In other embodiments, control modules and power distribution systems can be operable to perform portions of the methods.

十、申請專利範圍：

1. 一種使用一電力供應格之方法，包含以下步驟：

自一控制模組發送一第一識別啟動命令，其被一第一電力供應單元接收，以啟動一第一相對應識別命令，其中該第一電力供應單元具有一第一電力供應單元識別符；

自該第一電力供應單元發送該第一相對應識別命令，其被一第二電力供應單元接收，其中該第一相對應識別命令由一第一電源相運送；及

自該第二電力供應單元發送被該控制模組接收的一第一識別確認信號，以回應於該第一相對應識別命令，其中該第一識別確認信號包括該第二電力供應單元之一第二電力單元識別符。

2. 如申請專利範圍第1項所述之方法，其進一步包含以下步驟：

自該第一電力供應單元發送該第一相對應識別命令，其被一第三電力供應單元接收，其中該第一相對應識別命令由一第二電源相運送；及

自該第三電力供應單元發送被該控制模組接收的一第二識別確認信號，以回應於第一相對應識別命令，其中該第二識別確認信號包括該第三電力供應單元之一第三電力單元識別符。

3. 如申請專利範圍第2項所述之方法，其進一步包含以下步驟：映射該第一電力供應單元、該第二電力供應單元

和該第三電力供應單元到一第一電力格。

4. 如申請專利範圍第3項所述之方法，其中該第一電力供應單元、該第二電力供應單元和該第三電力供應單元的每一個包括一單相電力供應單元。
5. 如申請專利範圍第1項所述之方法，其中發送該第一相對應識別命令包含，路由該第一相對應識別命令經過一電力分配單元。
6. 如申請專利範圍第5項所述之方法，其進一步包含以下步驟：在該第一電力供應單元和該第二電力供應單元處接收來自一外部電力來源之電力，經由該電力分配單元。
7. 如申請專利範圍第1項所述之方法，其進一步包含以下步驟：

並不自一第三電力供應單元接收任何識別確認信號；

自該控制模組發送一第二識別啟動命令，其被一第三電力供應單元接收，以啟動一第二相對應識別命令，其中該第三電力供應單元具有一第三電力供應單元識別符；

自該第三電力供應單元發送該第二相對應識別命令，其被一第四電力供應單元接收，其中該第二相對應識別命令由一第三電源相運送；及

自該第四電力供應單元發送被該控制模組接收的一第二識別確認信號，以回應於該第二相對應識別命

令，其中該第二識別確認信號包括該第四電力供應單元之一第四電力單元識別符。

8. 如申請專利範圍第7項所述之方法，其進一步包含以下步驟：

映射該第一電力供應單元和該第二電力供應單元到一第一電力格，且映射該第三電力供應單元和第四電力供應單元到不同於該第一電力格的一第二電力格。

9. 如申請專利範圍第8項所述之方法，其進一步包含以下步驟：

偵測哪些電力供應單元被耦接到該控制模組；及
決定是否所有已經被該控制模組偵測到的電力供應單元都已經被映射。

10. 一種控制模組，包含：

一格處理器，操作來進行下列動作：

啟動一識別程序，使用出現在一電力格內的三個可用相位之一特定相位；及

處理在該等三個可用相位之該特定相位上所接收之電力供應單元識別符；及

一通訊模組，操作來進行下列動作：

發送一識別啟動命令到一第一電力供應單元，以使該第一電力供應單元發送要由一第一電源相運送之一第一相對應識別命令；及

自一第二電力供應單元接收一第一識別確認信號，其中該第一識別確認信號包括一第二電力供應單

元識別符。

11. 如申請專利範圍第10項所述之控制模組，其中該格處理器進一步操作來進行下列動作：根據由該通訊模組所發送或接收之訊息，映射哪些電力供應單元與一電力格相關聯。

12. 如申請專利範圍第11項所述之控制模組，進一步包含一偵測模組，其操作來進行下列動作：偵測哪些電力供應單元被耦接到該控制模組，其中該格處理器進一步操作來進行下列動作：決定一被偵測電力供應單元是否未被映射。

13. 如申請專利範圍第10項所述之控制模組，其中：

該識別啟動命令也命令該第一電力供應單元發送要由一第二電源相運送之一第二相對應識別命令；及

該通訊模組進一步操作來進行下列動作：自一第三電力供應單元接收一第二識別確認信號，其中該第二識別確認信號包括一第三電力供應單元識別符。

14. 如申請專利範圍第13項所述之控制模組，其中該第一電源相和該第二電源相是不同的相位。

15. 一種電力分配系統，包含：

一控制模組，其包括一第一通訊模組；

一第一電力供應單元，其被耦接到該控制模組，其中該第一電力供應單元包括一第二通訊模組，操作來進行下列動作：

接收由該控制模組發送的一第一命令；及

發送由一電源相運送的一相對應識別命令；及
一第二電力供應單元，其被耦接到該控制模組，其中該第二電力供應單元包括一第三通訊模組，操作來進行下列動作：

自該第一電力供應單元接收該相對應識別命令；及

發送一識別確認信號到該控制模組，回應於接收該相對應識別命令。

16. 如申請專利範圍第15項所述之電力分配系統，其進一步包含被耦接到該第一電力供應單元和該第二電力供應單元之一第一電力分配單元，其中該第一電力分配單元操作來進行下列動作：允許該相對應識別命令被路由經過該第一電力分配單元。

17. 如申請專利範圍第16項所述之電力分配系統，其進一步包含：

被耦接到該控制模組之一第三電力供應單元；

被耦接到該控制模組之一第四電力供應單元；及

被耦接到該第三電力供應單元和該第四電力供應單元之一第二電力分配單元。

18. 如申請專利範圍第17項所述之電力分配系統，其中：

該第一電力供應單元、第二電力供應單元和該第一電力分配單元與一第一電力格相關聯；及

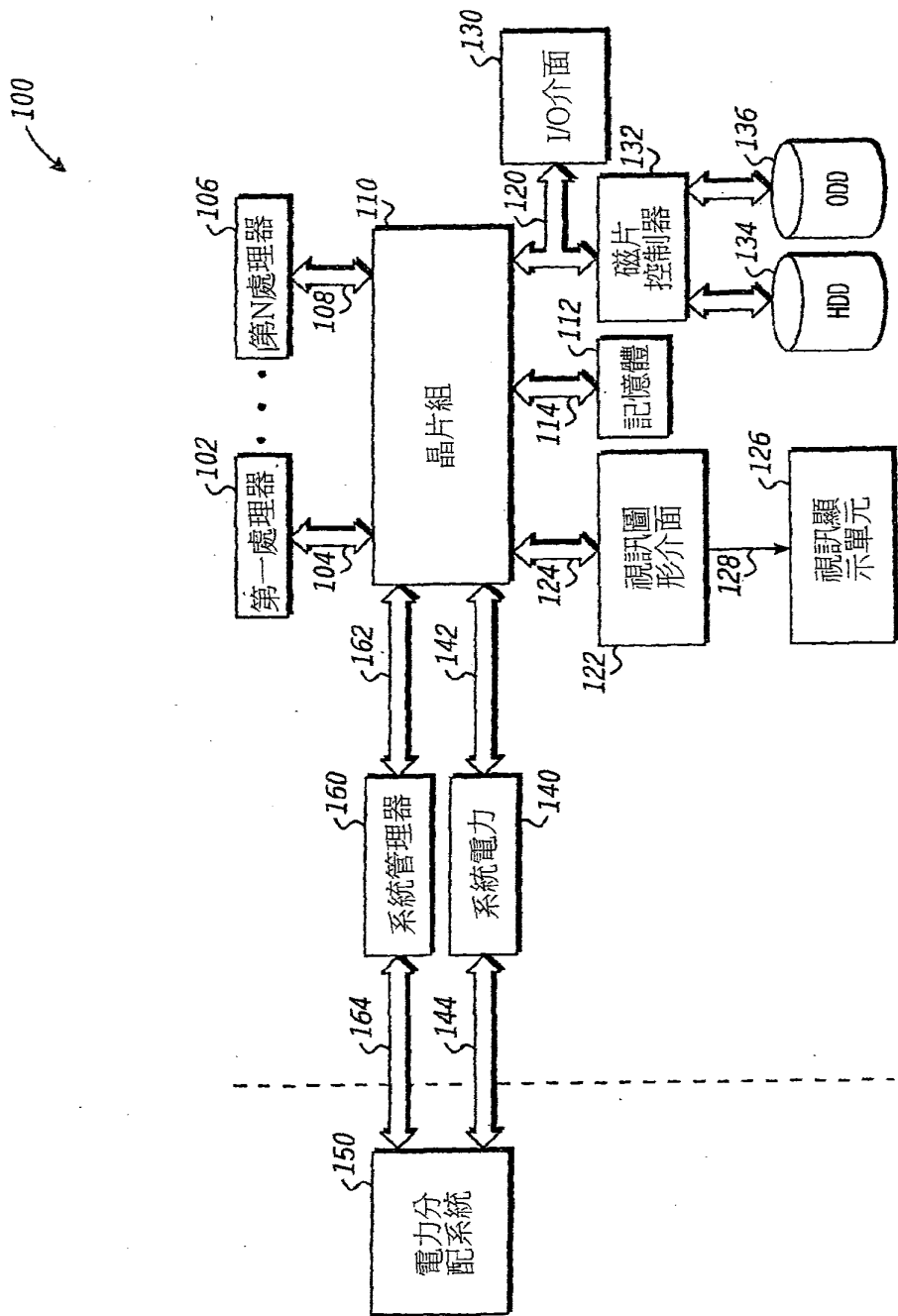
該第三電力供應單元、該第四電力供應單元和該第二電力分配單元與一第二電力格相關聯。

19. 如申請專利範圍第18項所述之電力分配系統，其進一步包含一N+N組態。

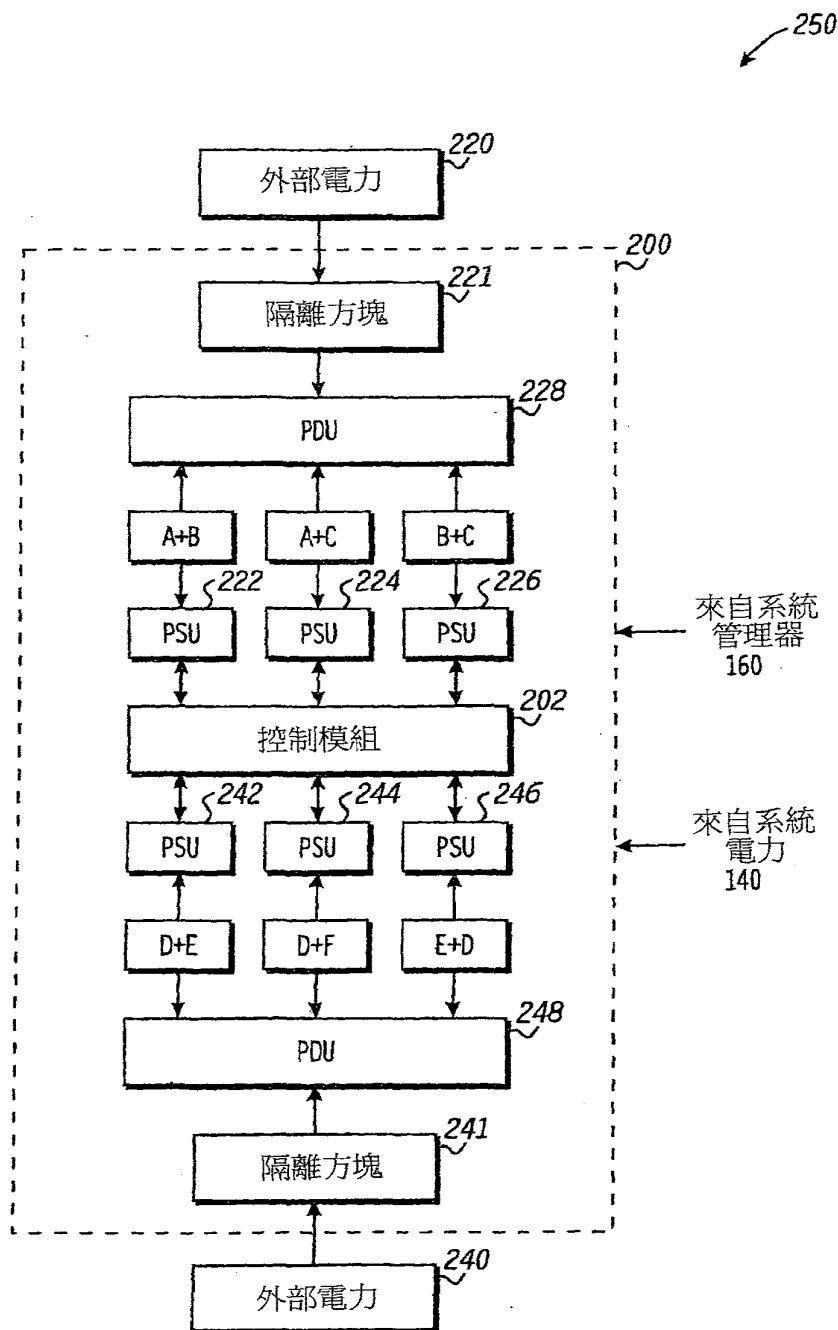
20. 如申請專利範圍第15項所述之電力分配系統，其進一步包含一資訊處置系統，該資訊處置系統包括：

可操作來接收由具有該第一電力供應的一電力格之輸入電力之一輸入電力來源；及

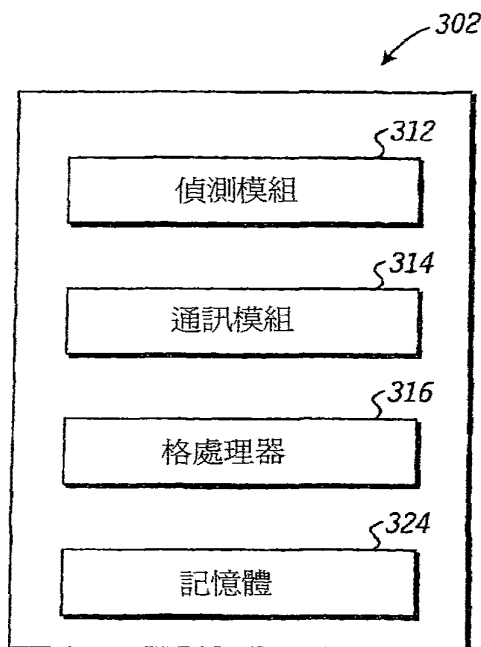
可操作以使用該輸入電力的電子元件。



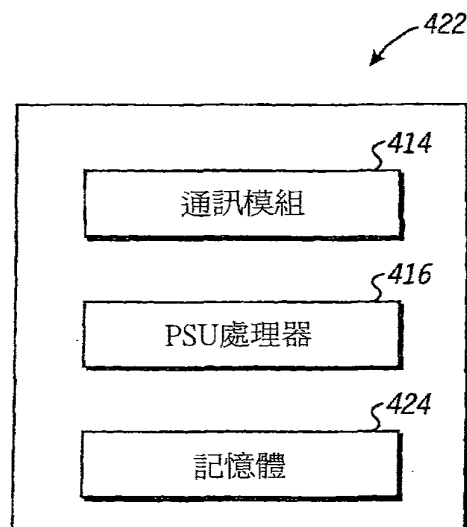
第 1 圖



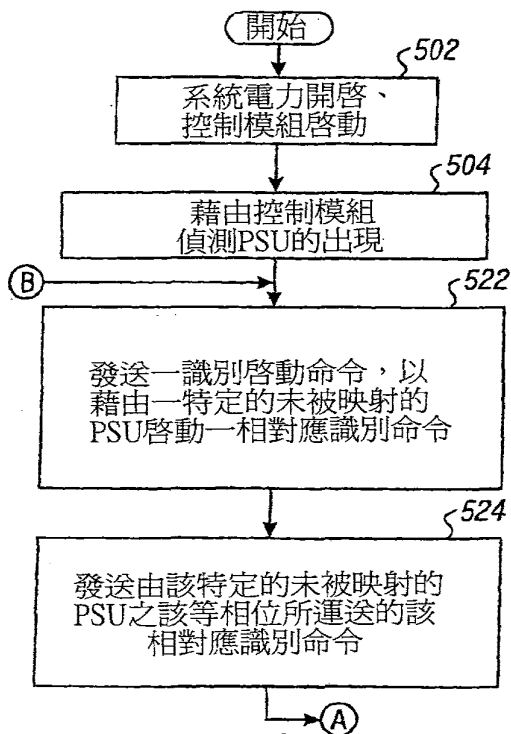
第 2 圖



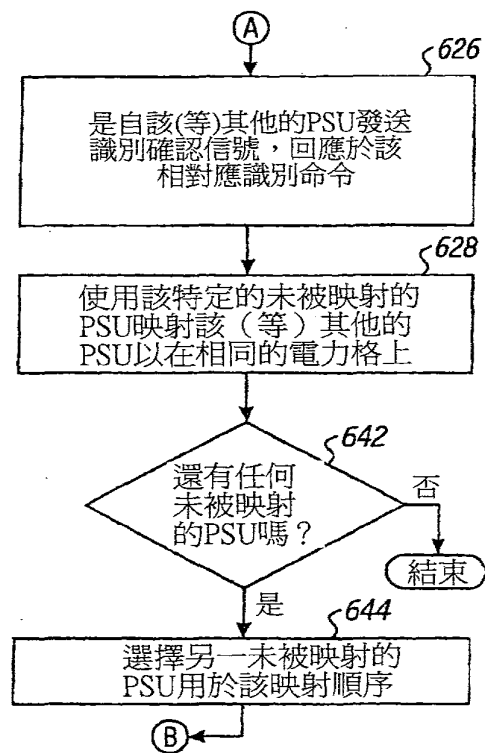
第 3 圖



第 4 圖



第 5 圖



第 6 圖

七、指定代表圖：

(一)本案指定代表圖為：第 (5) 圖。

(二)本代表圖之元件符號簡單說明：

502~524...方塊

八、本案若有化學式時，請揭示最能顯示發明特徵的化學式：

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Frank Bou-Kain Yang/Sarah Glenn			
Attorney Docket Number:	8029P150			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
Total in USD (\$)				180

Electronic Acknowledgement Receipt

EFS ID:	18037389
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	65702
Filer:	Frank Bou-Kain Yang
Filer Authorized By:	
Attorney Docket Number:	8029P150
Receipt Date:	27-JAN-2014
Filing Date:	11-DEC-2009
Time Stamp:	22:29:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 180
RAM confirmation Number	8601
Deposit Account	192555
Authorized User	

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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)	25732IDS.pdf	182076	no	2
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3	Foreign Reference	JP-2005-217799.pdf	900367	no	26
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8	Fee Worksheet (SB06)	fee-info.pdf	30561 da0d4947bcd42465fa24e01f8de6348738b54e2a	no	2
Warnings:					
Information:					
Total Files Size (in bytes):				33086478	
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:



Practitioners associated with Customer Number:

120363

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:



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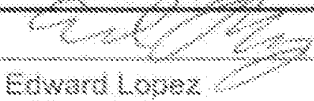
☐	Firm or Individual Name			
☐	Address			
☐	City	State	Zip	
☐	Country			
☐	Telephone	Email		

Assignee Name and Address: Silicon Image, Inc.
1140 East Argue Avenue
Sunnyvale, CA 94085

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTOIAIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	JANUARY 13, 2014
Name	Edward Lopez	Telephone	408-616-4177
Title	Chief Legal Officer		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, reviewing, 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 1480, Alexandria, VA 22313-1480. (DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1480, Alexandria, VA 22313-1480.

If you need assistance in completing the form, call 1-800-PTO-5199 and select option 2.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: Dongyun Lee et al.Application No./Patent No.: 12/636,063 Filed/Issue Date: 12/11/2009Titled: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)Silicon Image, Inc., a Corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Dongyun Lee et al. To: Synerchip Co. Ltd.The document was recorded in the United States Patent and Trademark Office at
Reel 024321, Frame 0918, or for which a copy thereof is attached.2. From: Synerchip Co., Ltd. To: Silicon Image, Inc.The document was recorded in the United States Patent and Trademark Office at
Reel 029451, Frame 0939, or for which a copy thereof is attached.

[Page 1 of 2]

This collection of information is required by 37 CFR 3.73(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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
 Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Dohyun Ahn/

Signature

Dohyun Ahn

Printed or Typed Name

Jan. 23, 2014

Date

63,237

Title or Registration 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.

Electronic Acknowledgement Receipt

EFS ID:	18023453
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	65702
Filer:	Dohyun Ahn/Sarah Glenn
Filer Authorized By:	Dohyun Ahn
Attorney Docket Number:	8029P150
Receipt Date:	24-JAN-2014
Filing Date:	11-DEC-2009
Time Stamp:	18:26:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	SIMG_Executed_POA_80.pdf	244840 f27f330bae48eee8fdbc4211f95b335b3b230cdc	no	1

Warnings:

Information:

2	Assignee showing of ownership per 37 CFR 3.73.	25732_Form_373.pdf	132539 8f76bd849debd7b7f0558a15f1fb4bff9c591fed	no	3
Warnings:					
Information:					
Total Files Size (in bytes):				377379	
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					



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.
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12/636,063

12/11/2009

Dongyun Lee

8029P150

1550

65702

7590

12/24/2013

SILICON IMAGE/BSTZ

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP

1279 OAKMEAD PARKWAY

SUNNYVALE, CA 94085-4040

EXAMINER

DANG, KHANH

ART UNIT

PAPER NUMBER

2111

MAIL DATE

DELIVERY MODE

12/24/2013

PAPER

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.

Supplemental Notice of Allowability	Application No. 12/636,063	Applicant(s) LEE ET AL.	
	Examiner KHANH DANG	Art Unit 2111	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/23/2013.
☐ 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 13-16, 18, 19 and 22-25. 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) | 5. ☐ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>20131114</u> | 6. ☐ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/Khanh Dang/
Primary Examiner, Art Unit 2111

Substitute for form 1449A/PTO SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	Complete if Known	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	DANG, KHANH
Sheet 1 of 2		Attorney Docket No: 8029P150

US PATENT DOCUMENTS					
Examiner Initial *	Cite No ¹	USP Document Number	Publication or Issue Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No ¹	Foreign Patent Document Country Code/Number/Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
	A1	KR-10-2005-0012310	02/02/2005	LG Electronics Inc.,		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A2	"Introduction to DiiVA Designed Specifically for Home Entertainment Networking," DiiVA Licensing LLC, 2010, 4 pages	
	A3	Decision on Rejection dated February 5, 2013 (+ English translation), in Chinese Patent Application No. 200980100976.3, 16 pages	
	A4	DiiVA Specification 1.1 Draft A, DiiVA Promoters Group, distribution date January 7, 2010, 188 pages	
	A5	International Search Report and Written Opinion of the International Searching Authority dated June 29, 2010, in International Patent Application No. PCT/US2009/067744, 10 pages	
	A6	International Search Report and Written Opinion of the International Searching Authority dated November 24, 2009, in International Patent Application No. PCT/US2009/038077, 7 pages	
	A7	International Search Report and Written Opinion of the International Searching Authority dated September 27, 2011, in International Patent Application No. PCT/US11/21031	
	A8	Microprocessor and Microcomputer Standards Committee of the IEEE Computer Society, "IEEE P1394r Draft 1 Draft Standard for High Performance Serial Bus", 2007	
	A9	Office Action dated January 31, 2012 (+ English translation), in Chinese Patent Application No. 200980100976.3, 21 pages	
	A10	Office Action dated July 24, 2013 (+ English translation), in Taiwan Patent Application No. 098142426, 12 pages	
	A11	Office Action dated July 31, 2012 (+ English translation), in Taiwan Patent Application No. 098110096, 35 pages	

EXAMINER

/Khanh Dang/

DATE CONSIDERED

12/23/2013

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional) ² Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.D./

Substitute for form 1449A/PTO SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	<i>Complete if Known</i>	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	DANG, KHANH
Sheet 2 of 2	Attorney Docket No: 8029P150	

	B1	Office Action dated March 30, 2012 (+ English translation), in Chinese Patent Application No. 200980105447.2, 16 pages	
	B2	Office Action dated November 29, 2012 (+ English translation), in Chinese Patent Application No. 200980105447.2, 8 pages	
	B3	Office Action dated September 13, 2012 (+ English translation), in Chinese Patent Application No. 200980100976.3, 21 pages	
	B4	Office Action for Patent Application No.: 2011-501975 (Attorney Docket No. 8029P146JP), (8/5/2013)	

EXAMINER

/Khanh Dang/

DATE CONSIDERED

12/23/2013

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.D./



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

65702 7590 11/14/2013
SILICON IMAGE/BSTZ
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER

DANG, KHANH

ART UNIT

PAPER NUMBER

2111

DATE MAILED: 11/14/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/636,063

12/11/2009

Dongyun Lee

8029P150

1550

TITLE OF INVENTION: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	02/14/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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.

65702 7590 11/14/2013
SILICON IMAGE/BSTZ
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	8029P150	1550

TITLE OF INVENTION: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	02/14/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
DANG, KHANH	2111	307-042000

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p>☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p>☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.</p>	<p>2. For printing on the patent front page, list</p> <p>(1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____</p> <p>(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____</p> <p>3 _____</p>
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see form 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: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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



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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	8029P150	1550
65702	7590	11/14/2013	EXAMINER	
SILICON IMAGE/BSTZ			DANG, KHANH	
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP			ART UNIT	PAPER NUMBER
1279 OAKMEAD PARKWAY			2111	
SUNNYVALE, CA 94085-4040			DATE MAILED: 11/14/2013	

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 557 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 557 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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.

**Notices of Allowance and Fee(s) Due mailed between October 1, 2013 and
December 31, 2013**

(Addendum to PTOL-85)

If the “Notice of Allowance and Fee(s) Due” has a mailing date on or after October 1, 2013 and before January 1, 2014, the following information is applicable to this application.

If the issue fee is being timely paid on or after January 1, 2014, the amount due is the issue fee and publication fee in effect January 1, 2014. On January 1, 2014, the issue fees set forth in 37 CFR 1.18 decrease significantly and the publication fee set forth in 37 CFR 1.18(d)(1) decreases to \$0.

If an issue fee or publication fee has been previously paid in this application, applicant is not entitled to a refund of the difference between the amount paid and the amount in effect on January 1, 2014.

Notice of Allowability	Application No. 12/636,063	Applicant(s) LEE ET AL.	
	Examiner KHANH DANG	Art Unit 2111	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/23/2013.
☐ 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 13-16, 18, 19 and 22-25. 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.

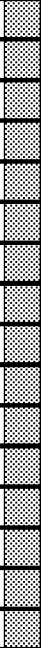
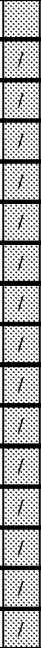
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings 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) | 5. ☐ Examiner's Amendment/Comment |
| 2. ☒ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>20131023</u> | 6. ☐ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

/Khanh Dang/
Primary Examiner, Art Unit 2111

Issue Classification 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

CPC		
Symbol	Type	Version
		
		

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version
				
				

NONE		Total Claims Allowed: 10	
(Assistant Examiner)	(Date)		
/KHANH DANG/ Primary Examiner.Art Unit 2111	11/07/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

<i>Index of Claims</i> 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

✓	Rejected
=	Allowed

-	Cancelled
÷	Restricted

N	Non-Elected
I	Interference

A	Appeal
O	Objected

☐ Claims renumbered in the same order as presented by applicant						☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE									
Final	Original	09/14/2012	12/31/2012	06/11/2013	11/07/2013						
	1	÷	N	-	-						
	2	÷	N	-	-						
	3	÷	N	-	-						
	4	÷	N	-	-						
	5	÷	N	-	-						
	6	÷	N	-	-						
	7	÷	N	-	-						
	8	÷	N	-	-						
	9	÷	N	-	-						
	10	÷	N	-	-						
	11	÷	N	-	-						
	12	÷	N	-	-						
1	13	÷	✓	=	=						
2	14	÷	✓	=	=						
3	15	÷	✓	=	=						
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6	19	÷	✓	=	=						
	20	÷	N	-	-						
	21	÷	N	-	-						
7	22	÷	✓	=	=						
8	23	÷	✓	=	=						
9	24			=	=						
10	25			=	=						

Search Notes 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
307	42	12/28/2012	KD
	54	12/28/2012	KD
710	104	12/28/2012	KD
	305	12/28/2012	KD
	313	12/28/2012	KD
	8	12/28/2012	KD
	9	12/28/2012	KD
	15-17	12/28/2012	

SEARCH NOTES		
Search Notes	Date	Examiner
East Search Note	12/28/2012	KD
Search Updated	6/11/2013	KD
Search Updated	11/07/2013	KD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
710	15	11/07/2013	KD
307	54	11/07/2013	KD

--	--

Substitute for form 1449A/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	Complete if Known	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	Khanh Dang
Sheet 1 of 1		Attorney Docket No: 8029P150

US PATENT DOCUMENTS					
Examiner Initial *	Cite No ¹	USP Document Number	Publication or Issue Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	US-20020171741	11/21/2002	Tonkin, Steven W. et al.	
	A2	US-20040073697	04/15/2004	Nobuyuki, Saito et al.	
	A3	US-20050004708	01/06/2005	Goldenberg, Andrew et al.	
	A4	US-20070200859	08/30/2007	Banks et al.	
	A5	US-20070257923	11/08/2007	Whitby-Strevens Colin	
	A6	US-20080005433	01/03/2008	Diab et al.	
	A7	US-20080008470	01/10/2008	Lin, Chih-Chuan et al.	
	A8	US-20080301748	12/04/2008	Lida, Eyran et al.	
	A9	US-20080317181	12/25/2008	Suzuki et al.	
	A10	US-20090013366	01/08/2009	You et al.	
	A11	US-20090245345	10/01/2009	Lee, Dongyun et al.	
	A12	US-20090260043	10/15/2009	Tatsuta, Akihiro et al.	
	A13	US-20100283324	11/11/2010	Lee, Dongyun et al.	
	A14	US-7,295,578	11/13/2007	Lyle, James D. et al.	
	A15	US-7,639,765	12/29/2009	Suzuki, Akihiro et al.	
	A16	US-7,916,780	03/29/2011	Lee, Bong-Joon	
	A17	US-7,940,809	05/10/2011	Lee, Bong-Joon	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No ¹	Foreign Patent Document Country Code/Number/Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
	A18	CN-101032113	09/05/2007	Makoto		
	A19	EP-0166441	01/02/1986	Hewlett-Packard Company		
	A20	EP-1473941	03/11/2004	Genesis Microchip, Inc.		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A21	"Electrical Transient Immunity for Power-Over-Ethernet," Application Report, SLVA233A, Texas Instruments, April 2006, Revised August 2006, 20 pages	
	A22	Digital Visual Interface DVI Revision 1.0, Digital Display Working Group, April 2, 1999, 76 pages	
	A23	DisplayPort Ver. 1.2 Overview, DisplayPort Developer Conference, Taipei, December 6, 2010, 33 pages	
	A24	High-Definition Multimedia Interface Specification Version 1.3, HDMI Licensing, LLC, June 22, 2006, 237 pages	

EXAMINER

/Khanh Dang/

DATE CONSIDERED

11/07/2013

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional) ² Applicant is to place a check mark here if English language Translation is attached

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.D./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Dongyun Lee et al.

Application No.: 12/636,063

Filed: December 11, 2009

Title: POWER DELIVERY OVER
DIGITAL INTERACTION
INTERFACE FOR VIDEO AND
AUDIO (DiiVA)

Examiner: Khanh Dang

Art Unit: 2111

Conf. No.: 1550

PRELIMINARY AMENDMENT

Commissioner for Patents:

Applicants respectfully request that the present application be amended as follows.

CERTIFICATE OF TRANSMISSION

This correspondence is being submitted electronically via EFS Web prior to 11:59pm on the date shown below.

Date: November 14, 2013 /Andrea Dolder/
Andrea Dolder

AMENDMENTS TO THE DRAWINGS

Please amend the drawings as follows:

Please replace the current 7 sheets of drawings (including Figures 1-7) with the attached 7 sheets of drawings (including Figures 1-7).

Attachments:

7 Replacement Sheets of Drawings (Figs. 1-7)

REMARKS

Applicants respectfully submit that the drawings have been amended to conform to USPTO proper text height and margin requirements, and to more clearly define the lines. Applicants believe the drawings now comply with 37 CFR 1.84. Pursuant to MPEP 608.02, the substitute drawings are not being used to overcome any insufficiency of the specification due to lack of an enabling disclosure or otherwise inadequate disclosure therein, or to supplement the original disclosure thereof for the purpose of interpretation of the scope of any claim.

More particularly, Figure 5 includes corrections to the spelling of certain terms, in which three instances incorrectly referring to “Diva” are amended to recite “DiiVA”.

Applicants respectfully submit that no new subject matter is being added by the amendments, and that the use of the term “DiiVA” is fully supported by the application. See, for example, paragraphs [036] through [038], which describe Figure 5.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at 503-439-8778 if there remains any issue with allowance of the case.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: November 14, 2013 /Mark C. Van Ness/
Mark C. Van Ness
Reg. No. 39,865

1279 Oakmead Parkway
Sunnyvale, CA 94085-4040
(503) 439-8778

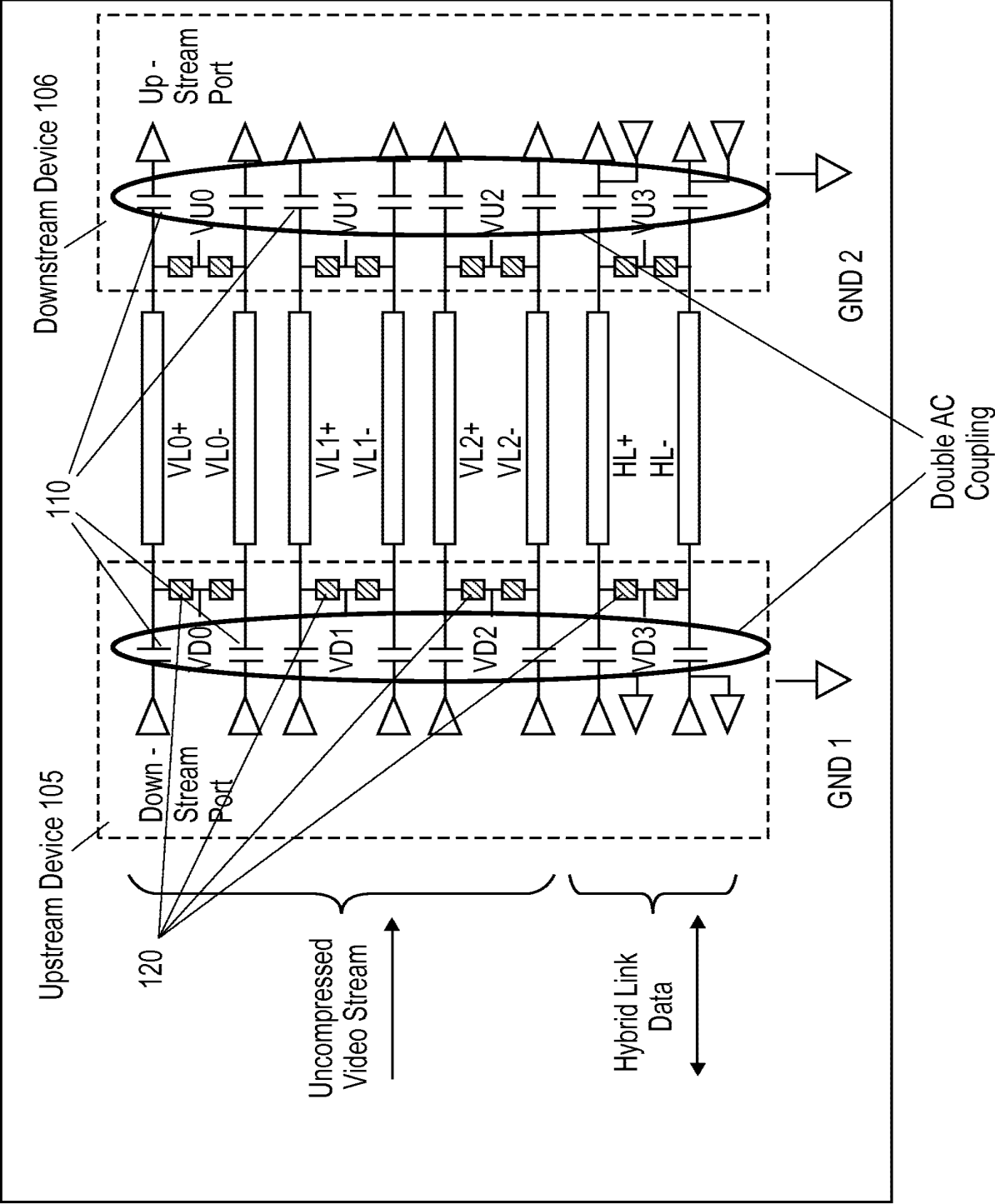


FIG. 1

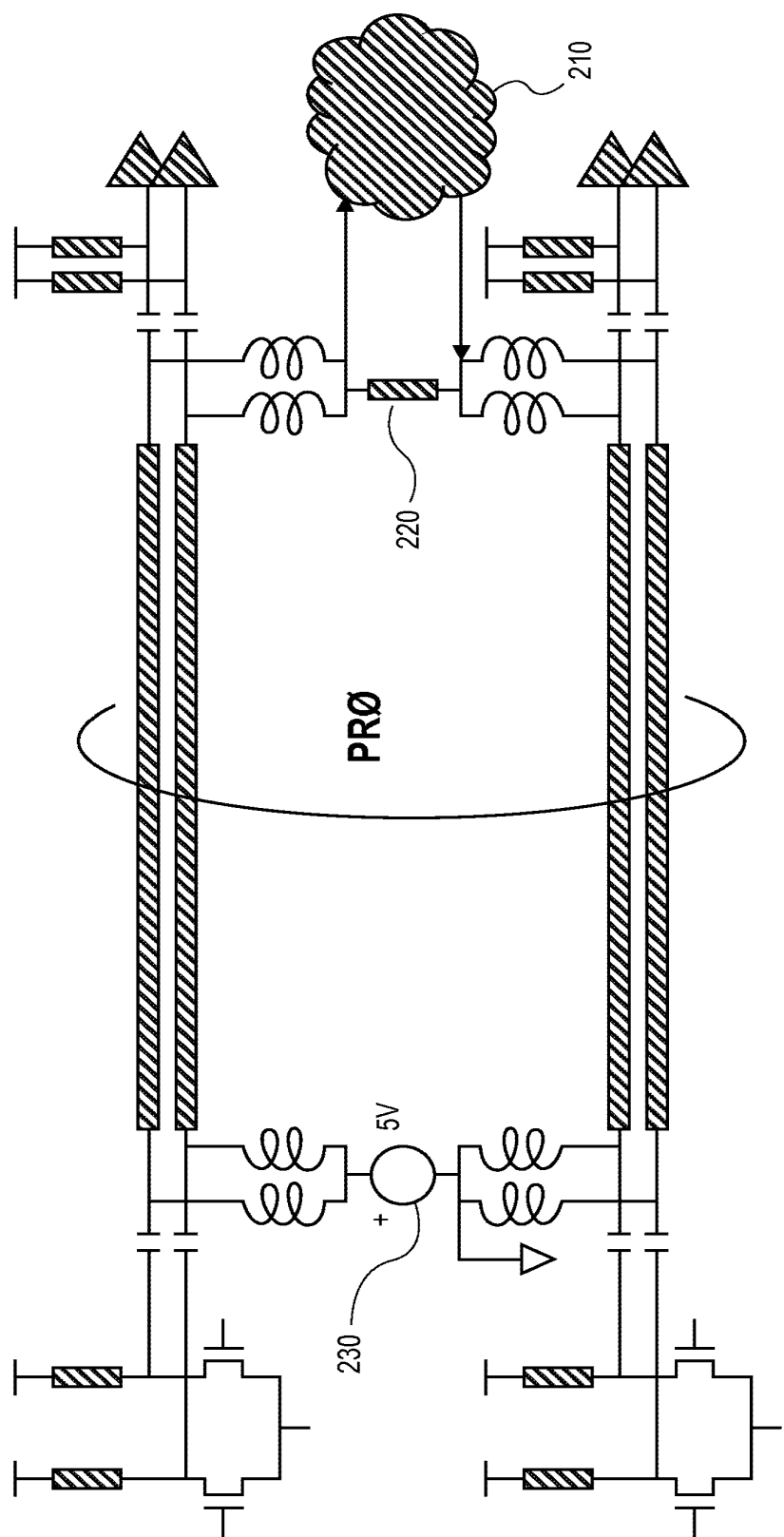


FIG. 2

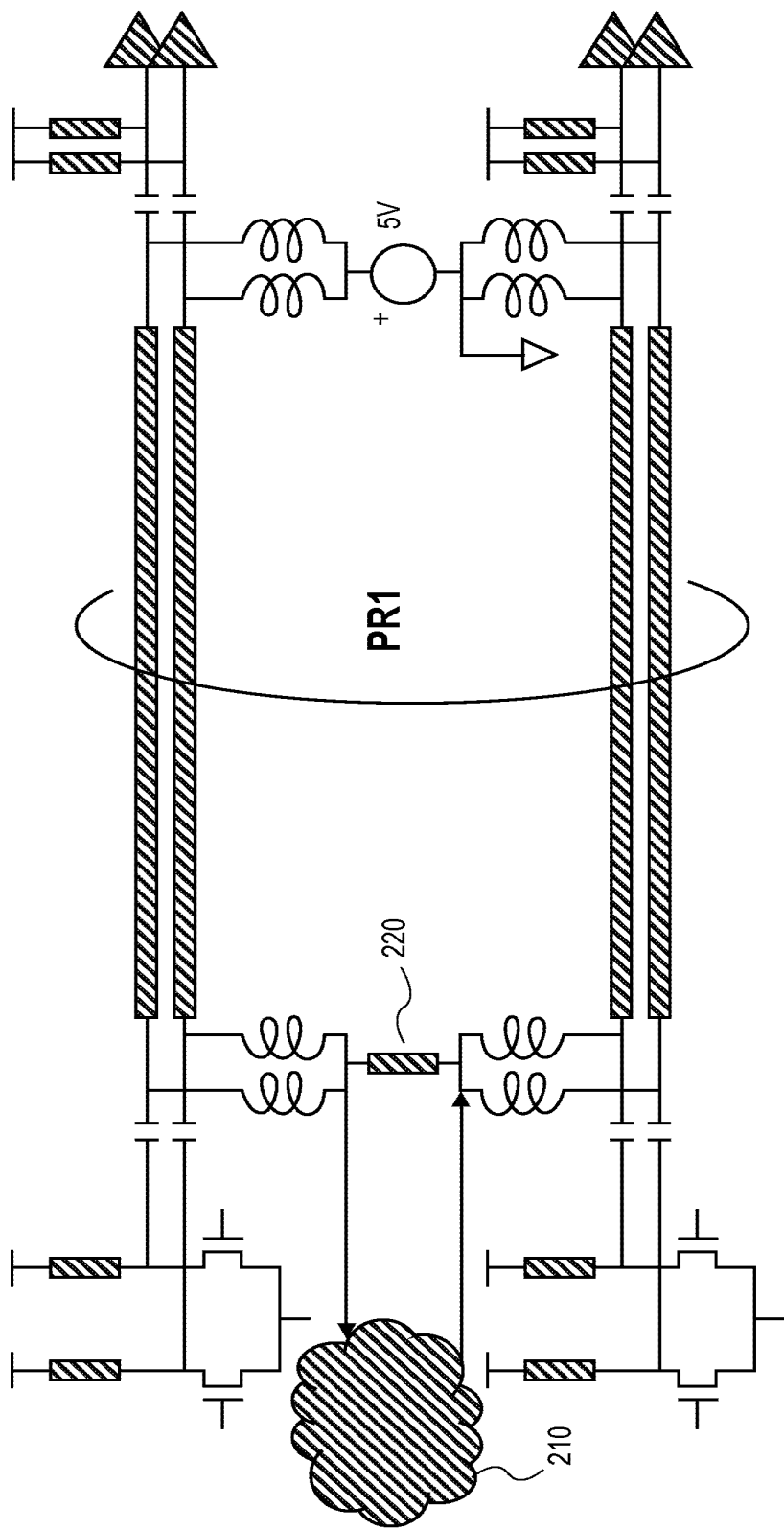


FIG. 3

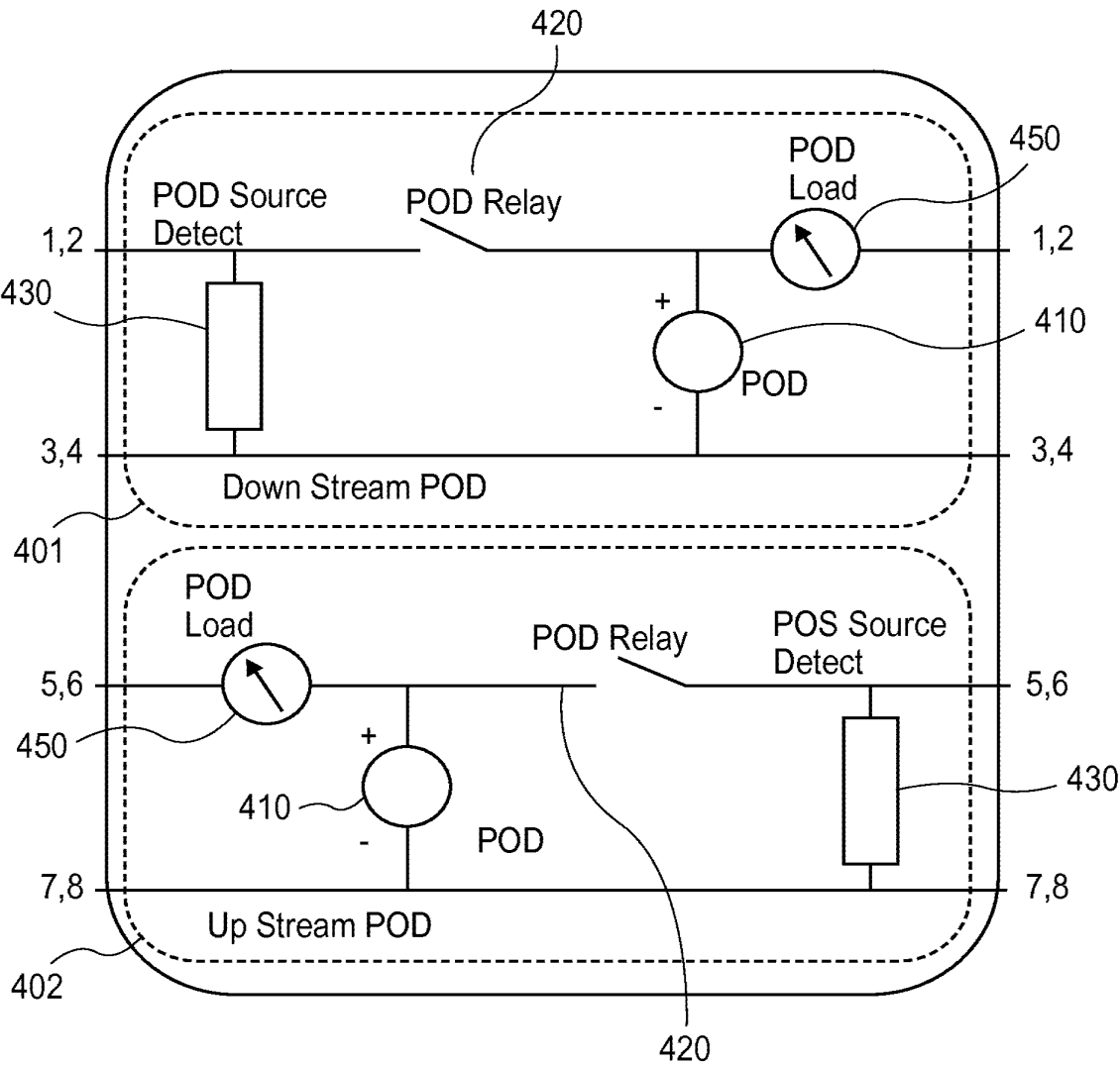


FIG. 4

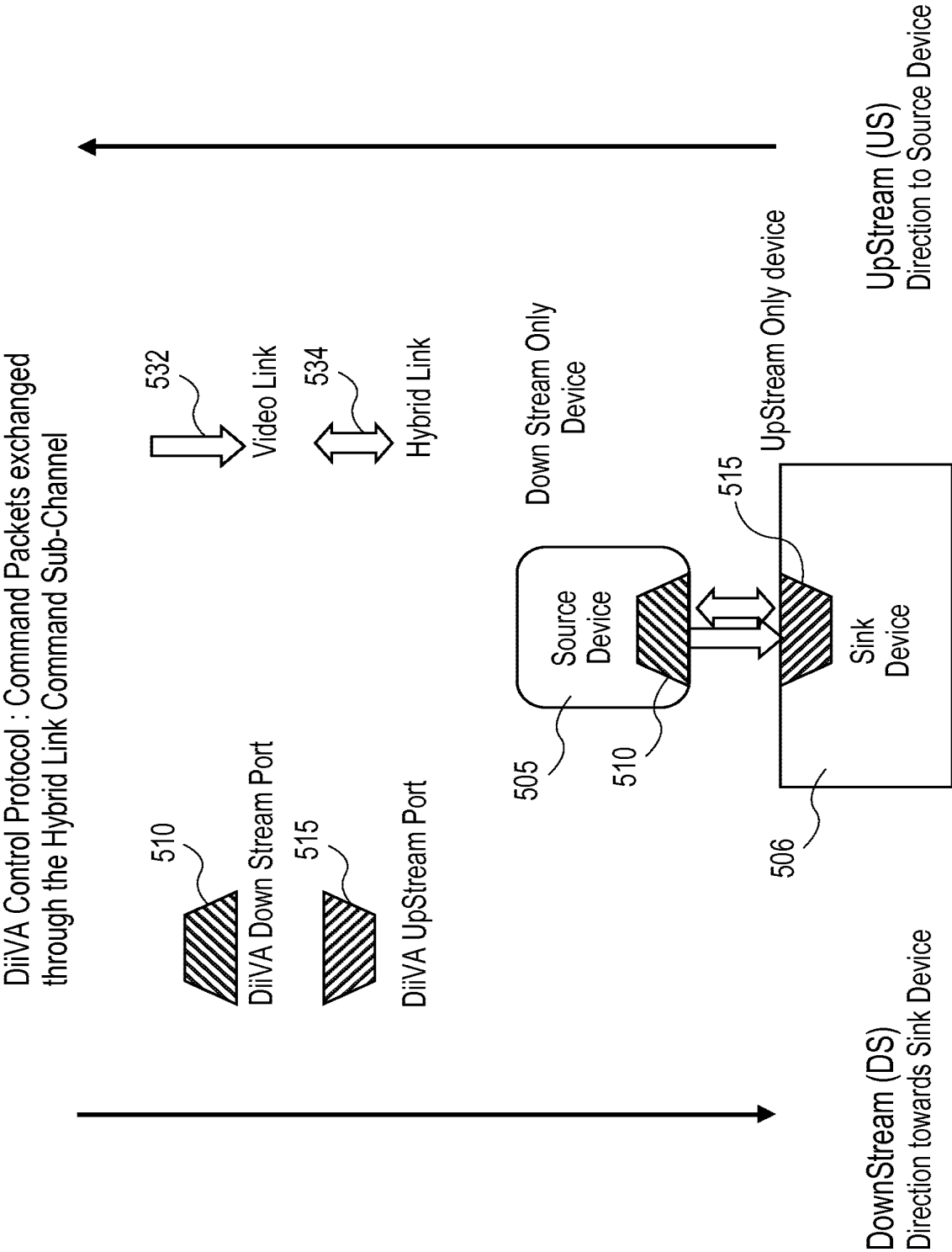


FIG. 5

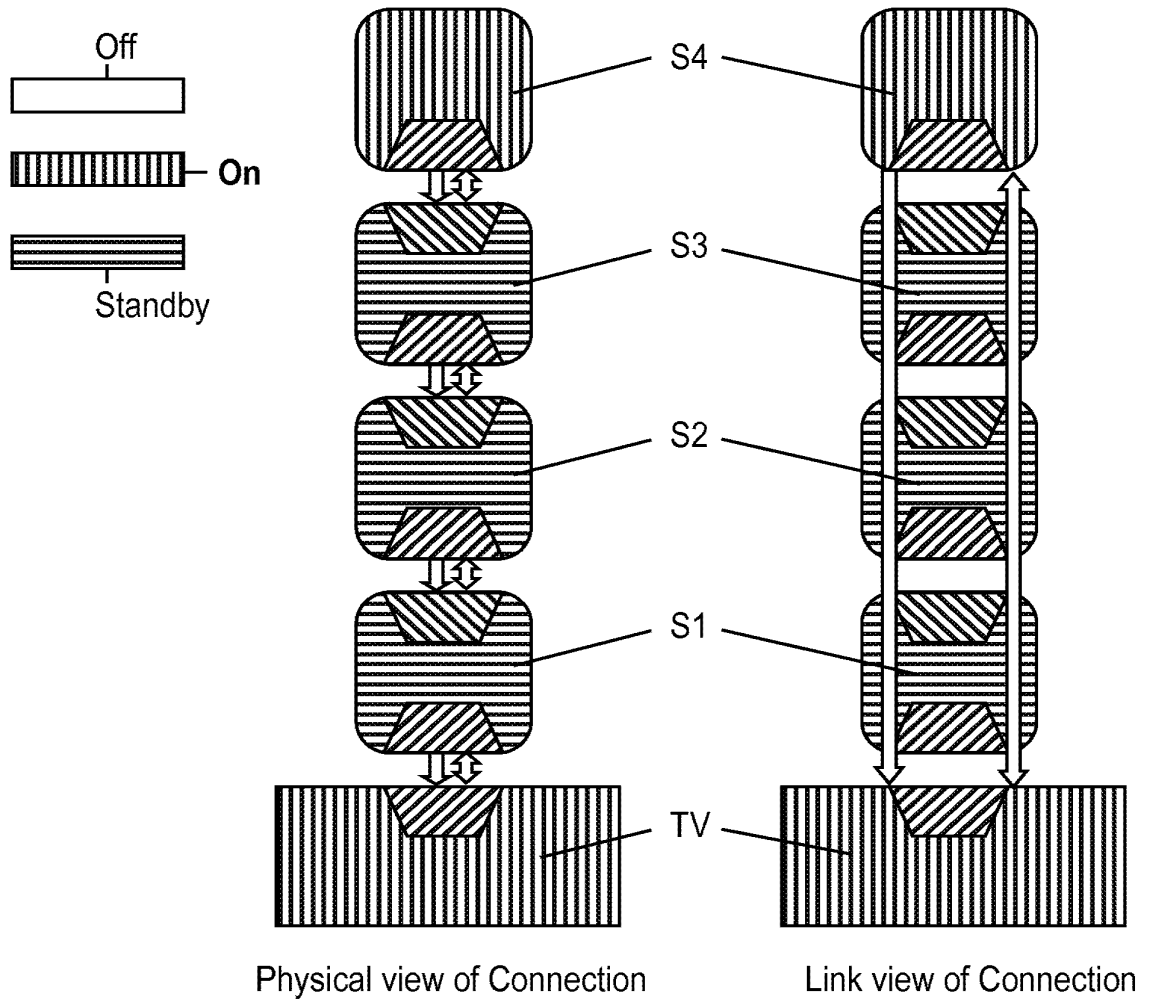
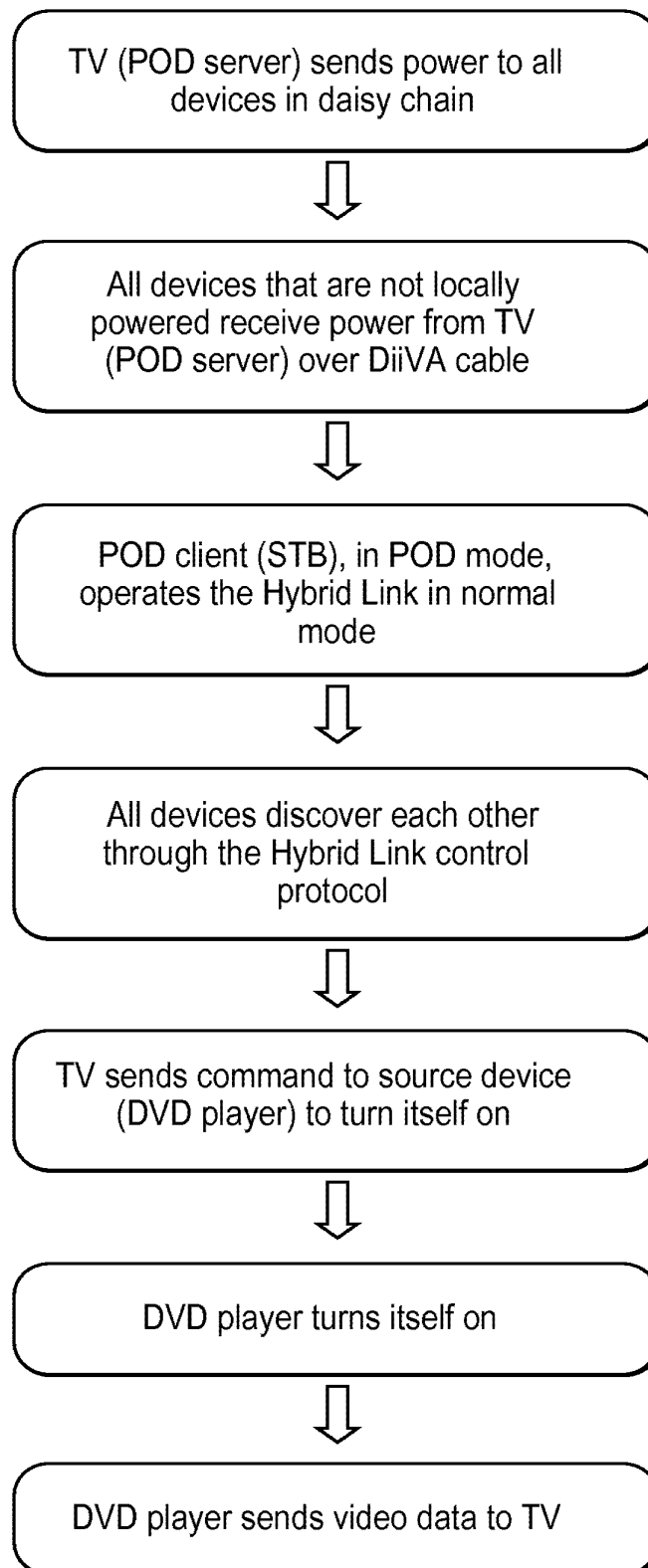


FIG. 6

**FIG. 7**

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application No. 12/636,063

Filing Date December 11, 2009

First Inventor Dongyun Lee, et al.

Art Unit 2111

Examiner Name Khanh Dang

Attorney Docket No. 8029P150

Conf. No. 1550

DUTY OF DISCLOSURE STATEMENT

In accordance with the duty of disclosure, enclosed is a copy of an Information Disclosure Statement (IDS) Citation Form PTO/SB/08 or PTO-1449, together with copies of the documents cited on that form, except for copies not required to be submitted (e.g., copies of U.S. patents and U.S. published patent applications need not be enclosed). This IDS and IDS Citation Form are being submitted before the mailing of a first Office Action on the merits. It is respectfully requested that the cited references be considered and that the enclosed copy of PTO/SB/08 be initialed by the Examiner to indicate such consideration and a copy thereof returned to applicant(s).

The submission of this Information Disclosure Statement is not to be construed as a representation that a search has been made in the subject application and is not to be construed as an admission that the information cited in this statement is material to patentability.

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).

OR

☒ None

☐ The IDS Filing Fee in the amount of \$180.00 as set forth in 37 CFR 1.17(p) has been submitted herewith.

☒ It is requested that any requisite fees be debited from Deposit Account 02-2666.

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 signature.

Signature	/Mark C. Van Ness/	Date (MM-DD-YYYY)	11-14-2013
Name/Print	Mark C. Van Ness	Registration Number	39865

/Andrea Dolder/

Andrea Dolder

11/14/2013
Date

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.

(19)대한민국특허청(KR)
(12) 공개특허공보(A)

(51) Int. Cl.⁷
H04L 12/10

(11) 공개번호 10-2005-0012310
(43) 공개일자 2005년02월02일

(21) 출원번호 10-2003-0051221
(22) 출원일자 2003년07월25일

(71) 출원인 엘지전자 주식회사
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(54) 이더넷을 통한 자동 전원 공급 장치 및 그 방법

요약

본 발명은 이더넷 접속 단말기에 자동으로 전원을 공급하는 장치 및 그 방법에 관한 것으로, 특히 CPLD를 이용하여 기존 망 중단 장치 및 라인 상태를 감지하여 자동으로 전원 공급이 필요한 단말기에 이더넷을 통한 전원 공급을 제공할 수 있도록 한 이더넷을 통한 자동 전원 공급 장치 및 그 방법에 관한 것이다.

상기의 장치 및 그 방법을 달성하기 위한 구성수단은, 장치에 있어서는 선로 상태를 감지하여 이더넷을 통한 전원 공급으로 동작할 수 있는 단말 장치가 연결되어 있는지를 판단하여, 연결된 단말 장치에 전원 공급을 할 것인가를 판단하는 PD 감지부와; 상기 PD 감지부에서 판단한 결과에 따라 이더넷 선로를 통하여 단말 장치에 전원을 공급하는 전원 공급부와; 상기 PD 감지부에서의 선로 감지와 전원 공급부에서 전원 공급을 하기 위해 릴레이 되는 스위치부와; 상기 PD 감지부와 전원 공급부로부터 출력 값을 전달받아 이들의 값에 따라 PD 감지부와 전원공급부 및 스위치부를 제어하는 CPLD를 이용한 제어부:를 포함하여 이루어진 것을 특징으로 하고 방법에 있어서는, PD 감지부에서 선로의 상태를 감지하여 단말 장치가 이더넷을 통해 공급되는 전원으로 동작할 수 있는 구조를 가지고 있는지를 판단하는 1 단계와; 상기 1단계의 판단 결과 단말 장치가 이더넷을 통해 전원을 공급받을 수 있는 구조가 아니면 다시 선로의 상태를 계속 감지하고, 이더넷을 통해 전원을 공급받을 수 있는 구조이면 단말 장치의 콘덴서의 용량을 감지하는 2단계와; 상기 2단계에서 단말 장치의 콘덴서의 용량을 감지한 결과 기준 용량 이상이면 단말 장치에 전원을 공급하지 않고 선로 개방을 확인한 후 다시 단말 장치가 연결되는 것을 확인하여 선로의 상태를 감지하고, 기준 용량 이하이면 단말 장치에 전원을 공급하는 3단계:를 포함하여 이루어진 것을 특징으로 한다.

대표도

도 2

색인어

이더넷, 전원 공급 장치

명세서

도면의 간단한 설명

도 1은 종래의 네트워크 인터페이스와 이더넷을 통한 전원 공급 장치의 구성도이다.

도 2는 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성도이다.

도 3은 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성부인 PD 감지부의 구성도이다.

도 4는 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성부인 전원 공급부의 구성도이다.

도 5는 본 발명인 이더넷을 통한 자동 전원 공급 방법의 절차 흐름도이다.

발명의 상세한 설명

발명의 목적

발명이 속하는 기술 및 그 분야의 종래기술

본 발명은 이더넷 접속 단말기에 자동으로 전원을 공급하는 장치 및 그 방법에 관한 것으로, 특히 CPLD를 이용하여 기존 망 중단 장치 및 라인 상태를 감지하여 자동으로 전원 공급이 필요한 단말기에 이더넷을 통한 전원 공급을 제공할 수 있도록 한 이더넷을 통한 자동 전원 공급 장치 및 그 방법에 관한 것이다.

PoE(Power over Ethernet)는 기존 이더넷 케이블을 통해 전류를 네트워크 장비에 보내는 최신 기술로, 각 단말기를 위한 별도의 전원 공급 장치 설치 부담을 덜어 상당한 비용 절감 효과에 대한 기대감을 모으고 있는 기술이다.

전력과 이더넷 네트워킹을 아우르는 인프라를 보유함으로써 기업들은 비용 절감, 장소 이동의 편리함, 높은 전원 이용 효율성에 따른 네트워크 장애 최소화 등의 장점을 구현할 수 있을 것으로 기대된다.

도 1은 종래의 네트워크 인터페이스(a)와 이더넷을 통한 전원 공급 장치(b)에 관한 구성도이다.

도 1의 (a)에서 보여주는 것처럼 종래의 네트워크 인터페이스에는 SWITCH/HUB(100)와, 망 중단 장치(110)의 물리적 프로토콜을 수행하는 디바이스인 PHY와, 라인단과의 신호 전송 및 절연을 위한 트랜스포머(T1, T2)와, 물리적 연결을 위한 커넥터인 RJ45와, 저항(R) 및 콘덴서(C)를 통하여 접지에 연결되는 Bob Smith 회로(120)로 구성되어 신호를 송수신한다.

한편 도 2의 (b)에서 보여주는 것처럼 이더넷을 통한 전원 공급은 SWITCH/HUB(200)와, 망 중단 장치(220)의 프로토콜을 수행하는 디바이스인 PHY와, 라인단과의 신호 전송 및 절연을 위한 트랜스포머(T3, T4)와, 물리적 연결을 위한 커넥터인 RJ45로 구성되며, 망 중단 장치에 이더넷을 통하여 전원을 공급하기 위해 SWITCH/HUB에는 전원 공급 장치(210)가 있으며, 단말 장치에는 단말 장치에 필요한 전원으로 변환하여 주는 단말기 전원 장치(230)로 구성된다.

상기 SWITCH/HUB와 DTE간에 신호 전송은 물리층 프로토콜을 수행하는 PHY에 의하여 아날로그 신호로 변환되며 트랜스포머를 통하여 선로를 연결되어 신호를 전송한다.

이더넷을 통한 전원 공급은 SWITCH/HUB로부터 각각 전류 소모가 작은 이더넷 전화기, 무선 AP, Web Camera 등의 단말 장치에 전원을 공급하여 이들을 동작하게 한다.

상기와 같은 종래의 기술 구성에서 전원 공급이 가능한 SWITCH/HUB와 기존 네트워크 인터페이스를 가지는 망 중단장치가 연결되어 동작할 경우 단말 장치내의 저항은 SWITCH/HUB로부터 공급되는 공급 전압에 의하여 과전류가 흐르게 되어 장비의 파손을 발생하는 문제점이 있다.

또, 단말 장치의 전원을 SWITCH/HUB로부터 공급받고자 하는 경우에는 단말 장치의 각각에 대해 수동으로 전원 공급 라인을 설치해야 하므로 시간상, 경제상에 문제가 있고 설치자의 많은 노고가 필요로 하는 문제가 있다.

발명이 이루고자 하는 기술적 과제

본 발명은 상기와 같은 종래의 문제점을 해결하고자 제안된 것으로서, 기존의 망 종단 장치 및 라인 상태를 감지하여 자동으로 전원 공급이 필요로 하는 단말 장치에 이더넷을 통하여 전원을 공급하는 이더넷을 통한 자동 전원 공급 장치 및 그 방법을 제공하는데 그 목적이 있다.

발명의 구성 및 작용

상기와 같은 기술적 과제를 해결하기 위해 제안된 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성수단은,

선로 상태를 감지하여 이더넷을 통한 전원 공급으로 동작할 수 있는 단말 장치가 연결되어 있는지를 판단하여, 연결된 단말 장치에 전원 공급을 할 것인가를 판단하는 PD 감지부와;

상기 PD 감지부에서 판단한 결과에 따라 이더넷 선로를 통하여 단말 장치에 전원을 공급하는 전원 공급부와;

상기 PD 감지부에서의 선로 감지와 전원 공급부에서 전원 공급을 하기 위해 릴레이 되는 스위치부와;

상기 PD 감지부와 전원 공급부로부터 출력 값을 전달받아 이들의 값에 따라 PD 감지부와 전원공급부 및 스위치부를 제어하는 CPLD를 이용한 제어부;를 포함하여 이루어진 것을 특징으로 한다.

한편, 상기 PD 감지부는,

단말 장치의 신호 저항에 흐르는 전류의 상한치와 하한치의 전류를 구별할 수 있는 기준전압을 발생하는 저항으로 구성된 기준 전압 발생부와;

선로에 흐르는 전류를 감지하여 전압으로 변환하는 저항으로 구성된 선로 전류 감지부와;

상기 기준 전압 발생부와 선로 전류 감지부의 전압을 비교하여 비교 정보를 출력하는 비교기부와;

상기 비교기부의 출력 값을 받은 CPLD를 이용한 제어부의 제어신호에 의해 선로의 양단을 개폐하는 트랜지스터;를 포함하여 이루어진 것을 특징으로 하고,

상기 전원 공급부는,

전원 공급에 의하여 선로를 통하여 흐르는 전류를 감지하기 위하여 트랜지스터 및 저항으로 구성된 선로 전류 감지부와;

단말 장치의 선로에 흐르는 전류의 상한치와 하한치의 전류를 구별할 수 있는 기준 전압을 발생하는 저항으로 구성된 기준 전압 발생부와;

상기 선로 전류 감지부와 기준 전압 발생부의 전압을 비교하여 비교 정보를 출력하는 비교기부;를 포함하여 이루어진 것을 특징으로 하며,

상기 CPLD를 이용한 제어부는,

PD 감지부의 비교기부에서 출력되는 값에 의해 단말 장치가 연결된 것으로 판단한 경우에 단말 장치의 콘덴서의 용량을 측정하여 전원을 공급할 것인가를 판단하기 위하여 PD 감지부 내의 트랜지스터에 제어 신호를 보내는 것을 특징으로 한다.

이하 도면을 참조하여 본 발명인 이더넷을 통한 자동 전원 공급 장치에 관한 작동과 바람직한 실시예를 상술한다.

도 2는 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성도이고, 도 3은 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성부인 PD 감지부의 구성도이고, 도 4는 본 발명인 이더넷을 통한 자동 전원 공급 장치의 구성부인 전원 공급부의 구성도이다.

이더넷을 통해 자동으로 전원을 공급받을 단말 장치를 선택하기 위해 PD 감지부(320)는 선로의 상태를 감지하는데 그 작동과 실시예는 다음과 같다.

이더넷 선로에 단말 장치가 연결되어 있는지를 확인하기 위하여 선로에 단말 장치를 감지하기 위한 전압(VCC)을 공급한다. 이때, 스위치부(340)의 스위치 상태는 도 2에서 도시된 상태이다(이 상태를 이하 'OFF' 상태로 정의한다).

한편, 도 2에서 다이오드(D1, D2)는 역전압을 보호하기 위해 필요하며, 서미스터(PT1)는 과전류를 보호하기 위해 구성된다.

이더넷을 통해 전원 공급을 받아 동작할 수 있는 구조를 갖는 단말 장치의 신호 저항(25Kohm, 미도시)에 흐르는 전류의 상한치와 하한치를 구별하는 기준 전압 1과 기준 전압 2를 설정한다.

상기와 같은 기준 전압 설정은 기준 전압 발생부(321)에서 만들어지는데, 이는 기준 전압 발생부(321)에 있는 저항(설계자에 의해 결정되는 저항)에 의해서 기준 전압 1과 기준 전압 2가 결정되며, 이 기준 전압 값들은 각각 비교기부의 각각의 비교기의 '+' 단자에 입력 신호로 동작한다.

한편 선로 전류 감지부(322)는 이더넷 선로에 흐르는 전류를 감지하여 전압으로 변환한다. 즉, 선로 전류 감지부에 있는 저항에 흐르는 전류에 의해서 선로 전류 감지부의 저항에 전압이 형성된다.

상기 저항에 흐르는 전류로 인해서 발생하는 전압은 비교기부(323)의 각각의 비교기의 '-' 단자의 입력 신호로 동작을 한다.

비교기부(323)의 각각의 비교기는 상기 기준 전압 발생부(321)에서의 전압과 선로 전류 감지부(322)에서 변환된 전압을 입력으로 하여 각각 출력 1과 출력 2를 낸다.

상기 비교기는 기준 전압 1과 2의 입력단인 '+' 단의 전압보다 선로 전류 감지부에서 변환된 전압의 입력단인 비교기의 '-' 단의 전압이 크면 비교기의 출력은 '1'이 되고, 반대로 기준 전압 보다 변환된 전압이 더 작으면 비교기의 출력은 '0'이 된다.

따라서, 비교기의 입력 전압에 따른 비교기의 출력 값은 다음과 같다.

선로 전류 감지부(322)에서 변환된 전압('-' 단의 전압)이 기준 전압 1과 기준 전압 2보다 모두 큰 경우에는 비교기의 출력 1과 출력 2는 모두 '1'의 값을 가지고, 이때 단말 장치에 연결되어 있는 선로는 단락되어 있거나 기존의 망 종단 장치가 연결되어 있는 상태라 할 수 있다.

선로 전류 감지부에서 변환된 전압('-' 단의 전압)이 기준 전압 1과 기준 전압 2보다 모두 작은 경우에는 비교기의 출력 1과 출력 2는 모두 '0'의 값을 가지고, 이때 단말 장치에 연결되어 있는 선로는 개방 상태이거나 망 종단 장치가 연결되어 있지 않은 상태라 볼 수 있다.

선로 전류 감지부에서 변환된 전압('-' 단의 전압)이 기준전압 1보다는 작고 기준 전압 2보다는 큰 경우에는 비교기의 출력 1은 '0'을 가지고, 비교기의 출력 2는 '1'을 가지는데, 이 경우에는 이더넷 선로에 단말 장치가 연결되어 있다고 볼 수 있다.

한편, 이론적으로는 선로 전류 감지부(322)에서 변환된 전압('-' 단의 전압)이 기준 전압 1보다 크고 기준 전압 2보다는 작은 경우, 비교기의 출력 1은 '1'을 가지고 비교기의 출력 2는 '0'을 가질 수 있지만 기준 전압 1이 기준 전압 2보다 크기 때문에 실제 이런 경우는 발생하지 않는다.

상기와 같은 비교기부(323)의 각각의 비교기의 출력 1과 출력 2의 값은 CPLD를 이용한 제어부에 전달된다.

상기 CPLD를 이용한 제어부(310)는 출력 1이 '0(Low)', 출력 2도 '0(Low)'인 경우에는 선로가 개방 상태로 판단하고, 출력 1이 '1(High)'이고 출력 2도 '1(High)'인 경우에는 선로가 단락되거나 작은 저항값(Bob Smith회로)을 가지는 기존의 망 종단 장치로 판단하여 계속 선로 상태를 감시하여 망 종단 장치의 여부를 감지한다.

한편, 상기 CPLD를 이용한 제어부(310)는 비교기의 출력 1이 '0(Low)'이고 출력 2가 '1(High)'인 경우에는 이더넷을 통한 전원으로 동작할 수 있는 구조를 갖는 단말 장치가 연결된 것으로 판단한다.

상기와 같이 단말 장치가 연결된 것으로 CPLD를 이용한 제어부(310)가 판단한 경우에는 상기 단말 장치에 전원을 공급할 것인가를 판단하기 위하여 PD 감지부(320) 내에 있는 트랜지스터(Q1)에 제어 신호 1을 보내 트랜지스터(Q1)가 'ON(단락)'이 되게 하여 단말 장치의 콘덴서를 모두 방전을 시킨다.

단말 장치의 콘텐서가 모두 방전이 되면, CPLD를 이용한 제어부(310)는 다시 트랜지스터(Q1)에 제어 신호를 보내 트랜지스터를 'OFF(개방)' 시킨다. 그러면 단말 장치의 콘텐서가 다시 충전이 된다.

CPLD를 이용한 제어부(310)는 상기 트랜지스터(Q1)를 'OFF(개방)' 시킨 후부터 PD 감지부(320) 비교기의 출력 1이 '0(Low)', 출력 2가 '1(High)'이 되기까지를 카운터(미도시)에 의해 카운터 하여 시간(지연 시간)을 계산한다.

CPLD를 이용한 제어부(310)는 상기 계산된 시간(지연 시간)과 미리 세팅이 된 기준 시간을 비교하여 계산된 시간이 기준 시간 보다 작을 경우(단말 장치의 콘텐서 용량이 기준 용량 보다 작은 경우)에는 스위치를 'ON' 시켜(도 2에서의 스위치부에 있는 화살표 방향으로) 단말 장치에 전원을 공급하고, 계산된 시간이 기준 시간보다 클 경우(단말 장치의 콘텐서 용량이 기준 용량 보다 클 경우)에는 전원 공급을 하지 않고 비교기의 출력 1과 2가 모두 '0(Low)'이 되는 것을 확인(선로 개방을 확인)하여 다시 단말 장치가 연결되는 것을 확인한 다음 PD 감지부에서 다시 선로를 감지한다.

IEEE802.3에 따르면, 여기서 전원을 공급해야 할 콘텐서의 용량은 100nF 이하이며 공급하지 말아야 할 용량은 10uF 이상이다. 따라서 상기 기준 용량이란 전원 공급을 가능하게 하는 콘텐서 용량인 100nF 가 된다고 볼 수 있으며, 기준 시간이란 100nF가 충전되는 시간을 의미한다고 할 수 있다.

상기 스위치는 CPLD를 이용한 제어부(310)의 제어 신호에 의해 도 2의 화살표 방향으로 릴레이 되어 'ON' 되고, 이 상태에서 단말 장치에 전원을 공급하면서 CPLD를 이용한 제어부는 전원 공급부(330)의 비교기부(333)에서 나오는 출력 값을 체크를 하면서 전원을 계속 공급 할 것인가 아니면 전원 공급을 중단하고 다시 단말 장치의 선로를 감지할 것인가 판단한다.

전원 공급부(330)의 기준 전압 발생부(332)는 현재 전원을 공급하는 단말 장치에 흐를 수 있는 전류의 상한치와 하한치를 구별하는 기준 전압 3과 기준 전압 4를 설정한다.

상기 기준 전압 발생부(332)는 저항으로 이루어져 있어 전압 분배에 의하여 전원 공급부(330)의 비교기부(333)의 각각 비교기의 '-' 입력단에 입력 신호로 작용을 한다.

한편, 선로 전류 감지부(331)는 저항 및 트랜지스터(Q2, Q3)로 구성되어 있고 이를 이용하여 선로를 통하여 흐르는 전류를 감지하여 저항에 걸리는 전압을 발생시키고, 발생된 전압은 비교기부(333)의 각각 비교기의 '+'단의 입력 신호로 작용을 한다.

상기 기준 전압 발생부(332)의 전압과 선로 전류 감지부(331)에서 발생한 전압은 비교기부(333)의 각각의 비교기의 입력 신호로 작용을 하여 각각 출력 3과 출력 4를 발생하여 CPLD를 이용한 제어부(310)에 전달한다.

상기 CPLD를 이용한 제어부(310)에서 입력받은 비교기부(333)의 각각의 비교기의 출력 값이 출력 3의 '1(High)' 이고 출력 4가 '0(Low)' 인 경우에는 정상적인 단말 장치가 연결된 것으로 판단하여 전원을 계속 공급하면서 선로 상태를 감시한다.

한편, CPLD를 이용한 제어부(310)에서 입력받은 비교기부(333)의 각각의 비교기의 출력 값이 출력 3의 값은 무관하게 출력 4가 '1(High)' 경우에는 제어부는 선로 상태가 과전류 상태로 판단하여 전원 공급을 하고 있던 단말 장치의 전원 공급을 중단한다(CPLD를 이용한 제어부의 제어 신호에 의해 다시 스위치를 OFF).

그런 다음, PD 감지부(320)의 비교기부(323)의 각각의 비교기의 출력값(출력 1과 출력 2)이 모두 '0(Low)'임을 확인 하고(선로 개방을 확인) 다시 단말 장치가 연결되는 것을 확인한 다음 PD 감지부에서 선로를 감지한다.

한편, 전원 공급부(330)의 비교기부(333)의 비교기의 출력 값(출력 3과 출력 4)들이 모두 '0(Low)'인 경우에는 단말 장치가 동작 도중 연결이 해제된 것으로 판단하여 PD 감지부(320)에서 단말 장치를 감지하기 위한 준비를 한다.

이상과 같은 이더넷을 통한 자동 전원 공급 장치의 동작과 실시예를 살펴본 바와 같이 단말 장치의 신호 저항에 흐르는 전류의 상한치와 하한치를 구별하는 기준 전압과 이더넷 선로에 흐르는 전류를 감지하여 변환된 전압을 비교기에서 비교하여 비교기의 출력값에 따라 CPLD를 이용한 제어부의 제어에 따라 정격의 전원을 단말 장치에 공급할 수 있다.

다음은 또 다른 본 발명인 이더넷을 통한 자동 전원 공급 방법에 관한 구성수단과 바람직한 실시예를 상세히 설명한다.

이더넷을 통한 자동 전원 공급 방법의 구성수단은

PD 감지부에서 선로의 상태를 감지하여 단말 장치가 이더넷을 통해 공급되는 전원으로 동작할 수 있는 구조를 가지고 있는지를 판단하는 1단계와;

상기 1단계의 판단 결과 단말 장치가 이더넷을 통해 전원을 공급받을 수 있는 구조가 아니면 다시 선로의 상태를 계속 감지하고, 이더넷을 통해 전원을 공급 할 수 있는 구조이면 단말 장치의 콘텐츠의 용량을 감지하는 2단계와;

상기 2단계에서 단말 장치의 콘텐츠의 용량을 감지한 결과 기준 용량 이상이면 단말 장치에 전원을 공급하지 않고 선로 개방을 확인한 후 다시 단말 장치가 연결되는 것을 확인하여 선로의 상태를 감지하고, 기준 용량 이하이면 단말 장치에 전원을 공급하는 3단계;를 포함하여 이루어진 것을 특징으로 한다.

한편, 상기 1단계의 판단은 PD 감지부의 기준 전압 발생부의 전압과 선로 전류 감지부의 전압을 비교기부에서 비교하여 출력되는 값을 CPLD를 이용한 제어부가 전달받아 판단하는 것을 특징으로 하고,

상기 2단계에서, 단말 장치의 콘텐츠 용량을 감지하는 단계는 CPLD를 이용한 제어부의 제어 신호에 의해 PD 감지부 내의 트랜지스터를 단말 장치의 콘텐츠가 모두 방전할 때까지 단락하는 과정과; 단말 장치의 콘텐츠가 모두 방전되면 다시 CPLD를 이용한 제어부의 제어 신호에 의해 트랜지스터를 개방시키는 과정과; CPLD를 이용한 제어부가 기준 시간과 지연시간을 비교하는 과정을 포함하여 이루어진 것을 특징으로 하며,

상기 3단계에서 전원을 공급하는 과정 중에, 전원 공급부의 비교기부에서 출력되는 값이 CPLD를 이용한 제어부에서 판단할 결과 단말 장치에 흐르는 전류가 과전류 상태로 판단되는 경우 전원 공급을 멈추고 선로가 개방된 것을 확인한 후 다시 단말 장치가 연결되었는가를 감지하는 것을 특징으로 한다.

이하, 본 발명인 이더넷을 통한 자동 전원 공급 방법의 절차 흐름도를 보여주는 도 5를 참조하여 바람직한 실시예를 상세히 설명한다.

이더넷을 통하여 전원 공급을 받을 수 있는 단말 장치인가를 판단하기 위하여 먼저 PD 감지부에서 이더넷 선로를 감지한다.

이더넷 선로를 감지하기 위하여 스위치를 OFF 시키고 전원 공급을 받을 단말 장치를 감지하기 위하여 낮은 전압(5V)을 공급을 한다(S10).

상기와 같은 낮은 전압을 이더넷 선로에 공급을 하면 PD 감지부에서는 단말 장치의 신호 저항에 흐르는 전류의 상한치와 하한치를 구별하는 기준 전압 발생부에서 설정된 기준 전압과 선로 전류 감지부에서 이더넷 선로를 흐르는 전류를 감지하여 변환된 전압을 비교기부의 각각의 비교기의 입력 전압으로 하여 출력 1과 출력 2를 만들어 CPLD를 이용한 제어부에 전달한다.

상기 CPLD를 이용한 제어부는 PD 감지부의 비교기부에서 출력된 값에 따라 단말 장치에 전원을 공급할 것인가 판단을 하는데, 상기 비교기의 출력값이 출력 1이 '0'이고 출력 2가 '1'인 경우에는 단말 장치가 이더넷에 연결이 되어 있는 것으로 판단을 하고 단말 장치에 전원을 공급할 것인가를 판단하기 위해 PD 감지부의 트랜지스터를 제어한다(S20).

한편, CPLD를 이용한 제어부는 PD 감지부의 비교기의 출력값이 출력 1이 '0'이고 출력 2가 '1'인 경우 이외에는 단말 장치가 이더넷에 연결되어 있지 않거나(개방되어 있거나), 선로가 단락되어 있다고 판단하여 다시 단말 장치가 이더넷에 연결되어 있는지 감지한다(S20).

상기 이더넷에 연결되어 있는 것으로 판단된 단말 장치에 전원을 공급할 것인가 판단하기 위해 CPLD를 이용한 제어부는 카운터를 작동시키면서 PD 감지부의 트랜지스터에 제어 신호를 보내어 'ON(단락)'을 시켜 단말 장치의 콘텐츠가 모두 방전되도록 한다(S30).

상기 콘텐츠가 모두 방전이 되면 CPLD를 이용한 제어부는 다시 트랜지스터에 제어 신호를 보내어 'OFF(개방)'를 시켜 단말 장치의 콘텐츠가 충전되도록 하고, OFF 시킨 후부터 PD 감지부의 비교기의 출력값이 출력 1이 '0'이고 출력 2가 '1'이 되는 시간까지의 카운터를 하여 시간을 계산한다(S30~S60).

그런 다음, CPLD를 이용한 제어부는 이미 세팅된 기준 시간과 카운터에 의해 계산된 시간(지연 시간)을 비교하여 계산된 시간(지연 시간)이 기준 시간보다 작은 경우에는 CPLD를 이용한 제어부의 제어 신호를 받아 스위치를 'ON'을 시켜 전원을 단말 장치에 공급한다(S70).

상기 계산된 시간(지연 시간)이 기준 시간보다 클 경우에는 PD 감지부의 비교기의 출력값이 출력 1과 출력 2가 모두 '0'임을 확인(선로 개방을 확인)하여 다시 단말 장치가 연결되는 것을 확인하여 단말 장치를 감지한다.

상기 계산된 시간이 기준 시간보다 작아 CPLD를 이용한 제어부의 제어에 의해 스위치를 'ON' 시켜 전원 공급부로부터 단말 장치는 전원을 공급받으면서 계속해서 전원을 공급받아도 되는 정상 상태에 있는지 판단을 받는다.

스위치가 'ON' 상태로 됨에 따라 단말 장치에 흐를 수 있는 전류의 상한치와 하한치를 구별하는 전원 공급부의 기준 전압 발생부에서 설정된 기준 전압 3과 기준 전압 4 와 이더넷 선로에 흐르는 전류를 감지하는 선로 전류 감지부의 출력 전압을 입력 신호로 하여 전원 공급부의 비교기는 출력 3과 출력 4를 출력하여 CPLD를 이용한 제어부에 전달한다.

상기 출력 3과 출력 4의 값이, 출력 3이 '1'이고 출력 4가 '0'인 경우에는 정상적인 단말 장치가 연결되어 있는 것으로 CPLD를 이용한 제어부가 판단하여 계속적으로 전원을 공급하면서 선로 상태를 계속 감지하고, 상기 출력 3과 출력 4의 값이, 출력 3에는 무관하게 출력 4가 '1'인 경우에는 CPLD를 이용한 제어부가 선로 상태가 과전류 상태로 판단하여 전원 공급을 중단하고(CPLD를 이용한 제어부의 제어 신호에 의해 스위치를 릴레이 하여 OFF 시킴) PD 감지부의 비교기 값이 출력 1과 출력 2가 모두 '0'인 것을 확인(선로 개방을 확인)하여 다시 단말 장치가 연결되는 것을 확인한 다음 단말 장치의 선로를 PD 감지부에서 감지하게 하다(S80~S90).

한편, 한편, 전원 공급부의 비교기부의 비교기의 출력 값(출력 3과 출력 4)들이 모두 '0(Low)'인 경우에는 단말 장치가 동작 도중 연결이 해제된 것으로 판단하여 PD 감지부에서 단말 장치를 감지하기 위한 준비를 한다.

발명의 효과

상기와 같은 구성 수단과 작용, 실시예를 가지는 이더넷을 통한 자동 전원 공급 장치 및 방법인 본 발명은 SWITCH/HUB에서 이더넷을 통한 전원 공급으로 동작할 수 있는 구조를 갖는 단말 장치에 자동으로 전원을 공급하는 효과가 있다.

또, 단말 장치의 신호 저항에 흐르는 전류의 상한치와 하한치를 구별하는 기준 전압과 이더넷 선로에 흐르는 전류를 감지하여 변환된 전압을 비교기에서 비교하여 비교기의 출력값에 따라 CPLD를 이용한 제어부의 제어에 따라 정격의 전원을 단말 장치에 공급하므로 이더넷 망 중단 장치의 부품이 타서 화재가 일어나는 것을 방지하고, 자동 전원 공급 장치의 국제 규격화에 대응하며, 저렴한 가격으로 자동 전원 공급 장치를 구현할 수 있는 효과가 있다.

(37) 청구의 범위

청구항 1.

선로 상태를 감지하여 이더넷을 통한 전원 공급으로 동작할 수 있는 단말 장치가 연결되어 있는지를 판단하여, 연결된 단말 장치에 전원 공급을 할 것인가를 판단하는 PD 감지부와;

상기 PD 감지부에서 판단한 결과에 따라 이더넷 선로를 통하여 단말 장치에 전원을 공급하는 전원 공급부와;

상기 PD 감지부에서의 선로 감지와 전원 공급부에서 전원 공급을 하기 위해 릴레이 되는 스위치부와;

상기 PD 감지부와 전원 공급부로부터 출력값을 전달받아 이들의 값에 따라 PD 감지부와 전원공급부 및 스위치부를 제어하는 CPLD를 이용한 제어부:를 포함하여 이루어진 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 장치.

청구항 2.

청구항 1에 있어서, 상기 PD 감지부는,

단말 장치의 신호 저항에 흐르는 전류의 상한치와 하한치의 전류를 구별할 수 있는 기준전압을 발생하는 저항으로 구성된 기준 전압 발생부와;

선로에 흐르는 전류를 감지하여 전압으로 변환하는 저항으로 구성된 선로 전류 감지부와;

상기 기준 전압 발생부와 선로 전류 감지부의 전압을 비교하여 비교 정보를 출력하는 비교기부와;

상기 비교기부의 출력값을 받은 CPLD를 이용한 제어부의 제어신호에 의해 선로의 양단을 개폐하는 트랜지스터;를 포함하여 이루어진 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 장치.

청구항 3.

청구항 1에 있어서, 상기 전원 공급부는,

전원 공급에 의하여 선로를 통하여 흐르는 전류를 감지하기 위하여 트랜지스터 및 저항으로 구성된 선로 전류 감지부와;

단말 장치의 선로에 흐르는 전류의 상한치와 하한치의 전류를 구별할 수 있는 기준 전압을 발생하는 저항으로 구성된 기준 전압 발생부와;

상기 선로 전류 감지부와 기준 전압 발생부의 전압을 비교하여 비교 정보를 출력하는 비교기부;를 포함하여 이루어진 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 장치.

청구항 4.

청구항 1에 있어서, 상기 CPLD를 이용한 제어부는,

PD 감지부의 비교기부에서 출력되는 값에 의해 단말 장치가 연결된 것으로 판단한 경우에 단말 장치의 콘덴서의 용량을 측정하여 전원을 공급할 것인가를 판단하기 위하여 PD 감지부 내의 트랜지스터에 제어 신호를 보내는 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 장치.

청구항 5.

PD 감지부에서 선로의 상태를 감지하여 단말 장치가 이더넷을 통해 공급되는 전원으로 동작할 수 있는 구조를 가지고 있는지를 판단하는 1단계와;

상기 1단계의 판단 결과 단말 장치가 이더넷을 통해 전원을 공급받을 수 있는 구조가 아니면 다시 선로의 상태를 계속 감지하고, 이더넷을 통해 전원을 공급받을 수 있는 구조이면 단말 장치의 콘덴서의 용량을 감지하는 2단계와;

상기 2단계에서 단말 장치의 콘덴서의 용량을 감지한 결과 기준 용량 이상이면 단말 장치에 전원을 공급하지 않고 선로 개방을 확인한 후 다시 단말 장치가 연결되는 것을 확인하여 선로의 상태를 감지하고, 기준 용량 이하이면 단말 장치에 전원을 공급하는 3단계;를 포함하여 이루어진 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 방법.

청구항 6.

청구항 5에 있어서,

상기 1단계의 판단은 PD 감지부의 기준 전압 발생부의 전압과 선로 전류 감지부의 전압을 비교기부에서 비교하여 출력되는 값을 CPLD를 이용한 제어부가 전달받아 판단하는 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 방법.

청구항 7.

청구항 5에 있어서,

상기 2단계에서, 단말 장치의 콘덴서 용량을 감지하는 단계는 CPLD를 이용한 제어부의 제어 신호에 의해 PD 감지부 내의 트랜지스터를 단말 장치의 콘덴서가 모두 방전할 때까지 단락하는 과정과; 단말 장치의 콘덴서가 모두 방전되면 다시 CPLD를 이용한 제어부의 제어 신호에 의해 트랜지스터를 개방시키는 과정과; CPLD 를 이용한 제어부가 기준 시간과 지연시간을 비교하는 과정을 포함하여 이루어진 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 방법.

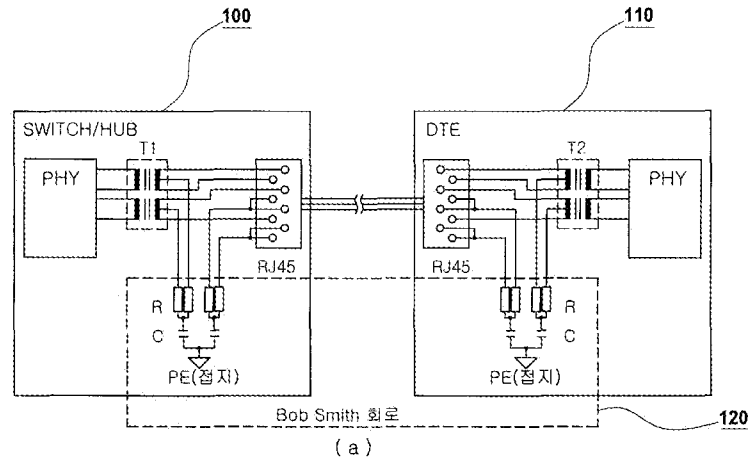
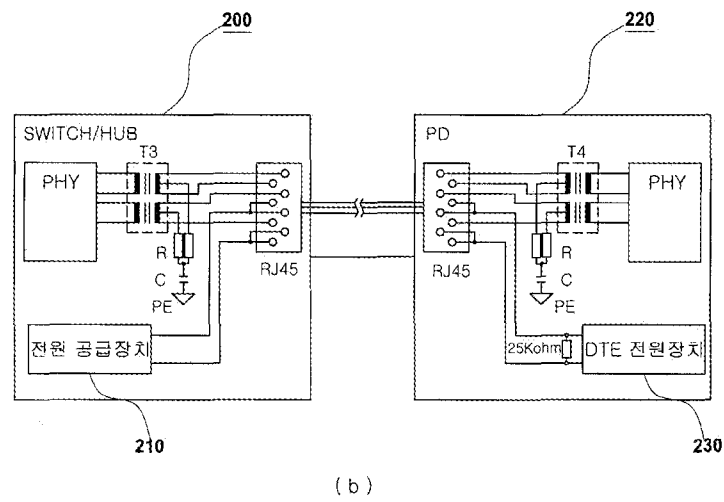
청구항 8.

청구항 5에 있어서,

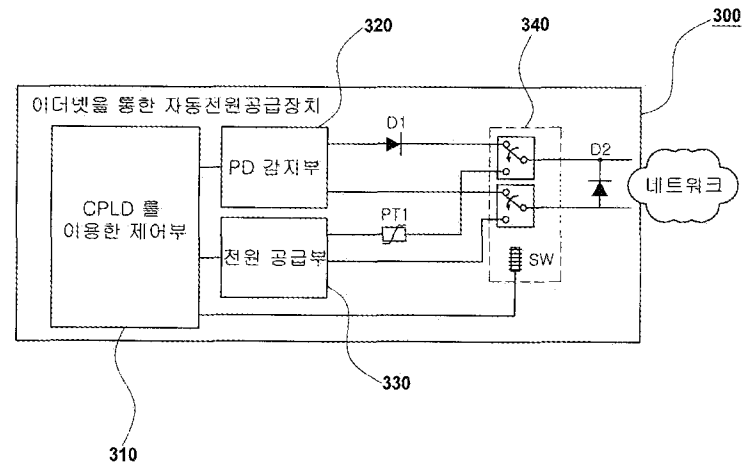
상기 3단계에서 전원을 공급하는 과정 중에, 전원 공급부의 비교기부에서 출력되는 값이 CPLD를 이용한 제어부에서 판단할 결과 단말 장치에 흐르는 전류가 과전류 상태로 판단되는 경우 전원 공급을 멈추고 선로가 개방된 것을 확인한 후 다시 단말 장치가 연결되었는가를 감지하는 것을 특징으로 하는 이더넷을 통한 자동 전원 공급 방법.

도면

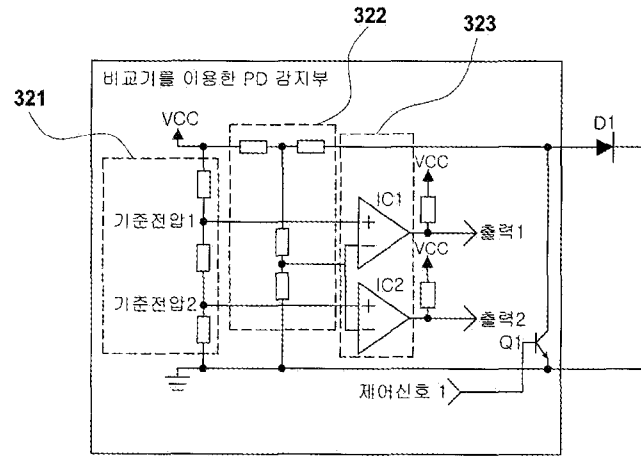
도면1



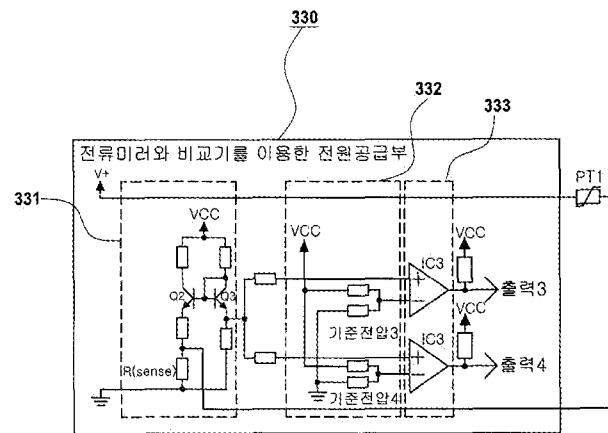
도면2



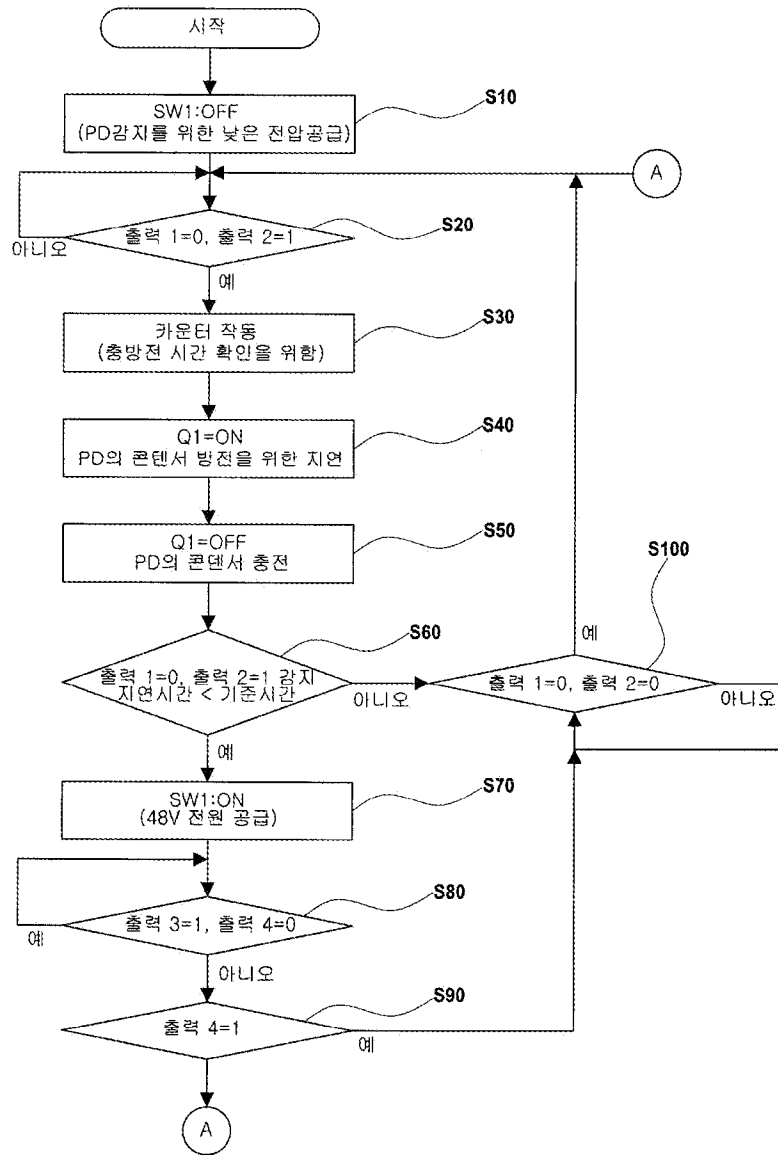
도면3



도면4



도면5



PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SYN-004PC	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2009/067744	International filing date (<i>day/month/year</i>) 11 DECEMBER 2009 (11.12.2009)	(Earliest) Priority Date (<i>day/month/year</i>) 11 DECEMBER 2008 (11.12.2008)
Applicant SYNERCHIP CO., LTD. et al		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 4 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☒ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the **drawings** to be published with the abstract is Figure No. 1

- ☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figure is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/067744**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I, claims 1-12, drawn to a system delivering power over a network of devices using 4 differential pairs of wires in the serial link.

Group II, claims 13-23, drawn to a power delivery circuit over a network of devices using a determination of the information of the devices.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1.

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/067744**A. CLASSIFICATION OF SUBJECT MATTER****H04N 5/44(2006.01)i, H04N 5/63(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04N 5/44; G06F 13/42; H04L 12/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: power, supply, link, relay, voltage

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2005-0012310 A (LG electronics INC.) 02 February 2005 See abstract, claim 1-6, pages 2-5, figures 1-4.	1-23
A	US 2008-0005433 A1 (Diab et al.) 03 January 2008 See abstract, paragraphs [0024]-[0031], [0042]-[0048], figures 2, 6A-6C, 8.	1-23
A	EP 0166441 A2 (HEWLETT-PACKARD COMPANY) 02 January 1986 See abstract, page 4, figure 5.	1-23

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

28 JUNE 2010 (28.06.2010)

Date of mailing of the international search report

29 JUNE 2010 (29.06.2010)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, Beaung Woo

Telephone No. 82-42-481-5984



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/067744

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
KR 10-2005-0012310 A	02.02.2005	None	
US 2008-0005433 A1	03.01.2008	EP 1988659 A1	05.11.2008
EP 0166441 A2	02.01.1986	EP 0166441 A3	20.04.1988
		EP 0166441 B1	04.03.1992
		JP 06-050860 B2	29.06.1994
		JP 61-015441 A	23.01.1986
		US 4703473 A1	27.10.1987
		US 4794592 A1	27.12.1988

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

KIM ELIZABETH

RAUSCHENBACH PATENT LAW GROUP, LLP 43
HACKENSACK ROAD CHESTNUT HILL MA 02467 USA

Date of mailing
(day/month/year) **29 JUNE 2010 (29.06.2010)**

Applicant's or agent's file reference
SYN-004PC

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2009/067744

International filing date (day/month/year)

11 DECEMBER 2009 (11.12.2009)

Priority date(day/month/year)

11 DECEMBER 2008 (11.12.2008)

International Patent Classification (IPC) or both national classification and IPC

H04N 5/44(2006.01)i, H04N 5/63(2006.01)i

Applicant

SYNERCHIP CO., LTD. et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☒ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139
Seonsa-ro, Seo-gu, Daejeon 302
-701, Republic of Korea
Facsimile No. 82-42-472-7140



Date of completion of this opinion

28 JUNE 2010 (28.06.2010)

Authorized officer

LEE, Beaug Woo

Telephone No.82-42-481-5984



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2009/067744

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

a. a sequence listing filed or furnished

- ☐ on paper
- ☐ in electronic form

b. time of filing or furnishing

- ☐ contained in the international application as filed.
- ☐ filed together with the international application in electronic form.
- ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2009/067744

Box No. IV Lack of unity of invention

1. ☐ In response to the invitation (Form PCT/ISA/206) to pay additional fees the applicant has, within the applicable time limit:
- ☐ paid additional fees
 - ☐ paid additional fees under protest and, where applicable, the protest fee
 - ☐ paid additional fees under protest but the applicable protest fee was not paid
 - ☐ not paid additional fees

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose not to invite the applicant to pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rule 13.1, 13.2 and 13.3 is

- ☐ complied with
- ☒ not complied with for the following reasons:

Multiple inventions exist as follows:

Group I, claims 1-12, drawn to a system delivering power over a network of devices using 4 differential pairs of wires in the serial link.

Group II, claims 13-23, drawn to a power delivery circuit over a network of devices using a determination of the information of the devices.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1.

4. Consequently, this opinion has been established in respect of the following parts of the international application :

- ☒ all parts.
- ☐ the parts relating to claims Nos. _____

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2009/067744

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-23	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-23	NO
Industrial applicability (IA)	Claims	1-23	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: KR 10-2005-0012310 A (LG ELECTRONICS INC.) 02 February 2005

I. Novelty and Inventive Step

Claim 1:

The subject matter relates to a system for delivering power over a network of devices connected through a serial link.

D1 discloses a system and method for providing power over Ethernet network to devices connected through a serial link, including: (i)a power source of voltage, (ii)a relay switch to relay a voltage, (iii)capacitors, transformers and resistors at each side of serial link wires of Ethernet, (iv)several pairs of wires configured to form serial link, (v)a resistor and transistors to detect an information of load devices, including current, and a lack of power, (vi)a controller for determining and comparing the state of devices connected to Ethernet.

The difference of claim 1 from D1 is that D1 does not disclose a HPF(high pass filter). Thus claim 1 is considered to be novel under PCT Article 33(2).

Corresponding to the difference, however, the serial link of Ethernet normally has AC coupling capacitors to prevent DC voltage saturation of circuits of transceivers, and the AC coupling capacitor electrically operates as a HPF. Thus a person skilled in the art can easily anticipate claim 1 from D1.

Accordingly, claim 1 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

Claims 2-12:

Claims 2-12 are also considered to be novel under PCT Article 33(2) as they depend on claim 1.

However, all the additional features of claims 2-12 are anticipated from D1: (i)claims 11, 12 correspond to power sources of voltages connected to the link, (ii)claims 2, 3, 8, 10 correspond to capacitors, transformers and resistors at each side of serial link wires of Ethernet, and AC coupling of Ethernet serial link, (iii)claims 4-7 correspond to several pairs of wires configured to form Ethernet serial link, (iv)claim 9 corresponds to a resistor and transistors to detect an information of load devices including current, and a lack of power.

Accordingly, claims 2-12 would have been obvious over D1, thus lack an inventive step under PCT Article 33(3).

(continued on the Supplemental Box)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

(Box No. V)

Claim 13:

The subject matter relates to a power delivery circuit to deliver power to one or more of a plurality of devices connected in a network.

D1 discloses a system and method for providing power over Ethernet network to devices connected through a serial link, including: (i)a power source of voltage, (ii)a relay switch to relay a voltage, (iii)capacitors, transformers and resistors at each side of serial link wires of Ethernet, (iv)several pairs of wires configured to form serial link, (v)a resistor and transistors to detect an information of load devices including current, and a lack of power, (vi)a controller for determining and comparing the state of devices connected to Ethernet.

The difference of claim 13 from D1 is that D1 does not disclose a load detector. Thus claim 13 is considered to be novel under PCT Article 33(2).

Corresponding to the difference, however, a person skilled in the art can easily anticipate the load detector of claim 13 from the function of the resistor, transistors and the controller of D1, because the resistor and transistors detects an information of load devices including current, and the controller determines the state of devices connected to Ethernet.

Accordingly, claim 13 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

Claims 14-19:

Claims 14-19 are also considered to be novel under PCT Article 33(2) as they depend on claim 13.

However, all the additional features of claims 14-19 are anticipated from D1: (i)claim 14 corresponds to a relay switch to relay a voltage, (ii)claim 15 corresponds to several pairs of wires configured to form Ethernet serial link, (iii)claims 16-19 correspond to a resistor and transistors to detect an information of load devices including current, a lack of power.

Accordingly, claims 14-19 would have been obvious over D1, thus lack an inventive step under PCT Article 33(3).

Claim 20:

The subject matter relates to a system for delivering power over a daisy chain.

D1 discloses a system and method for providing power over Ethernet network to devices connected through a serial link, including: (i)a power source of voltage, (ii)a relay switch to relay a voltage, (iii)capacitors, transformers and resistors at each side of serial link wires of Ethernet, (iv)several pairs of wires configured to form serial link, (v)a resistor and transistors to detect an information of load devices including current, and a lack of power, (vi)a controller for determining and comparing the state of devices connected to Ethernet.

The difference of claim 20 from D1 is that D1 does not disclose a sink device configured to supply power to a client device to enter a mode in which user data can flow through the client device, and to a source device to be powered on. Thus claim 20 is considered to be novel under PCT Article 33(2).

Corresponding to the difference, however, a person skilled in the art can easily anticipate the sink device of claim 20 from the controller, the resistor, and transistors of D1, because the controller determines the information of devices connected to Ethernet by using a resistor and transistors, and then supplies power to the devices lacking power to recover the normal state of operation.

Accordingly, claim 20 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

(continued on the next page)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

(Box No. V)

Claim 21:

Claim 21 is also considered to be novel under PCT Article 33(2) as claim 21 depends on claim 20.

However, the additional feature of claim 21 is anticipated from D1 of Ethernet serial link for transmitting or receiving user data and Ethernet control data.

Accordingly, claim 21 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

Claim 22:

The subject matter relates to a method of delivering power to one of a plurality of devices connected in a daisy chain.

D1 discloses a system and method for providing power over Ethernet network to devices connected through a serial link, including: (i)a power source of voltage, (ii)a relay switch to relay a voltage, (iii)capacitors, transformers and resistors at each side of serial link wires of Ethernet, (iv)several pairs of wires configured to form serial link, (v)a resistor and transistors to detect an information of load devices including current, and a lack of power, (vi)a controller for determining and comparing the state of devices connected to Ethernet.

The difference of claim 22 from D1 is that D1 does not disclose a step of detecting a load in the device. Thus claim 22 is considered to be novel under PCT Article 33(2).

Corresponding to the difference, however, a person skilled in the art can easily anticipate the step of detecting a load in the device of claim 22 from the resistor, transistors, and the controller of D1, because the resistor and transistors detects an information of load devices including current, and the controller determines the state of devices connected to Ethernet.

Accordingly, claim 22 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

Claim 23:

Claim 23 is also considered to be novel under PCT Article 33(2) as claim 23 depends on claim 22.

However, the additional feature of claim 23 is anticipated from D1, because the controller determines the information of devices connected to Ethernet by using a resistor and transistors, and then supplies power to the devices lacking power to recover the normal state of operation.

Accordingly, claim 23 would have been obvious over D1, thus lacks an inventive step under PCT Article 33(3).

II. Industrial applicability

The industrial applicability of all the claims is self-evident in the sense of PCT Article 33(4) because the subject matter claimed can be made or used in industry.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 83957-0013	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2009/038077	International filing date (<i>day/month/year</i>) 24 MARCH 2009 (24.03.2009)	(Earliest) Priority Date (<i>day/month/year</i>) 27 MARCH 2008 (27.03.2008)
Applicant SYNERCHIP CO., LTD. et al		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figure is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/038077**A. CLASSIFICATION OF SUBJECT MATTER****H04N 5/44(2006.01)i**

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: H04N, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models since 1975

Japanese utility models and applications for utility models since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) 'serial, hybrid link, bi-direction, bandwidth scale'

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	US 2002/0171741 A1 (STEVEN WALLACE TONKIN et al.) 21 November 2002 See whole document.	1 2-37
Y A	US 2005/0004708 A1 (ANDREW A. GOLDENBERG et al.) 06 January 2005 See abstract, page 1, paragraph [0015]-page 2, paragraph [0018], claim 1 and FIG. 1.	1 2-37
A	US 2007/0200859 A1 (JOHN D. BANKS et al.) 30 August 2007 See abstract, claim 1 and FIGS. 2,8.	1-37
A	US 2008/0008470 A1 (CHIH-CHUAN LIN et al.) 10 January 2008 See abstract, claim 1 and FIG. 1.	1-37

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 NOVEMBER 2009 (23.11.2009)

Date of mailing of the international search report

24 NOVEMBER 2009 (24.11.2009)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

MOON, Young Jae

Telephone No. 82-42-481-8592



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2009/038077

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002/0171741 A1	21.11.2002	EP 0815688 A1	07.01.1998
		EP 0815688 B1	10.05.2000
		EP 0971541 A2	12.01.2000
		EP 0971541 A3	23.08.2000
		US 06061089 A	09.05.2000
		US 06084631 A	04.07.2000
		WO 1996-031067 A1	03.10.1996
US 2005/0004708 A1	06.01.2005	US 07346429 B2	18.03.2008
US 2007/0200859 A1	30.08.2007	EP 1827020 A2	29.08.2007
		JP 2007-228606 A	06.09.2007
		KR 10-2007-0088402 A	29.08.2007
US 2008/0008470 A1	10.01.2008	JP 2008-017438 A	24.01.2008

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

KIM, ELIZABETHE.

MCDERMOTT WILL & EMERY LLP 28 STATE STREET
BOSTON MA 02109 USA

Date of mailing
(day/month/year) **24 NOVEMBER 2009 (24.11.2009)**

Applicant's or agent's file reference
83957-0013

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2009/038077

International filing date (day/month/year)

24 MARCH 2009 (24.03.2009)

Priority date(day/month/year)

27 MARCH 2008 (27.03.2008)

International Patent Classification (IPC) or both national classification and IPC

H04N 5/44(2006.01)i

Applicant

SYNERCHIP CO., LTD. et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139
Seonsa-ro, Seo-gu, Daejeon 302
-701, Republic of Korea
Facsimile No. 82-42-472-7140

Date of completion of this opinion
23 NOVEMBER 2009 (23.11.2009)

Authorized officer

MOON, Young Jae

Telephone No.82-42-481-8592



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2009/038077

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2009/038077

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-37	YES
	Claims	None	NO
Inventive step (IS)	Claims	2-37	YES
	Claims	1	NO
Industrial applicability (IA)	Claims	1-37	YES
	Claims	None	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2002/0171741 A1 (STEVEN WALLACE TONKIN et al.) 21 November 2002

D2: US 2005/0004708 A1 (ANDREW A. GOLDENBERG et al.) 06 January 2005

1. Novelty and Inventive Step

1.1 Claims 1-15

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a communication system comprising a serial communication link and a hybrid link. Claim 1 differs from D1 in that a hybrid link. However, the hybrid communication link is well known in D2. Accordingly, claim 1 would have been obvious over D1 in view of D2. Therefore, claim 1 lacks an inventive step under PCT Article 33(3).

The technical features of dependent claims 2-15 are not disclosed in either of the prior art documents D1-D2, nor are they obvious to a person skilled in the art from the prior art documents individually or in combination. Accordingly, claims 2-15 are novel and involve an inventive step under PCT Article 33(2)-(3).

1.2 Claims 16-18

Claim 16 satisfies the criteria set out in PCT Article 33(2)-(3) in that the prior art documents do not disclose or suggest a hybrid link comprising a bi-directional channel coupled between a first node and a second node, a first transceiver in the first node, a second transceiver in the second node, wherein the hybrid link delivers a clock signal to aid synchronization between the first node and the second node, and wherein the hybrid link delivers a data packet after the synchronization is established.

Claims 17-18 are dependent on claim 16 and therefore meet the requirements of PCT Article 33(2)-(3).

1.3 Claims 19-20

Claim 19 satisfies the criteria set out in PCT Article 33(2)-(3) in that the prior art documents do not disclose or suggest a communication node configured to be coupled to a serial communication link having a least one video channel and a hybrid channel having at least one sub-channel, the communication node comprising: an input coupled to receive video data and a clock signal or signals from a video system; a hybrid channel interface; video outputs; and circuitry.

Claim 20 is dependent on claim 19 and therefore meets the requirements of PCT Article 33(2)-(3).

(Continued on Supplement Box)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of :

Box V

1.4 Claims 21-22

Claim 21 satisfies the criteria set out in PCT Article 33(2)-(3) in that the prior art documents do not disclose or suggest a communication node configured to be coupled to a serial communication link having at least one video channel and a hybrid channel having at least one sub-channel, the communication node comprising: an input configured to be coupled to the serial communication link, to receive video data, including clock signal or signals embedded in the video data; a hybrid channel interface; a video output for asserting video data received from the serial communication link; and circuitry.

Claim 22 is dependent on claim 21 and therefore meets the requirements of PCT Article 33(2)-(3).

1.5 Claims 23-30

Claim 23 satisfies the criteria set out in PCT Article 33(2)-(3) in that the prior art documents do not disclose or suggest a method of communication comprising transmission of digital video data from a first node to a second node over one or more video channels of a serial communication link; transmission of at least one stream of supporting data between the first and the second node over one or more hybrid channels of a hybrid link; and scaling the bandwidth of the serial communication link according to a video pixel frequency.

Claims 24-30 are dependent on claim 23 and therefore meet the requirements of PCT Article 33(2)-(3).

1.6 Claims 31-34

Claim 31 satisfies the criteria set out in PCT Article 33(2)-(3) in that the prior art documents do not disclose or suggest a method for transmitting and receiving a clock signal and data packet over a hybrid link between a first and second node, a method comprising delivering, through the hybrid link, the clock signal, to aid synchronization between the first node and the second node such that the hybrid link delivers the data packet after the synchronization is established.

Claims 32-34 are dependent on claim 31 and therefore meet the requirements of PCT Article 33(2)-(3).

1.7 Claims 35-37

Claim 35 is dependent on claim 23 and therefore meets the requirements of PCT Article 33(2)-(3).

Claim 36 is dependent on claim 17 and therefore meets the requirements of PCT Article 33(2)-(3).

Claim 37 is dependent on claim 19 and therefore meets the requirements of PCT Article 33(2)-(3).

2. Industrial Applicability

Claims 1-37 are industrially applicable under PCT Article 33(4).

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SYN-005PC	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2011/021031	International filing date (<i>day/month/year</i>) 12 JANUARY 2011 (12.01.2011)	(Earliest) Priority Date (<i>day/month/year</i>) 12 JANUARY 2010 (12.01.2010)
Applicant SYNERCHIP USA CORP. et al		

This International search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (See Box No. II)

3. ☐ **Unity of invention is lacking** (See Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the drawings,

a. the figure of the **drawings** to be published with the abstract is Figure No. 2

- ☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.

b. ☐ none of the figure is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/021031**A. CLASSIFICATION OF SUBJECT MATTER*****H04L 29/06(2006.01)i, H04L 12/56(2006.01)i***

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H04L 29/06; G06F 15/16; H04N 7/173; H04N 11/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: USB, DIIVA, line state information, hybrid link

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2009-0245345 A1 (LEE DONGYUN et al.) 01 October 2009 See paragraph 74 and claims 1-4	1-26
A	US 2008-0301748 A1 (LIDA EYRAN et al.) 04 December 2008 See fig.5A, paragraphs 31, 34 and claims 1-5	1-26
A	US 2004-0073697 A1 (NOBUYUKI SAITO et al.) 15 April 2004 See abstract, figs.2A,2B, paragraphs 274-275 and claims 1-5	1-26

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

27 SEPTEMBER 2011 (27.09.2011)

Date of mailing of the international search report

27 SEPTEMBER 2011 (27.09.2011)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

LEE, JEONG SU

Telephone No. 82-42-481-5684



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/021031

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0245345 A1	01.10.2009	CN 101855900 A	06.10.2010
		JP 2011-515999 A	19.05.2011
		KR 10-2011-0058740 A	01.06.2011
		WO 2009-120682 A2	01.10.2009
		WO 2009-120682 A3	01.10.2009
US 2008-0301748 A1	04.12.2008	US 2008-0187028 A1	07.08.2008
		US 2009-0074040 A1	19.03.2009
		US 2009-0115911 A1	07.05.2009
		US 2009-0116547 A1	07.05.2009
		US 2009-0116548 A1	07.05.2009
		US 2009-0116583 A1	07.05.2009
		US 2009-0147864 A1	11.06.2009
		US 2010-0122135 A1	13.05.2010
		US 7835289 B2	16.11.2010
		US 7835382 B2	16.11.2010
		WO 2008-096267 A2	14.08.2008
		WO 2008-096267 A3	14.08.2008
US 2004-0073697 A1	15.04.2004	JP 2004-021613 A	22.01.2004
		US 7349973 B2	25.03.2008

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

ELIZABETH KIM

RAUSCHENBACH PATENT LAW GROUP, LLP 43
HACKENSACK ROAD CHESTNUT HILL MA 02467 USA

Date of mailing
(day/month/year) **27 SEPTEMBER 2011 (27.09.2011)**

Applicant's or agent's file reference
SYN-005PC

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US2011/021031

International filing date (day/month/year)

12 JANUARY 2011 (12.01.2011)

Priority date(day/month/year)

12 JANUARY 2010 (12.01.2010)

International Patent Classification (IPC) or both national classification and IPC

H04L 29/06(2006.01)i, H04L 12/56(2006.01)i

Applicant

SYNERCHIP USA CORP. et al

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 189
Cheongsa-ro, Seo-gu, Daejeon 302-
701, Republic of Korea
Facsimile No. 82-42-472-7140

Date of completion of this opinion
27 SEPTEMBER 2011 (27.09.2011)

Authorized officer

LEE, JEONG SU

Telephone No.82-42-481-5684



**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/021031

Box No. 1 Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :
 - ☒ the international application in the language in which it was filed
 - ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. a sequence listing filed or furnished
 - ☐ on paper
 - ☐ in electronic form
 - b. time of filing or furnishing
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in electronic form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US2011/021031

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-26	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	1-26	YES
	Claims	NONE	NO
Industrial applicability (IA)	Claims	1-26	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2009-0245345 A1 (LEE, DONGYUN et al.) 01 October 2009

D2: US 2008-0301748 A1 (LIDA, EYRAN et al.) 04 December 2008

D3: US 2004-0073697 A1 (SAITO, NOBUYUKI et al.) 15 April 2004

1. Novelty (PCT Article 33(2)) and Inventive Step (PCT Article 33(3))

1.1 Independent Claims 1, 11

Claim 1 of the present invention relates to a system comprising a USB host controller, a first device, a second device, a network configured to transfer data between the first and second devices according to USB protocol and including a hybrid link. The feature of claim 1 of transferring data according to USB protocol corresponds to that of D1 of transferring data through USB over DIVA. However, the feature of claim 1 of transmitting a line state information packet between USB ports is not found in any of the documents D1-D3, nor is it obvious to a person skilled in the art.

The feature of claim 11 of communicating a line state information packet between USB ports is not found in any of the documents D1-D3, nor is it obvious to a person skilled in the art

Therefore, claims 1 and 11 of the present invention are novel and inventive under PCT Article 33(2)-(3).

1.2 Dependent Claims 2-10, 12-26

Claims 2-10 are directly or indirectly dependent on claim 1. Claims 12-26 are directly or indirectly dependent on claim 11.

Therefore, claims 2-10 and 12-26 of the present invention are novel and inventive under PCT Article 33(2)-(3).

2. Industrial Applicability (PCT Article 33(4))

Claims 1-26 of the present invention are industrially applicable under PCT Article 33(4).

Substitute for form 1449A/PTO SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	Complete if Known	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	DANG, KHANH
Sheet 1 of 2		Attorney Docket No: 8029P150

US PATENT DOCUMENTS					
Examiner Initial *	Cite No ¹	USP Document Number	Publication or Issue Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No ¹	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
		Country Code/Number/Kind Code (if known)				
	A1	KR-10-2005-0012310	02/02/2005	LG Electronics Inc.,		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A2	"Introduction to DiiVA Designed Specifically for Home Entertainment Networking," DiiVA Licensing LLC, 2010, 4 pages	
	A3	Decision on Rejection dated February 5, 2013 (+ English translation), in Chinese Patent Application No. 200980100976.3, 16 pages	
	A4	DiiVA Specification 1.1 Draft A, DiiVA Promoters Group, distribution date January 7, 2010, 188 pages	
	A5	International Search Report and Written Opinion of the International Searching Authority dated June 29, 2010, in International Patent Application No. PCT/US2009/067744, 10 pages	
	A6	International Search Report and Written Opinion of the International Searching Authority dated November 24, 2009, in International Patent Application No. PCT/US2009/038077, 7 pages	
	A7	International Search Report and Written Opinion of the International Searching Authority dated September 27, 2011, in International Patent Application No. PCT/US11/21031	
	A8	Microprocessor and Microcomputer Standards Committee of the IEEE Computer Society, "IEEE P1394r Draft 1 Draft Standard for High Performance Serial Bus", 2007	
	A9	Office Action dated January 31, 2012 (+ English translation), in Chinese Patent Application No. 200980100976.3, 21 pages	
	A10	Office Action dated July 24, 2013 (+ English translation), in Taiwan Patent Application No. 098142426, 12 pages	
	A11	Office Action dated July 31, 2012 (+ English translation), in Taiwan Patent Application No. 098110096, 35 pages	

EXAMINER

DATE CONSIDERED

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional) ² Applicant is to place a check mark here if English language Translation is attached

Substitute for form 1449A/PTO SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	<i>Complete if Known</i>	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	DANG, KHANH
Sheet 2 of 2	Attorney Docket No: 8029P150	

	B1	Office Action dated March 30, 2012 (+ English translation), in Chinese Patent Application No. 200980105447.2, 16 pages	
	B2	Office Action dated November 29, 2012 (+ English translation), in Chinese Patent Application No. 200980105447.2, 8 pages	
	B3	Office Action dated September 13, 2012 (+ English translation), in Chinese Patent Application No. 200980100976.3, 21 pages	
	B4	Office Action for Patent Application No.: 2011-501975 (Attorney Docket No. 8029P146JP), (8/5/2013)	

EXAMINER

DATE CONSIDERED

Based on PTO/SB/08A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

Electronic Acknowledgement Receipt

EFS ID:	17408784
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	65702
Filer:	Mark C. Van Ness/Andrea Dolder
Filer Authorized By:	Mark C. Van Ness
Attorney Docket Number:	8029P150
Receipt Date:	14-NOV-2013
Filing Date:	11-DEC-2009
Time Stamp:	20:38:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		8029P150_PrelAM.pdf	23439 d539babaccdf9cb9e9b436b5e764cfeff7bca5dccc	yes	3

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Preliminary Amendment		1	1	
	Drawings-only black and white line drawings		2	2	
	Applicant Arguments/Remarks Made in an Amendment		3	3	
Warnings:					
Information:					
2	Drawings-only black and white line drawings	8029P150_FormalDraw.pdf	112167	no	7
			b150ad4b74415489bab35ef406a85632b3017d98		
Warnings:					
Information:					
3	Transmittal Letter	8029P150_IDSTrans.pdf	1809123	no	1
			cd08c9af8acc86acfd2ee2edeae6693c1ae148bef		
Warnings:					
Information:					
4	Foreign Reference	A1a.pdf	14395131	no	11
			67a77cc6f08f0c4525cd72ee4f05246c593a3df9		
Warnings:					
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5	Foreign Reference	A1b.pdf	237040	no	2
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6	Foreign Reference	A1c.pdf	77905	no	2
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Information:					
7	Non Patent Literature	A2.pdf	7443407	no	4
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8	Other Reference-Patent/App/Search documents	A3.pdf	19905615	no	16
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9	Non Patent Literature	A4a.pdf	4473671	no	48
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10	Non Patent Literature	A4b.pdf	5500389	no	52
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Information:					
11	Non Patent Literature	A4c.pdf	6202290	no	52
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Information:					
12	Non Patent Literature	A4d.pdf	2873137	no	36
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Warnings:					
Information:					
13	Other Reference-Patent/App/Search documents	A5a.pdf	164022	no	4
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14	Other Reference-Patent/App/Search documents	A5b.pdf	291743	no	6
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17	Other Reference-Patent/App/Search documents	A7a.pdf	129472	no	3
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18	Other Reference-Patent/App/Search documents	A7b.pdf	122919	no	3
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Information:					
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21	Other Reference-Patent/App/Search documents	A9a2.pdf	17966031	no	11
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22	Other Reference-Patent/App/Search documents	A10a.pdf	30541	no	4
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Information:					
25	Other Reference-Patent/App/Search documents	A11b.pdf	2480397	no	28
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Warnings:					
Information:					
26	Other Reference-Patent/App/Search documents	B1aF.pdf	24150629	no	16
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Warnings:					

Information:					
27	Other Reference-Patent/App/Search documents	B2.pdf	396817	no	8
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28	Other Reference-Patent/App/Search documents	B3a1.pdf	14310173	no	10
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Warnings:					
Information:					
29	Other Reference-Patent/App/Search documents	B3a2.pdf	16954776	no	11
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Warnings:					
Information:					
30	Other Reference-Patent/App/Search documents	B4aF.pdf	3610058	no	4
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Warnings:					
Information:					
31	Other Reference-Patent/App/Search documents	B4b.pdf	3629809	no	4
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Warnings:					
Information:					
32	Information Disclosure Statement (IDS) Form (SB08)	8029P150_1449F.pdf	35303	no	2
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Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
Total Files Size (in bytes):			169829881		

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.

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

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	12/636,063
Filing Date	December 11, 2009
First Named Inventor	Dongyun Lee
Art Unit	2111
Examiner Name	Khanh Dang
Attorney Docket Number	8029P150

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

- Submission required under 37 CFR 1.114** Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

 - ☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.
 - ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
 - ☐ Other _____
 - ☒ Enclosed
 - ☐ Amendment/Reply
 - ☐ Affidavit(s)/ Declaration(s)
 - ☒ Information Disclosure Statement (IDS)
 - ☐ Other _____
- Miscellaneous**

 - ☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)
 - ☐ Other _____
- Fees**

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any overpayments, to Deposit Account No. 02-2666.

 - ☒ RCE fee required under 37 CFR 1.17(e)
 - ☐ Extension of time fee (37 CFR 1.136 and 1.17)
 - ☐ Other _____
 - ☐ Check in the amount of \$ _____ enclosed
 - ☐ Payment by credit card (Form PTO-2038 enclosed)

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.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Mark C. Van Ness/	Date	October 23, 2013
Name (Print/Type)	Mark C. Van Ness	Registration No.	39865

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	/Andrea Dolder/	Date	October 23, 2013
Name (Print/Type)	Andrea Dolder		

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, 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.

Instruction Sheet for RCEs

(not to be submitted to the USPTO)

NOTES:

An RCE is not a new application, and filing an RCE will not result in an application being accorded a new filing date.

Filing Qualifications:

The application must be a utility or plant application filed on or after June 8, 1995. The application cannot be a provisional application, a utility or plant application filed before June 8, 1995, a design application, or a patent under reexamination. See 37 CFR 1.114(e).

Filing Requirements:

Prosecution in the application must be closed. Prosecution is closed if the application is under appeal, or the last Office action is a final action, a notice of allowance, or an action that otherwise closes prosecution in the application (e.g., an Office action under *Ex parte Quayle*). See 37 CFR 1.114(b).

A submission and a fee are required at the time the RCE is filed. If reply to an Office action under 35 U.S.C. 132 is outstanding (e.g., the application is under final rejection), the submission must meet the reply requirements of 37 CFR 1.111. If there is no outstanding Office action, the submission can be an information disclosure statement, an amendment, new arguments, or new evidence. See 37 CFR 1.114(c). The submission may be a previously filed amendment (e.g., an amendment after final rejection).

WARNINGS:

Request for Suspension of Action:

All RCE filing requirements must be met before suspension of action is granted. A request for a suspension of action under 37 CFR 1.103(c) does not satisfy the submission requirement and does not permit the filing of the required submission to be suspended.

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Before Appeal - If the RCE is improper (e.g., prosecution in the application is not closed or the submission or fee has not been filed) and the application is not under appeal, the time period set forth in the last Office action will continue to run and the application will be abandoned after the statutory time period has expired if a reply to the Office action is not timely filed. No additional time will be given to correct the improper RCE.

Under Appeal - If the RCE is improper (e.g., the submission or the fee has not been filed) and the application is under appeal, the improper RCE is effective to withdraw the appeal. Withdrawal of the appeal results in the allowance or abandonment of the application depending on the status of the claims. If there are no allowed claims, the application is abandoned. If there is at least one allowed claim, the application will be passed to issue on the allowed claim(s). See MPEP 1215.01.

See MPEP 706.07(h) for further information on the RCE practice.

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Mark C. Van Ness/Andrea Dolder			
Attorney Docket Number:	8029P150			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
Total in USD (\$)				1200

Electronic Acknowledgement Receipt

EFS ID:	17212639
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	65702
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

**Espacenet****Bibliographic data: CN101032113 (A) — 2007-09-05****Single-line two-way communication device and system**

No documents available for this priority number.

Inventor(s): MAKOTO SUZUKI AKIHIRO HIRANO [JP] ± (SUZUKI AKIHIRO,HIRANO MAKOTO, ; HIRANO MAKOTO, ; SUZUKI AKIHIRO)

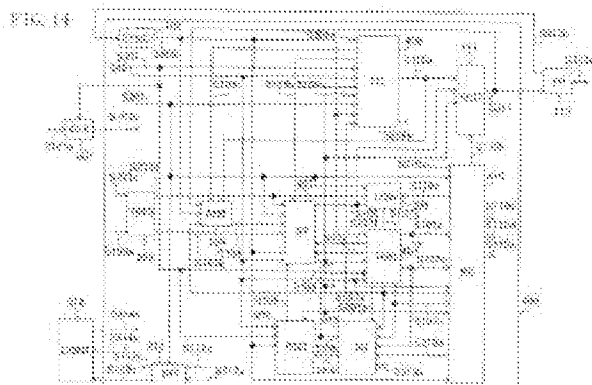
Applicant(s): MATSUSHITA ELECTRIC IND CO LTD [JP] ± (MATSUSHITA ELECTRIC IND CO., LTD, ; MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD)

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Abstract of CN101032113 (A)

A communication device (400) capable of matching two two-way communication protocols is connected with a single-line two-way signal line and a controller (414). The controller (414) has its software processing limited to a transmission request, a setting of transmission data and a decode processing of a reception data, but all the communication processing operations such as the waveform generation at the transmission time, the data sampling at the reception time or the decoding of a reception address are subjected to the hardware processing of the communication device (400). Under the control of a state decision circuit (405), a transmission control circuit (409) and a data output circuit (111) control the wave-form generation at the transmission time, and a wave-form timing decision circuit (407) and a reception control circuit (410) control the data sampling at the reception time and the decoding of the reception address. The transmission wave form can be arbitrarily set from the controller (414), and a transmission/reception timing and forced LOW transmission control circuit (208) can act to select the hard/soft processing.

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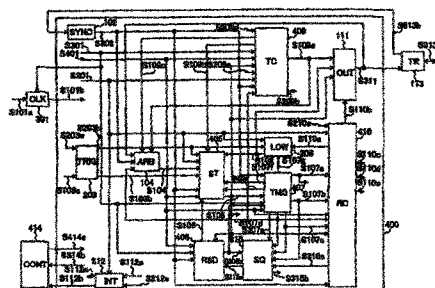
权利要求书 3 页 说明书 35 页 附图 24 页

[54] 发明名称

单线双向通信装置和系统

[57] 摘要

将能够适应 2 种双向通信协议的通信装置 (400) 与单线双向信号线和控制器 (414) 连接。控制器 (414) 的软件处理只包括以下处理, 即发送请求、发送数据设定、接收数据的译码处理, 发送时的波形生成、接收时的数据采样、接收地址的译码等通信处理全部为通信装置 (400) 的硬件处理。在状态确定电路 (405) 的控制下, 发送时的波形生成由发送控制电路 (409) 和数据输出电路 (111) 进行, 接收时的数据采样和接收地址的译码由波形时序设定电路 (407) 和接收控制电路 (410) 进行。能够从控制器 (414) 任意地设定发送波形, 收发时刻和强制 LOW 发送控制电路 (208) 的动作能够选择由硬件/软件进行处理。



1. 一种双向通信装置，连接在单线双向信号线上、且连接在用于软件处理的控制器上使用，该双向通信装置包括：

输入同步化电路，根据驱动时钟脉冲使来自上述单线双向信号线的输入信号与同步化输入信号同步；

触发脉冲生成电路，根据来自上述控制器的发送请求生成发送请求触发脉冲信号；

状态确定电路，确定该双向通信装置的动作状态，提供状态信号；

发送控制电路，根据响应上述发送请求触发脉冲信号而改变为表示发送状态的上述状态信号，提供发送数据输出边沿生成脉冲信号，以便依照来自上述控制器的发送数据设定来控制发送波形的生成；

数据输出电路，根据上述发送数据输出边沿生成脉冲信号，生成对上述单线双向信号线的输出信号的波形；

仲裁监视电路，发送时进行上述单线双向信号线的信号的仲裁监视；

接收开始检测电路，当根据上述同步化输入信号识别出接收开始时提供开始检测信号；

波形时序判断电路，响应接收上述开始检测信号后改变为表示接收状态的状态信号，提供接收采样脉冲信号，并检查上述同步化输入信号的接收波形中的时序；

接收控制电路，根据上述接收采样脉冲信号控制上述同步化输入信号的数据采样并且对接收地址进行译码；

强制 LOW 发送控制电路，当在接收期间在上述同步化输入信号中发生了时序违反时，进行用于强制性地对上述单线双向信号线发送 LOW 电平的控制；以及

中断信号发生电路，从上述各电路接收中断生成边沿信号，生成对上述控制器的中断信号，

其中，上述控制器，从上述接收控制电路取得上述接收数据和上

述接收地址的译码结果作为观测数据。

2. 根据权利要求1所述的双向通信装置，其特征在于：

还具有分别进行上述单线双向信号线的双向信号与上述输入信号和上述输出信号之间的变换的开路漏极端子。

3. 根据权利要求1所述的双向通信装置，其特征在于：

上述状态确定电路，确定该双向通信装置的动作状态是地址状态、发送开始等待状态、发送状态、接收状态、以及强制 LOW 发送状态中的哪一种状态。

4. 根据权利要求1所述的双向通信装置，其特征在于：

上述触发脉冲生成电路，根据来自上述控制器的强制 LOW 发送开始和结束请求，生成强制 LOW 发送开始和结束请求触发信号，

上述状态确定电路，根据上述强制 LOW 发送开始和结束请求触发信号，确定该双向通信装置的动作状态。

由上述控制器分别控制上述发送控制电路的发送继续及结束设定、和上述接收控制电路的接收时 ACK 输出设定。

5. 根据权利要求1所述的双向通信装置，其特征在于：

还包括

驱动脉冲生成电路，根据基准时钟脉冲生成上述驱动脉冲，使上述驱动脉冲对2种双向通信协议的每一个具有不同的频率；

追加序列检测电路，对上述2种双向通信协议中在通信格式内存在追加序列的一方的双向通信协议进行该追加序列的接收处理，

上述接收开始检测电路，在接收开始的识别处理中，选择上述2种双向通信协议中的任一者的处理，

上述波形时序判断电路，检查与上述2种双向通信协议对应的接收波形中的时序。

6. 根据权利要求1所述的双向通信装置，其特征在于：

由上述控制器分别对上述状态确定电路设定强制 LOW 发送结束时间、对上述发送控制电路设定发送波形时序、对上述接收开始检测电路设定接收开始判断的时序条件、对上述波形时序判断电路设定接

收波形中的时序的检查条件、对上述接收控制电路设定 ACK 发送时序。

7. 根据权利要求 1 所述的双向通信装置，其特征在于：

还具有仲裁期间调整电路，该仲裁期间调整电路根据表示仲裁期间的信号，生成调整为从上述单线双向信号线上的双向信号的上升沿和下降沿起在由上述控制器设定的期间内使仲裁停止的调整后仲裁期间选通脉冲信号，

上述仲裁监视电路，根据上述调整后仲裁期间选通脉冲信号，按上述驱动时钟的每个脉冲进行仲裁监视。

8. 根据权利要求 1 所述的双向通信装置，其特征在于：

还包括

波形恶化检测电路，生成指示从上述数据输出电路到上述单线双向信号线的输出信号的波形恶化的波形恶化检测信号；

发送时序设定值调整电路，根据上述波形恶化检测信号和来自上述控制器的波形时序设定信号，进行运算处理，生成调整后发送波形时序设定信号。

9. 一种双向通信系统，包括权利要求 1 所述的双向通信装置和所述控制器，其中：

上述控制器，具有实现低功耗的停止模式，而且具有根据来自上述双向通信装置的中断信号从上述停止模式转移到动作模式的功能。

单线双向通信装置和系统

技术领域

本发明涉及实现用单线进行的双向通信的装置和系统。

背景技术

按照某种数字通信技术，能够由计算机系统将视频数据信号与控制信号一起用 1 条串行信号线传输（参照专利文献 1）。

目前，已知有用单线实现多媒体数据的双向通信的协议。例如，能够举出被确定为数字接口标准 HDMI（High-Definition Multimedia Interface：高分辨率多媒体接口）中的任选标准的 CEC（Consumer Electronic Control：用户电子控制）的通信协议、或欧洲市场上的从 TV 控制 VCR（在 SCART 端子间的连接）的被称为 AV.Link（或 Q-link 等，以下统称为 AV.Link）的通信协议。

以往，例如当实现使用 AV.Link 通信协议的双向通信时，通常是使用安装在 LSI 内部的作为外围功能的计时功能、外部中断功能、端口功能，通过 CPU 的软件处理控制这些功能来实现通信。

当实现发送时，用计时功能对由标准确定的时间进行计数，根据该计时中断，使用端口输出功能，进行“High（高）”和“Low（低）”电平的端口输出。而当实现接收时，用外部中断功能在所输入的 AV.Link 信号的边沿产生外部中断，根据该外部中断用计时功能进行是否为由标准确定的波形的检查和接收数据的采样。另外，由于 AV.Link 通信是双向通信，在 LSI 中必需另外设置用于用发送用的端口输出端子和接收用的端口输出端子这 2 个端子在 LSI 外部进行双向通信的电路。而且，在发送时的仲裁监视中，使用计时功能的中断以某个周期来监视 LSI 中发送用的端口输出端子和接收用的端口输出端子，当两个端子的状态不同时，从发送切换到接收。

专利文献 1: 美国专利第 6151334 号说明书

发明内容

但是, 在现有技术中, 通常是通过在 CPU 的软件处理中控制安装在 LSI 内部的作为外围功能的计时功能、外部中断功能、端口功能来实现使用 AV. Link 通信协议的双向通信, 因此, 发送时的波形生成和接收时的数据采样等处理必须用软件实现, 就连收发数据的译码处理等实现 AV. Link 通信的大部分处理也必须用软件实现。因此, 使 CPU 的处理负荷增大, 成为 CPU 性能降低的原因。

本发明的目的在于, 在连接在用于软件处理的控制器上使用的单线双向通信装置中、和在包括该单线双向通信装置和控制器的系统中, 减轻控制器的处理负荷。

按照本发明, 不是由软件处理实现全部处理, 只是对发送请求、发送数据设定、接收数据的译码(命令的解释和执行)的处理采用软件处理, 至于发送时的波形生成、接收时的数据采样、接收地址的译码等的通信处理则全部采用硬件处理。

具体地说, 本发明的单线双向通信装置, 包括: 输入同步化电路, 根据驱动时钟脉冲使来自单线双向信号线的输入信号与同步化输入信号同步; 触发脉冲生成电路, 根据来自控制器的发送请求生成发送请求触发脉冲信号; 状态确定电路, 确定该双向通信装置的动作状态, 提供状态信号; 发送控制电路, 根据响应发送请求触发脉冲信号而改变为表示发送状态的状态信号, 提供发送数据输出边沿生成脉冲信号, 以便依照来自控制器的发送数据设定来控制发送波形的生成; 数据输出电路, 根据发送数据输出边沿生成脉冲信号, 生成对单线双向信号线的输出信号的波形; 仲裁监视电路, 发送时进行单线双向信号线的信号的仲裁监视; 接收开始检测电路, 当根据同步化输入信号识别出接收开始时提供开始检测信号; 波形时序判断电路, 响应接收开始检测信号后改变为表示接收状态的状态信号, 提供接收采样脉冲信号, 并检查同步化输入信号的接收波形中的时序; 接收控制电路, 根

据接收采样脉冲信号控制同步化输入信号的数据采样并且对接收地址进行译码；强制 LOW 发送控制电路，当在接收期间在同步化输入信号中发生了时序违反时，进行用于强制性地对单线双向信号线发送 LOW 电平的控制；以及中断信号发生电路，从各电路接收中断生成边沿信号，生成对控制器的中断信号，其中，控制器，从接收控制电路取得接收数据和接收地址的译码结果作为观测数据。

按照本发明的双向通信装置，与由以往的软件处理实现双向通信相比，能够大幅度地减轻控制器（CPU）性能的降低。

附图说明

图 1A 是表示 CEC 通信格式的图。

图 1B 是表示 CEC 起始位波形时序的时序图。

图 1C 是表示 CEC 数据位波形时序的时序图。

图 1D 是表示 AV. Link 通信格式的图。

图 2 是表示本发明的实施方式 1 的 CEC 通信装置的结构框图。

图 3 是表示本发明的实施方式 1 的 CEC 通信装置的状态转移的状态转移图。

图 4A 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序图，示出发送状态的动作。

图 4B 是接续图 4A 的图。

图 5A 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序图，示出从发送开始等待状态向接收状态转移的动作。

图 5B 是接续图 5A 的图。

图 5C 是与图 5A 相同的期间的时序图。

图 5D 是接续图 5C 的图。

图 6 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序图，示出从发送状态识别总线损失（bus lost）并向接收状态转移的动作。

图 7 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序

图，示出从接收状态转移到强制 LOW 发送状态的动作。

图 8 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序图，示出从发送状态识别来自接收方的强制 LOW 发送并向 IDLE 状态转移的动作。

图 9 是说明本发明的实施方式 1 的 CEC 通信装置的动作的时序图，示出从接收状态识别来自其他方的强制 LOW 发送并向 IDLE 状态转移的动作。

图 10 是表示本发明的实施方式 2 的 CEC 通信装置的结构框图。

图 11 是表示本发明的实施方式 3 的 CEC/AV. Link 通信装置的结构框图。

图 12 是说明本发明的实施方式 3 的 CEC/AV. Link 通信装置的动作的时序图，示出发送状态的动作。

图 13A 是说明本发明的实施方式 3 的 CEC/AV. Link 通信装置的动作的时序图，示出从发送开始等待状态向接收状态转移的动作。

图 13B 是与图 13A 相同的期间的时序图。

图 14 是表示本发明的实施方式 4 的 CEC/AV. Link 通信装置的结构框图。

图 15 是表示本发明的实施方式 5 的 CEC/AV. Link 通信装置的结构框图。

图 16 是表示本发明的实施方式 6 的 CEC/AV. Link 通信装置的结构框图。

图 17 是表示本发明的实施方式 7 的 CEC/AV. Link 通信装置的结构框图。

符号说明

- 100、200 CEC 通信电路
- 101、301、702 驱动块生成电路 (CLK)
- 102 输入同步化电路 (SYNC)
- 103 触发脉冲生成电路 (TRIG)
- 104、504 仲裁监视电路 (ARB)

- 105、205、405 状态确定电路 (ST)
- 106、306、406 接收开始检测电路 (RSD)
- 107、307、407 波形时序判断电路 (TMG)
- 108、208 强制 LOW 发送控制电路 (LOW)
- 109、209、309、409 发送控制电路 (TC)
- 110、210、310、410 接收控制电路 (RC)
- 111 数据输出电路 (OUT)
- 112、212 中断信号发生电路 (INT)
- 113 N 沟道 MOS 晶体管开路漏极端子 (TR)
- 114、214、314、414、514、703 控制器 (CONT)
- 300、400、500、600、701 CEC/AV. Link 通信电路
- 315 追加序列检测电路 (SQ)
- 516 仲裁期间调整电路 (PER)
- 617 波形恶化检测电路 (DEG)
- 618 发送时序设定值调整电路 (SET)
- 700 CEC/AV. Link 通信系统
- 704 基准时钟脉冲输入端子
- 705 CEC/AV. Link 通信输入端子
- C200 IDLE 状态
- C201 发送开始等待状态
- C202 发送状态
- C203 接收状态
- C204 强制 LOW 发送状态
- S101a、S700a 基准时钟脉冲
- S101b、S702 驱动时钟脉冲
- S102 同步化 CEC 输入信号
- S103a 发送请求信号
- S103b 发送请求触发脉冲信号
- S103b' 发送开始等待开始信号

- S104 总线损失检测信号
- S105 状态信号
- S106 状态检测信号
- S107a 波形时序判断信号
- S107b 接收字节计数信号
- S107c 接收位计数信号
- S107d 接收采样脉冲信号
- S107e 接收数据等待时间结束信号
- S107f 他人强制 LOW 发送条件信号
- S107g 强制 LOW 发送条件检测信号
- S108 强制 LOW 发送开始脉冲信号
- S109a 发送数据输出边沿生成脉冲信号
- S109b 发送结束脉冲信号
- S109c 仲裁期间选通脉冲信号
- S109d、S309d 发送数据设定信号
- S110a 地址译码信号
- S110b ACK 输出边沿生成脉冲信号
- S110c 接收地址数据
- S110d 接收数据
- S110e 接收 EOM 数据
- S111 CEC 输出信号
- S112a 中断生成边沿信号
- S112b、S701b 中断信号
- S113a CEC 信号
- S113b CEC 输入信号
- S114a、S214a、S314a、S414a、S514a、S703 控制数据
- S114b、S214b、S314b、S701a 观测数据
- S201 硬件软件处理选择信号
- S203a 强制 LOW 发送开始和结束请求信号

S203b 强制 LOW 发送开始和结束请求触发脉冲信号

S209a 发送继续和结束设定信号

S209b 接收 ACK 数据

S210a 接收时 ACK 输出设定信号

S212a 中断生成边沿信号（软件处理选择时）

S301 CEC/AV. Link 通信选择信号

S302 同步化 CEC/AV. Link 输入信号

S306a 起始位检测信号

S307a 追加序列时序脉冲信号

S310a 并行变换后接收数据

S313a CEC/AV. Link 信号

S313b、S700b CEC/AV. Link 输入信号

S311 CEC/AV. Link 输出信号

S315a 追加序列检测信号

S315b 接收应用识别数据

S401 波形时序设定信号

S501 仲裁期间设定信号

S516 调整后仲裁期间选通信号

S617 波形恶化值检测信号

S618 调整后发送波形时序设定信号

具体实施方式

在示出实施方式之前,首先用图 1A~图 1D 说明 CEC 通信和 AV. Link 通信的格式和波形时序。

首先,说明 CEC 通信。CEC 通信格式,如图 1A 所示,开始时发送被称为起始位的波形,接着发送被称为标题块的 9 位数据,之后,发送来自接收方的被称为 ACK (确认) 的数据。此处,标题块的除 ACK 之外的格式,由开始时的作为发送方地址的前 4 位的启动程序

(initiator) 地址、接着的作为接收方地址的目标 (destination) 地址、最后的表示是继续下一个块的发送还是结束的信息的 1 位的 EOM (End of Message: 报文结束) 数据构成。在发送标题块之后, 传送数据块直到 EOM 数据表示结束为止。对于该数据块, 也同样发送 9 位数据, 之后, 发送来自发送方的被称为 ACK 的数据。此处, 数据块的除 ACK 之外的格式, 由 8 位数据和 EOM 数据构成。另外, 在上述目标地址中, 当向特定的通信对方发送时, 发送接收方的地址 (以下称为直接地址发送), 当向所有的通信对方发送时, 发送预先确定的地址 (以下称为广播地址发送)。在这 2 种发送中, 接收方的 ACK 发送的含义不同。首先, 对于直接地址发送, 当接收方正常地接收到发送数据时, ACK 发送 “0”, 如不是这样, 则 ACK 发送 “1”。其次, 对于广播地址发送, 当接收方正常地接收到发送数据时, ACK 发送 “1”, 如不是这样, 则 ACK 发送 “0”。

接着, 关于上述起始位的波形时序, 根据标准确定如图 1B 所示的波形时序, 首先在时刻 T1 使 CEC 信号从 “High” 改变为 “Low”。然后在时刻 T3 使 CEC 信号从 “Low” 改变为 “High”。此处, 时刻 T3, 表示由标准所确定的用作基准的时刻, 在标准中, 时刻 T2 表示 CEC 信号的上升沿的 MIN 值, 时刻 T4 表示 CEC 信号的上升沿的 MAX 值, 确定 CEC 信号的上升沿必须位于从上述 T2 到上述 T4 的范围内。进一步, 在时刻 T6 使 CEC 信号从 “High” 改变为 “Low”。此处, 时刻 T6, 表示由标准所确定的用作基准的时刻, 在标准中, 时刻 T5 表示 CEC 信号的下降沿的 MIN 值, 时刻 T7 表示 CEC 信号的下降沿的 MAX 值, 确定 CEC 信号的下降沿必须位于从上述 T5 到上述 T7 的范围内。

其次, 关于上述数据位的波形时序, 根据标准确定如图 1C 所示的波形时序, 数据位的波形时序表示 1 位数据。此处, 上侧表示输出 “0” 时的波形时序, 下侧表示输出 “1” 时的波形时序。

先说明输出 “0” 时的波形时序。首先, 在时刻 T8 使 CEC 信号从 “High” 改变为 “Low”。然后在时刻 T14 使 CEC 信号从 “Low”

改变为“High”。此处，时刻 T14，表示由标准所确定的用作基准的时刻，在标准中，时刻 T13 表示 CEC 信号的上升沿的 MIN 值，时刻 T15 表示 CEC 信号的上升沿的 MAX 值，确定 CEC 信号的上升沿必须位于从上述 T13 到上述 T15 的范围内。进一步，在时刻 T17 使 CEC 信号从“High”改变为“Low”。此处，时刻 T17，表示由标准所确定的用作基准的时刻，在标准中，时刻 T16 表示 CEC 信号的下降沿的 MIN 值，时刻 T18 表示 CEC 信号的下降沿的 MAX 值，确定 CEC 信号的下降沿必须位于从上述 T16 到上述 T18 的范围内。另外，在如上述中所示的输出“0”时的 CEC 波形中，接收方在时刻 T12 对数据“0”进行采样。

接着，说明输出“1”时的波形时序。首先，在时刻 T8 使 CEC 信号从“High”改变为“Low”。然后在时刻 T10 使 CEC 信号从“Low”改变为“High”。此处，时刻 T10 表示由标准确定的用作基准的时刻，在标准中，时刻 T9 表示 CEC 信号的上升沿的 MIN 值，时刻 T11 表示 CEC 信号的上升沿的 MAX 值，确定 CEC 信号的上升沿必须位于从上述 T9 到上述 T11 的范围内。进一步，在时刻 T17 使 CEC 信号从“High”改变为“Low”。此处，时刻 T17 表示由标准所确定的用作基准的时刻，在标准中，时刻 T16 表示 CEC 信号的下降沿的 MIN 值，时刻 T18 表示 CEC 信号的下降沿的 MAX 值，确定 CEC 信号的下降沿必须位于从上述 T16 到上述 T18 的范围内。另外，在如上述中所示的输出“1”时的 CEC 波形中，接收方在时刻 T12 对数据“1”进行采样。

当不满足如上述中所示的数据位的波形时序时，视为违反数据时序，进而当在作为 CEC 信号的下降沿的标准范围的从上述 T16 到 T18 的范围中，在比作为 CEC 信号的下降沿的 MIN 值的上述 T16 短的方向发生了时序违反时，构成要从接收方向发送方进行特殊的发送的条件。此处，所谓特殊的发送，是指接收方在由标准所确定的期间内强制性地发送“Low”（以下称为强制 LOW 发送）。当发送方识别出上述强制 LOW 发送时，必须将当前的发送结束并从最起始再次进行

发送。

以下,说明 AV.Link 通信格式。AV.Link 通信格式,如图 1D 所示,首先发送被称为起动序列的序列。该起动序列,首先发送与上述 CEC 通信格式相同的起始位,其后发送 3 位固定数据“110”。接着发送被称为应用识别数据的 3 位数据。之后,与上述 CEC 通信格式同样地接着发送标题块、数据块直到数据块内的 EOM 数据表示结束为止。而且,AV.Link 通信的直接地址发送、广播地址发送中的 ACK 的动作方式也与上述 CEC 通信中的相同。此外,应用识别数据的位数是任意的。

其次,关于 AV.Link 通信中的起始位和数据位的波形时序,除了上述 CEC 通信的上述各种时序的实际时间为 2 倍以外,与上述 CEC 通信相同。不过,CEC 通信的强制 LOW 发送在 AV.Link 通信中不存在。

《实施方式 1》

图 2 是表示本发明的实施方式 1 的单线双向通信装置的结构框图,作为具体的通信,假定 CEC 通信。

N 沟道 MOS 晶体管开路漏极端子 (TR) 113,输入输出连接在进行通信的对方侧上的 CEC 信号 S113a。CEC 信号 S113a,为设有负载电阻的单线的信号线。进一步,N 沟道 MOS 晶体管开路漏极端子 113,将 CEC 信号 S113a 的 High 和 Low 的状态作为 CEC 输入信号 S113b 输出,输入到后述的输入同步化电路 (SYNC) 102。而且,还输入从后述的数据输出电路 (OUT) 111 输出的 CEC 输出信号 S111。此处,当 CEC 输出信号 S111 为 Low 时,从输入输出端子向 CEC 信号 S113a 输出“Low”,当为 High 时,从输入输出端子输出 HighZ (高阻抗),利用负载电阻使 CEC 信号 S113a 的状态变为“High”。

驱动时钟脉冲生成电路 (CLK) 101,被输入基准时钟脉冲 S101a,根据该基准时钟脉冲 S101a 生成驱动时钟脉冲 S101b,将其提供到 CEC 通信电路 100 内的各电路。

输入同步化电路 (SYNC) 102,被输入 CEC 输入信号 S113b,

根据驱动时钟脉冲 S101b 进行同步化, 输出同步化 CEC 输入信号 S102。

触发脉冲生成电路 (TRIG) 103, 根据作为来自控制器 114 的控制数据 S114a 之一的发送请求信号 S103a, 生成发送请求触发脉冲信号 S103b 并将其输出。

仲裁监视电路 (ARB) 104, 被输入 CEC 输出信号 S111 和同步化 CEC 输入信号 S102, 调整这 2 个信号的时序, 在调整为相同的时序后进行这 2 个信号的比较。作为进行该比较的期间, 根据所输入的仲裁期间选通脉冲信号 S109c 来确定, 进一步, 使用发送数据输出边沿生成脉冲信号 S109a 和接收采样脉冲信号 107d, 用作反映上述比较后的结果的采样点。当上述 2 个信号的比较结果在该采样点上不相等时, 识别为总线损失, 输出总线损失检测信号 S104。

状态确定电路 (ST) 105, 是确定 CEC 通信电路 100 的动作状态的电路, 根据来自前述和后述的各电路的输入, 确定动作状态, 输出状态信号 S105。关于状态信号 S105, 稍后将用图 3 进行说明。

接收开始检测电路 (RSD) 106, 被输入同步化 CEC 输入信号 S102 和状态信号 S105, 按照状态信号 S105 的状态, 用同步化 CEC 输入信号 S102 的边沿, 进行内部计数器的复位和数据装入, 判断该装入值是否满足由标准所确定的起始位的时序条件, 如果满足, 则输出开始检测信号 S106。

波形时序判断电路 (TMG) 107, 被输入同步化 CEC 输入信号 S102 和状态信号 S105, 按照状态信号 S105 的状态, 用同步化 CEC 输入信号 S102 的边沿, 进行内部计数器的复位和数据装入, 判断该装入值是否是满足由标准所确定的时序条件的波形数据, 输出波形时序判断信号 S107a。进一步, 如在发送或接收状态时在同步化 CEC 输入信号 S102 中识别出强制 LOW 发送, 则输出他人强制 LOW 发送条件信号 S107f。另外, 如在接收状态时在同步化 CEC 输入信号 S102 中识别出上述发送方的异常的波形发送, 则输出强制 LOW 发送条件信号 S107g。而当在接收状态中在预先确定的期间内没有接收到下一

个数据时，无论正常和异常接受都视为接收结束，输出接收数据等待时间结束信号 S107e。而且，根据同步化 CEC 输入信号 S102，用内部计数器输出接收字节计数信号 S107b 和接收位计数信号 S107c，进而输出在对接收数据进行采样的时刻生成的接收采样脉冲信号 S107d。

强制 LOW 发送控制电路 (LOW) 108，根据所输入的强制 LOW 发送条件信号 S107g 和地址译码信号 S110a 输出强制 LOW 发送开始脉冲信号 S108。

发送控制电路 (TC) 109，进行发送时的动作控制，按照所输入的状态信号 S105 的状态，输出发送数据输出边沿生成脉冲信号 S109a，以便根据在作为来自控制器 114 的控制数据 S114a 之一的发送数据设定信号 S109d 中设定的数据形成由标准确定的序列和波形。进一步，对于来自接收方的 ACK，也用同步化 CEC 输入信号 S102 和接收采样脉冲信号 S107d 进行 ACK 数据的接收，根据在发送数据设定信号 S109d 中设定的发送地址状态，判断是直接地址发送或广播地址发送的哪一种发送，据此进行接收 ACK 数据的判断。而且，还根据在发送数据设定信号 S109d 中设定的发送 EOM 数据来进行发送的继续或结束的判断。当根据这 2 个判断结果结束发送时，输出发送结束脉冲信号 S109b。另外，CEC 通信是双向通信，存在着多个发送者同时进行发送的情况，因此，在发送时，必须在由标准确定的期间内进行总线仲裁，输出表示该仲裁期间的仲裁期间选通脉冲信号 S109c。

接收控制电路 (RC) 110，进行接收时的动作控制，按照所输入的状态信号 S105 的状态，由同步化 CEC 输入信号 S102、接收字节计数信号 S107b、接收位计数信号 S107c 和接收采样脉冲信号 S107d 对数据进行采样，在由标准确定的序列中，输出接收地址数据 S110c、接收数据 S110d、接收 EOM 数据 S110e，构成对控制器 114 输入的观测数据 S114b 的一部分。另外，对接收地址数据 S110c 中是预先设定的自身的地址或表示连接在 CEC 信号 S113a 上的所有 CEC 通信电路

的地址的某一个进行译码,输出地址译码信号 S110a。进一步,在 ACK 发送中,根据接收地址数据 S110c 和所输入的输出波形时序判断信号 S107a,输出 ACK 输出边沿生成脉冲信号 S110b。

数据输出电路(OUT)111,按照所输入的状态信号 S105 的状态,在发送时的地址数据、数据和 EOM 数据的发送中,根据所输入的发送数据输出边沿生成脉冲信号 S109a 和状态信号 S105 的状态变化的边沿输出 CEC 输出信号 S111,在接收时的 ACK 发送中,根据所输入的 ACK 输出边沿生成脉冲信号 S110b 和状态信号 S105 的状态变化的边沿来输出 CEC 输出信号 S111,在强制 LOW 发送中,根据所输入的强制 LOW 发送开始脉冲信号 S108 和状态信号 S105 的状态变化的边沿输出 CEC 输出信号 S111。

中断信号发生电路(INT)112,被输入由 CEC 通信电路 100 内的各电路生成的用作未图示的软件处理的触发信号的脉冲信号来作为中断生成边沿信号 S112a,生成和输出识别来自各电路的中断生成边沿信号 S112a 的中断识别信号 S112c。该中断识别信号 S112c,作为观测数据 S114b 之一输入到控制器 114。另外,还根据来自各电路的中断生成边沿信号 S112a,生成和输出对控制器 114 的用作软件处理的触发信号的中断信号 S112b。

控制器(CONT)114,输出控制数据 S114a,被输入观测数据 S114b。此处,控制数据 S114a 是用于通过软件处理控制或设定 CEC 通信电路 100 内的电路的数据,观测数据 S114b 是用于通过软件处理对由 CEC 通信电路内的电路生成的数据进行观测的数据。

以下,用图 3 的状态转移图说明状态确定电路 105 中的状态转移。

在 CEC 通信电路 100 中,存在着 5 个动作状态、即“IDLE(空闲)”状态 C200、“发送开始等待”状态 C201、“发送”状态 C202、“接收”状态 C203、“强制 LOW 发送”状态 C204。另外,表示该动作状态的状态信号 105,作为对控制器 114 的观测数据 S114b 之一输入,能够通过软件进行观测。

“IDLE”状态 C200,表示 CEC 通信电路 100 不进行任何动作的

状态。在该“IDLE”状态 C200 的期间内，当产生了发送请求触发脉冲信号 S103b 时，在状态确定电路 105 的内部产生发送开始等待开始信号 S103b'，电路状态，转移到“发送开始等待”状态 C201。此处，当发送请求触发脉冲信号 S103b 在“IDLE”状态 C200 以外的状态中产生时，不产生发送开始等待开始信号 S103b'，不进行电路状态的转移。

“发送开始等待”状态 C201，表示在 CEC 信号 S113a 中确认开始发送前在预定的时间内任何通信都没有进行的状态。在该“发送开始等待”状态 C201 中，由内部所设置的计数器对预先确定的时间进行计数，当在经过预定的时间之前在 CEC 信号 S113a 中发生了变化时，根据由同步化 CEC 输入信号 S102 在状态确定电路 105 的内部生成的 CEC 输入下降沿信号，电路状态转移到“IDLE”状态 C200。当在 CEC 信号 S113a 中没有发生变化时，根据状态信号 105 使电路状态转移到“发送”状态。

“发送”状态 C202，表示 CEC 通信电路进行发送的状态。在该“发送”状态 202 中，在 CEC 通信格式内发送标题块中的启动程序地址之前的期间，进行 CEC 信号 S113a 的总线仲裁，当在该期间内产生总线损失检测信号 S104 时，电路状态转移到“接收”状态 C203。而当产生发送结束脉冲信号 S109b 和其他方强制 LOW 发送条件信号 S107f 时，电路状态转移到“IDLE”状态 C200。

“接收”状态 C203，表示 CEC 通信电路正在进行接收的状态。在该“接收”状态 C203 中，当产生强制 LOW 发送开始脉冲信号 S108 时，电路状态转移到“强制 LOW 发送”状态 C204，当产生接收数据等待时间结束信号 S107e 或其他方强制 LOW 发送条件信号 S107f 时，电路状态转移到“IDLE”状态 C200。当在“IDLE”状态 C200 中产生开始检测信号 S106 时，电路状态转移到“接收”状态 C203。

“强制 LOW 发送”状态 C204，表示 CEC 通信电路强制地发送 LOW 的状态。该状态，只从“接收”状态 C203 进行状态转移。在该“强制 LOW 发送”状态 C204 中，在由内部所设置的计数器预先确

定的时间内，向 CEC 信号 S113a 输出 “LOW”，并在经过了预先确定的时间后结束对 CEC 信号 S113a 的 “LOW” 输出，并且，内部状态根据状态信号 S105 转移到 “IDLE” 状态。

以下，用图 4A 和图 4B 的时序图说明按如上所述的方式构成的 CEC 通信电路 100 的 “发送” 时的动作。

(a) 表示作为 CEC 通信电路 100 的输出的 CEC 输出信号 S111 的波形，(b) 表示通信对方侧输出的波形，(c) 表示通过 N 沟道 MOS 晶体管开路漏极端子 113 输入 CEC 通信电路的 CEC 输入信号 S113b 的波形。此处，(a) 中示出的 CEC 输出信号 S111 和 (b) 中示出的通信对方侧输出接 “与” (AND) 而构成 (c) 中示出的 CEC 输入信号 S113b。

首先，在时刻 T1，当根据作为来自控制器 114 的控制数据 S114a 之一的发送请求信号 S103a 生成从触发脉冲生成电路 103 输出的发送请求触发脉冲信号 S103b 时，如 (d) 中示出的状态信号 S105 为 “IDLE”，则在状态确定电路 105 的内部生成 (e) 中示出的发送开始等待开始信号 S103b'。

在时刻 T2，根据在时刻 T1 生成的发送开始等待开始信号 S103b'，(d) 中示出的状态信号 S105 变为 “发送开始等待” 状态。

在时刻 T3，从时刻 T2 起确认 (c) 中示出的 CEC 输入信号 S113b 内没有信号变化并持续地经过了预定的时间后，(d) 中示出的状态信号 S105 变为 “发送” 状态。

在时刻 T4，由于从时刻 T3 起 (d) 中示出的状态信号 S105 转移到 “发送” 状态，生成 (g) 中示出的发送数据 (下降) 输出边沿生成脉冲信号 S109a，并从 (a) 中示出的 CEC 输出信号 S111 输出形成表示起始位的开始的下降沿的 “Low”。而且，使 (j) 中示出的发送位计数信号 (发送控制电路 109 的内部信号) 复位到 0。

在时刻 T5，生成 (h) 中示出的发送数据 (上升) 输出边沿生成脉冲信号 S109a，从 (a) 中示出的 CEC 输出信号 S111 输出形成起始位的上升沿的 “High”。

在时刻 T6, 生成 (g) 中示出的发送数据 (下降) 输出边沿生成脉冲信号 S109a, 从 (a) 中示出的 CEC 输出信号 S111 输出形成表示起始位的结束的下降沿和表示启动程序地址的第 1 位的数据位的开始的下降沿的 “Low”。而且, (j) 中示出的发送位计数信号被递增计数。

在时刻 T7, 生成 (h) 中示出的发送数据 (上升) 输出边沿生成脉冲信号 S109a, 从 (a) 中示出的 CEC 输出信号 S111 输出生成数据位的上升沿的 “High”。此处, 图 4A 中示出的上升时刻, 表示数据位输出 “0” 时的情况。

在时刻 T8, 生成 (g) 中示出的发送数据 (下降) 输出边沿生成脉冲信号 S109a, 从 (a) 中示出的 CEC 输出信号 S111 输出形成表示数据位的结束的下降沿和表示下一个数据位的开始的下降沿的 “Low”。而且, (j) 中示出的发送位计数信号被递增计数。

在时刻 T9, 启动程序地址的发送结束, 接着开始目标地址的发送。而且, 在从作为发送开始的时刻 T4 到该时刻 T9 的期间内进行 CEC 信号的总线仲裁, 唯一地确定发送方。

在时刻 T10, 构成 EOM 数据前的标题块的数据的发送结束, 接着发送来自接收方的 ACK。而且, 在 (b) 中示出的通信对方侧输出中输出形成表示 ACK 发送的开始的下降沿的 “Low”。

在时刻 T11, 用 (i) 中示出的接收采样脉冲信号 S107d 对 (c) 中示出的 CEC 输入信号 S113b 进行采样, 并作为 (k) 中示出的接收 ACK 数据存储。

在时刻 T12, 标题块的收发结束, 生成 (g) 中示出的发送数据 (下降) 输出边沿生成脉冲信号 S109a, 从 (a) 中示出的 CEC 输出信号 S111 输出形成表示接着发送的数据块的第 1 位的数据位的开始的下降沿的 “Low”。而且, 为开始下一个数据块的发送, 使 (j) 中示出的发送位计数信号置位为 1。

在时刻 T13, 数据块的收发结束, 数据块内的 EOM 数据为 1, 意味着发送结束, 因此, 生成 (f) 中示出的发送结束脉冲信号 S109b,

在时刻 T4, (d) 中示出的状态信号 S105 转移到 “IDLE” 状态, 使发送结束。

以下, 用图 5A ~ 图 5D 的时序图说明从 “发送开始等待” 状态向 “接收” 状态转移的动作。

首先, 在时刻 T1, 生成 (e) 中示出的发送开始等待开始信号 S103b'。

在时刻 T2, 根据在时刻 T1 生成的发送开始等待开始信号 S103b', (d) 中示出的状态信号 S105, 变为 “发送开始等待” 状态。

在时刻 T3, 当 (d) 中示出的状态信号 S105 为 “发送开始等待” 状态时, (c) 中示出的 CEC 输入信号 S113b 内发生了信号变化, 因此生成 (f) 中示出的 CEC 输入下降沿信号。

在时刻 T4, 根据在时刻 T3 生成的 CEC 输入下降沿信号, (d) 中示出的状态信号 S105 变为 “IDLE” 状态。而且, (k) 中示出的接收位计数信号 S107c, 复位到 0。

在时刻 T5, 从 (b) 中示出的通信对方侧输出发送起始位, 当识别出该起始位时, 生成 (g) 中示出的开始检测信号 S106。

在时刻 T6, 根据在在时刻 T5 中生成的开始检测信号 S106, (d) 中示出的状态信号 S105 变为 “接收” 状态。而且, (k) 中示出的接收位计数信号 S107c 被递增计数, 并将 (l) 中示出的接收字节计数信号 S107b 复位到 0, 对 (o) 和 (p) 中示出的地址译码信号 S110a, 也复位到 0。

在时刻 T7, 用 (i) 中示出的接收采样脉冲信号 S107d 对 (c) 中示出的 CEC 输入信号 S113b 进行采样, 像移位寄存器那样存储到 (j) 中示出的并行变换后接收数据内。

在时刻 T8, (k) 中示出的接收位计数信号 S107c, 根据 (c) 中示出的 CEC 输入信号 S113b 的下降沿被递增计数。

在时刻 T9, 根据 (i) 中示出的接收采样脉冲信号 S107d, (k) 中示出的接收位计数信号 S107c 和 (l) 中示出的接收字节计数信号 S107b, 将此前已存储过的 (j) 中示出的并行变换后接收数据存储到

(m) 中示出的接收地址 (启动程序) 数据 S110c 内。

在时刻 T10, 根据 (i) 中示出的接收采样脉冲信号 S107d、(k) 中示出的接收位计数信号 S107c 和 (l) 中示出的接收字节计数信号 S107b, 将 (j) 中示出的并行变换后接收数据存储在 (n) 中示出的接收地址 (目标) 数据 S110c 内。而且, 用已存储的地址 (目标) 数据 S110c 对是直接地址发送还是广播地址发送进行译码, 生成 (o) 和 (p) 中示出的地址译码信号 S110a。

在时刻 T11, 根据 (i) 中示出的接收采样脉冲信号 S107d 和 (k) 中示出的接收位计数信号 S107c, 将 (j) 中示出的并行变换后接收数据存储在 (r) 中示出的接收 EOM 数据 S110e 内。

在时刻 T12, 根据图 5A ~ 图 5D 中未示出的输出波形时序判断信号 S107a、和 (o) 和 (p) 中示出的地址译码信号 S110a, 确定要发送的 ACK 的值, 生成 (s) 中示出的输出 ACK 输出 (下降) 沿生成脉冲信号 S110b, 从 (a) 中示出的 CEC 输出信号 S111 输出生成 ACK 的下降沿的 “Low”。此处, 示出图 5A 中所示的 ACK 输出 “0” 时的情况。

在时刻 T13, 生成 (t) 中示出的 ACK 输出 (上升) 沿生成脉冲信号 S110b, 并从 (a) 中示出的 CEC 输出信号 S111 输出生成 ACK 的上升沿的 “High”。

在时刻 T14, 根据 (c) 中示出的 CEC 输入信号 S113b 的下降沿, 开始下一个数据块的发送, 因此使 (k) 中示出的接收位计数信号 S107c 置位为 1, (l) 中示出的接收字节计数信号 S107b 被递增计数。

在时刻 T15, 根据 (i) 中示出的接收采样脉冲信号 S107d、(k) 中示出的接收位计数信号 S107c 和 (l) 中示出的接收字节计数信号 S107b, 将 (j) 中示出的并行变换后接收数据存储在 (q) 中示出的接收数据 S110d 内。

在时刻 T17, 由于从时刻 T16 起在预先确定的时间内没有识别出 CEC 输入信号 S113b 的下一个下降沿, 视为发送结束, 生成 (h) 中示出的接收数据等待时间结束信号 S107e, 在时刻 T18 使 (d) 中示

出的状态信号 S105 转移到 “IDNL” 状态，结束接收。

以下，用图 6 的时序图说明从 “发送” 状态识别总线损失并向 “接收” 状态转移的动作。但是，对于进行与此前说明过的动作相同的动作的时刻，将说明省略。

在时刻 T1，(d) 中示出的状态信号 S105 为 “发送” 状态，生成 (i) 中示出的发送数据（下降）输出边沿生成脉冲信号 S109a，从 (a) 中示出的 CEC 输出信号 S111 输出形成表示起始位的开始的下降沿的 “Low”。此处，对于 (b) 中示出的通信对方侧输出，假定也在同一时刻输出形成表示起始位的开始的下降沿的 “Low”。而且，使 (h) 中示出的仲裁期间选通脉冲信号 S109c 变为有效，开始仲裁监视动作。

在时刻 T2，根据 (j) 中示出的发送数据（上升）输出边沿生成脉冲信号 S109a，(a) 中示出的 CEC 输出信号 S111 变为 “High”，(b) 中示出的通信对方侧输出也同样地变为 “High”。而且，还利用 (j) 中示出的发送数据（上升）输出边沿生成脉冲信号 S109a，进行仲裁监视电路 104 内的仲裁结果的判断。此处，(a) 中示出的 CEC 输出信号和 (b) 中示出的通信对方侧输出两者都为 “Low”（由于对 (a) 中示出的 CEC 输出信号刚刚变化之前的值进行比较，因此两者都为 “Low”），输出完全相同的信号，因而不进行总线损失的识别。

在时刻 T3，基于 (i) 中示出的发送数据（下降）输出边沿生成脉冲信号 S109a，(a) 中示出的 CEC 输出信号 S111 变为 “Low”，(b) 中示出的通信对方侧输出也同样地变为 “Low”。而且，还利用 (i) 中示出的发送数据（下降）输出边沿生成脉冲信号 S109a，进行仲裁监视电路 104 内的仲裁结果的判断。此处，(a) 中示出的 CEC 输出信号和 (b) 中示出的通信对方侧输出两者都为 “High”（由于对 (a) 中示出的 CEC 输出信号刚刚变化之前的值进行比较，因此两者都为 “High”），输出完全相同的信号，因而不进行总线损失的识别。

在时刻 T4，利用 (k) 中示出的接收采样脉冲信号 S107d，进行仲裁监视电路 104 内的仲裁结果的判断。此处，(a) 中示出的 CEC 输出信号 S111 和 (b) 中示出的通信对方侧输出两者都输出“0”，都为“Low”，因而输出完全相同的信号，不进行总线损失的识别。

在时刻 T5，利用 (k) 中示出的接收采样脉冲信号 S107d，进行仲裁监视电路 104 内的仲裁结果的判断。此处，(a) 中示出的 CEC 输出信号 S111，输出“1”，(b) 中示出的通信对方侧输出，输出“0”，因而 (c) 中示出的 CEC 输入信号 S113b 为“0”，因此，在仲裁监视电路 104 中生成 (f) 中示出的总线损失检测信号 S104，在时刻 T6 使 (d) 中示出的状态信号 S105 转移到“接收”状态，之后与接收时的动作相同。

以下，用图 7 的时序图说明从“接收”状态向“强制 LOW 发送”状态转移的动作。但是，对于进行与此前说明过的动作相同的动作的时刻，将说明省略。

在时刻 T2，假定借助于 (b) 中示出的通信对方侧输出而发送从时刻 T1 起数据位的周期（从下降沿到上升沿的时间）在比 MIN 值小的方向不满足由标准所确定的时序的波形。此处，生成图 7 中未示出的强制 LOW 发送条件信号 S107g，进而由强制 LOW 发送控制电路 108 生成 (f) 中示出的强制 LOW 发送开始脉冲信号 S108。

在时刻 T3，根据在时刻 T2 生成的强制 LOW 发送开始脉冲信号 S108，从 (a) 中示出的 CEC 输出信号 S111 输出“Low”，同时，(d) 中示出的状态信号 S105 转移到“强制 LOW 发送”状态。

在时刻 T4，从时刻 T3 起经过了预先确定的时间后，使 (a) 中示出的 CEC 输出信号 S111 变为“High”，同时，(d) 中示出的状态信号 S105 转移到“IDNL”状态，使强制 LOW 发送结束。

以下，用图 8 的时序图说明从“发送”状态识别来自接收方的强制 LOW 发送并向“IDNL”状态转移的动作。但是，对于进行与此前说明过的动作相同的动作的时刻，将说明省略。

在时刻 T1，假定 (d) 中示出的状态信号 S105 为“发送”状态，

在(b)中示出的通信对方侧输出中输出形成强制 LOW 发送的下降沿的“Low”。此处,在(c)中示出的 CEC 输入信号 S113b 中也输入形成下降沿的“Low”,使波形时序判断电路 107 的内部计数器复位,开始递增计数。

在时刻 T2,由于波形时序判断电路 107 的内部计数器到达预先确定的时间,识别为强制 LOW 发送,生成(f)中示出的其他方强制 LOW 发送条件信号 S107f,在时刻 T3,使(d)中示出的状态信号 S105 转移到“IDNL”状态,在时刻 T4 从(a)中示出的 CEC 输出信号 S111 输出“High”(此处,当已输出“High”时,不再进行改变)。而且,在(b)中示出的通信对方侧输出中,在输出“Low”达到规定的期间之后,进行“High”输出。此处,在进行了该通信处理后,作为发送方的 CEC 的通信电路 100,进行同样的数据的再次发送。

以下,用图 9 的时序图说明从“接收”状态识别来自其他方的强制 LOW 发送并向“IDNL”状态转移的动作。但是,对于进行与此前说明过的动作相同的动作的时刻,将说明省略。

首先,(c)中示出的通信对方侧输出(其 2),与(b)中示出的通信对方侧输出一样,表示进行 CEC 通信的对方侧的输出,包括(a)中示出的 CEC 输出信号 S111 在内的这 3 个信号的接“与”(AND)构成(d)中示出的 CEC 输入信号 S113b。而且,图 9 中示出的通信例,假定从生成(b)中示出的通信对方侧输出的 CEC 通信电路向生成(c)中示出的通信对方侧输出(其 2)的 CEC 通信电路进行数据发送,并假定在所讨论的 CEC 通信电路 100 中进行了无关的数据发送。

在期间 T1,从生成(c)中示出的通信对方侧输出(其 2)的 CEC 通信电路向生成(b)中示出的通信对方侧输出的 CEC 通信电路发送 ACK,对于所讨论的 CEC 通信电路 100,由于是无关的数据发送,所以不进行 ACK 发送,也不进行任何动作。

在时刻 T2,从(b)中示出的通信对方侧输出发送用作强制 LOW 发送条件的异常波形,(c)中示出的通信对方侧输出(其 2)输出形

成强制 LOW 发送的下降沿的“Low”。此处，在(d)中示出的 CEC 输入信号 S113b 中也输入形成下降沿的“Low”，使波形时序判断电路 107 的内部计数器复位，开始递增计数。

在时刻 T3，由于波形时序判断电路 107 的内部计数器到达预先确定的时间，识别为强制 LOW 发送，生成(g)中示出的其他方强制 LOW 发送条件信号 S107f，在时刻 T4，使(e)中示出的状态信号 S105 转移到“IDNL”状态。

在时刻 T5，在(c)中示出的通信对方侧输出(其 2)中，在输出规定的期间的“Low”之后，进行“High”输出。此处，在进行了该通信处理后，作为发送方的生成(b)中示出的通信对方侧输出的 CEC 的通信电路，进行同样的数据的再次发送。

如上所述，按照本实施方式 1 的 CEC 的通信电路 100，触发用于实现 CEC 通信的中断信号 S112b 的软件处理，在进行发送时，只是生成用于开始发送的触发信号的发送请求信号 S103a 并设定发送数据设定信号 S109d 作为来自控制器 114 的控制数据 S114a，观测作为中断信号 S112b 的识别信号的中断识别数据 S112c 作为观测数据 S114b；在进行接收时，只是观测作为对控制器 114 的观测数据 S114b 而给予的接收地址数据 S110c、接收数据 S110d、接收 EOM 数据 S110e 及中断识别数据 S112c，并且解码和执行借助于接收数据 S110d 而传送的命令，因此，能够大幅度地削减以往所需的软件处理。

而且，由于能以少量的软件处理实现 CEC 通信，能够将 CPU 性能的降低抑制到最小限度。另外，还能够将 CPU 资源有效地分配给 CEC 通信的命令解码后的应用处理，因此能够处理更多的命令。

另外，由于具有 N 沟道 MOS 晶体管开路漏极端子 113，不需要用于在 LSI 外部转换为双向信号的电路，因而具有削减印刷电路板上的零件数量的效果。

《实施方式 2》

图 10 是表示本发明的实施方式 2 的单线双向通信装置的结构框图，在图 10 中，与图 2 相同的符号表示相同或相应的部分。假定

CEC 通信作为具体的通信。

控制器 214 输出用于控制 CEC 通信电路 200 的控制数据 S214a。

作为该控制数据 S214a 之一，输出硬件软件处理选择信号 S201，该硬件软件处理选择信号 S201，使实施方式 2 构成为即使是基于软件的控制也能进行实施方式 1 中用硬件进行的一部分处理，是用于选择该硬件处理和软件处理中的任何一个的信号。进一步，除控制数据 S214a 以外，还输出选择软件处理时使用的强制 LOW 发送开始和结束请求信号 S203a、发送继续和结束设定信号 S209a、接收时 ACK 输出设定信号 S210a。

另外，将用于观测 CEC 通信电路 200 中的处理结果的观测数据 S214b 输入到控制器 214。在该观测数据 S214b 中，除了在实施方式 1 中使用过的接收地址数据 S110c、接收数据 S110d、接收 EOM 数据 S110e 以外，还输入接收 ACK 数据 S209b、波形时序判断结果信号 S107a。

触发脉冲生成电路 203，被输入发送请求信号 S103a 和强制 LOW 发送开始和结束请求信号 S203a。该强制 LOW 发送开始和结束请求信号 S203a，当在表示 CEC 通信电路 200 的动作状态的状态信号 S105 中通过软件处理控制向“强制 LOW 发送”状态的转移和从“强制 LOW 发送”状态向“IDLE”状态的转移时请求。而且，根据该强制 LOW 发送开始和结束请求信号 S203a 生成强制 LOW 发送开始和结束请求触发脉冲信号 S203b，请求开始强制 LOW 发送的触发脉冲，输入到后述的强制 LOW 发送控制电路 208，请求结束强制 LOW 发送的触发脉冲，输入到后述的状态确定电路 205。

状态确定电路 205，除与实施方式 1 中的状态确定电路 105 相同的输入以外，还被输入硬件软件处理选择信号 S201 和强制 LOW 发送开始和结束请求触发脉冲信号 S203b 中的请求结束强制 LOW 发送的触发脉冲，当由硬件软件处理选择信号 S201 选择了软件处理时，状态信号 S105，根据所输入的强制 LOW 发送开始和结束请求触发脉冲信号 S203b。进行从“强制 LOW 发送”状态向“IDLE”状态的转

移。

强制 LOW 发送控制电路 208, 除强制 LOW 发送条件信号 S107g 以外, 还被输入硬件软件处理选择信号 S201 和强制 LOW 发送开始和结束请求触发脉冲信号 S203b 中的请求开始强制 LOW 发送的触发脉冲, 当由硬件软件处理选择信号 S201 选择了软件处理时, 根据所输入的强制 LOW 发送开始和结束请求触发脉冲信号 S203b 生成和发送强制 LOW 发送开始脉冲信号 S108。

发送控制电路 209, 除与实施方式 1 中的发送控制电路 109 相同的输入以外, 还被输入硬件软件处理选择信号 S201 和发送继续和结束设定信号 S209a, 进一步, 输出接收 ACK 数据 S209b, 并作为控制器 214 的观测数据 S214b 之一输入。此处, 当由硬件软件处理选择信号 S201 选择了软件处理时, 通过控制器 214 的软件处理, 根据发送数据设定信号 S109d 和接收 ACK 数据 S209b 确定下一次发送的继续或结束, 由作为控制数据 S214a 之一的发送继续和结束设定信号 S209a 进行发送和电路状态转移的控制, 由此控制发送结束脉冲信号 S109b 的生成。

接收控制电路 210, 除与实施方式 1 中的接收控制电路 110 相同的输入以外, 还被输入硬件软件处理选择信号 S201 和接收时 ACK 输出设定信号 S210a。当由硬件软件处理选择信号 S201 选择了软件处理时, 通过控制器 214 的软件处理, 根据接收地址数据 S110c、接收数据 S110d、接收 EOM 数据 S110e 及波形时序判断结果信号 S107a, 设定要在接收时 ACK 输出设定信号 S210a 中发送的 ACK 的值, 进行发送和电路状态转移的控制, 由此控制 ACK 输出边沿生成脉冲信号 S110b 的生成。

中断信号发生电路 212, 被输入选择硬件处理时生成的中断生成边沿信号 S112a 和选择软件处理时生成的中断生成边沿信号 (选择软件处理时) S212a, 利用这 2 个信号, 根据硬件软件处理选择信号 S201 生成和输出中断信号 S112b 和中断识别信号 S112c, 将中断信号 S112b 输入到控制器 214 用作软件处理的开始触发脉冲, 中断识别信号

S112c, 作为观测数据 S214b 之一输入到控制器 214 用作中断信号的识别数据。

另外, 此处, 硬件处理和软件处理的选择, 能够自由地以数据通信的标题块或数据块等块为单位进行切换。

如上所述, 按照本实施方式 2 的 CEC 通信电路 200, 对强制 LOW 发送开始结束、发送时的 ACK 判断和接收时的 ACK 输出的处理, 能够选择硬件处理和软件处理这两种处理, 因此, 例如当发生异常的通信、而且在两种处理的任一种处理中不能进行正常的处理时, 能够切换为另一种处理, 因此即使不进行硬件修改也能够进行通信。

另外, 关于发送时的 ACK 判断和接收时的 ACK 输出, 例如, 当此后在标准中追加了新的通信协议 (例如, 与 ACK 判断有关的追加标准等) 时, 由于在硬件处理中适应当前的标准, 因此会将新的通信协议判断为异常通信, 但是, 在软件处理中, 能够生成依据了新的通信协议的程序, 并由软件进行 ACK 的判断和输出, 因此即使不进行硬件修改也能够适应新的通信。

进一步, 关于接收时的 ACK 输出, 当想要通过软件处理解释作为在数据块中传送的处理命令的数据并根据该解释结果确定 ACK 发送时 (例如, 在系统上当前不能处理该解释后的命令时等), 如果是硬件处理, 则只能在数据中抽取并根据所发送的波形时序的结果确定 ACK 输出, 因此, 回送 ACK 并继续通信时无法考虑系统上的处理负荷等, 而在软件处理中, 能够通过软件处理设定 ACK 输出, 因此数据的命令解释和系统上的处理负荷等都能够考虑并能反映在 ACK 输出中。

《实施方式 3》

图 11 是表示本发明的实施方式 3 的单线双向通信装置的结构框图, 在图 11 中, 与图 2 和图 10 相同的符号表示相同或相应的部分。而且, 在本实施方式 3 中, 构成不仅能够实现 CEC 通信而且还能够适应 AV.Link 通信的单线双向通信装置, 前面示出的 N 沟道 MOS 晶体管开路漏极端子 113 的输入输出信号为 CEC/AV.Link 信号 S313a、

CEC/AV. Link 输入信号 S313b, 输入同步化电路 102 的输出信号为同步化 CEC/AV. Link 输入信号 S302, 数据输出电路 111 的输出信号为 CEC/AV. Link 输出信号 S311, 只是为适应 2 种通信而改变了信号名, 作为功能是相同的。

控制器 314, 输出用于控制 CEC/AV. Link 通信电路 300 的控制数据 S314a。作为该控制数据 S314a 之一, 输出 CEC/AV. Link 通信选择信号 S301, 由该 CEC/AV. Link 通信选择信号 S301 将实施方式 3 构成为对 CEC 通信或 AV. Link 通信中的任何一种通信都能适应, 是用于选择该 CEC 通信或 AV. Link 通信中的任何一种的信号。而且, 作为用于观测 CEC/AV. Link 通信电路 300 中的处理结果的观测数据 S314b 之一, 接收应用识别数据 S315b 被追加输入到控制器 314。

驱动时钟脉冲生成电路 301, 被输入 CEC/AV. Link 通信选择信号 S301, 在选择了 AV. Link 通信的情况下, 产生周期为选择了 CEC 通信时产生的驱动时钟脉冲 S101b 的 2 倍的驱动时钟脉冲 S101b。此处, 与 CEC 通信的波形时序相比, AV. Link 通信的波形时序全部规定为 2 倍的周期, 因此, 通过使 CEC/AV. Link 通信电路 300 的驱动时钟脉冲为 2 倍的周期, 在进行形成相同通信格式的部分处理的电路中, 能够由 1 个电路共享 CEC 通信和 AV. Link 通信这 2 种通信格式。

接收开始检测电路 306, 被输入 CEC/AV. Link 通信选择信号 S301, 在选择了 CEC 通信的情况下, 进行与实施方式 1 相同的处理, 在选择了 AV. Link 通信的情况下, 生成和输出起始位检测信号 S306a, 并输入到后述的追加序列检测电路 (SQ) 315。进一步, 被输入在由追加序列检测电路 315 检测出在 AV. Link 通信格式中追加的起动序列内的 3 位的数据 “110” 后产生的追加序列检测信号 S315a, 根据该追加序列检测信号 S315a 生成和输出开始检测信号 S106。

追加序列检测电路 315, 被输入起始位检测信号 S306a、追加序列时序脉冲信号 S307a、接收采样脉冲信号 S107d、接收位计数信号 S107c、接收字节计数信号 S107b、并行变换后接收数据 S310a, 根据这些信号生成和输出如上所述的追加序列检测信号 S315a, 在变为“接

收”状态后进一步接收在 AV. Link 通信格式中追加的 3 位的应用识别数据，输出接收应用识别数据 S315b，作为观测数据 S314b 之一输入到控制器 314。

波形时序判断电路 307，被输入 CEC/AV. Link 通信选择信号 S301，在选择了 CEC 通信的情况下，进行与实施方式 1 相同的处理，在选择了 AV. Link 通信的情况下，输出表示在 AV. Link 通信格式中追加的起动序列内的 3 位数据“110”和 3 位应用识别数据的时序的追加序列时序脉冲信号 S307a，输入到追加序列检测电路 315。另外，对于所输出的接收字节计数信号 S107b、接收位计数信号 S107c，也使用所输入的起始位检测信号 S306a 以考虑了这些追加序列的形式进行生成和输出。

发送控制电路 309，被输入 CEC/AV. Link 通信选择信号 S301，在选择了 CEC 通信的情况下，进行与实施方式 2 相同的处理，在选择了 AV. Link 通信的情况下，追加发送在 AV. Link 通信格式中追加的 3 位起动序列内的 3 位数据“110”，根据在发送数据设定信号 S309d 中追加输入的发送应用识别数据，发送在 AV. Link 通信格式中追加的 3 位应用识别数据。关于其后的发送，与实施方式 2 中示出的 CEC 通信同样地按标题块、数据块的顺序进行发送。

接收控制电路 310，除实施方式 2 的动作以外，还进行以下处理，即：输出对在上述追加序列检测电路 315 中为用于接收应用识别数据而输入的采样后的接收数据进行了并行变换的并行变换后接收数据 S310a。

以下，用图 12 的时序图说明按如上述方式构成的 CEC/AV. Link 通信电路 300 的选择 AV. Link 通信时的“发送”期间的动作。但是，对于进行与实施方式 1 中说明过的动作相同的动作的时刻，将说明省略。

首先，在时刻 T1，生成 (g) 中示出的发送数据 (下降) 输出边沿生成脉冲信号 S109a，并从 (a) 中示出的 CEC/AV. Link 输出信号 S311 输出形成表示起始位的结束的下沿和表示起动序列内的 3 位

固定数据“110”的第1位的数据(“1”)的开始的下沿的“Low”。而且，(j)中示出的发送位计数信号被递增计数。

在时刻 T2，起动序列内的3位固定数据“110”的发送结束，接着开始3位应用识别数据的发送。此处，(j)中示出的发送位计数信号，随着应用识别数据的发送而置位为1。

在时刻 T3，应用识别数据的发送结束，开始启动程序地址的发送，此处，(j)中示出的发送位计数信号，随着启动程序地址的发送而置位为1。另外，之后的发送处理动作进行与实施方式1相同的动作。

以下，用图13A和图13B的时序图说明选择AV.Link通信时的从“发送开始等待”状态转移到“接收”状态的动作。但是，对于进行与此前说明过的动作相同的动作的时刻，将说明省略。

首先，在时刻 T1，发送来自(b)中示出的通信对方侧的起动序列内的起始位，当识别出该起始位时，生成(g)中示出的起始位检测信号 S306a。而且，使(h)和(i)中示出的追加序列时序脉冲信号 S307a 复位到0。

在时刻 T2，根据在时刻 T1 生成的起始位检测信号 S306a，使(p)中示出的接收字节计数信号 S107b 复位到0。

在时刻 T3，发送来自(b)中示出的通信对方侧的起动序列内的3位固定数据“110”，根据该3位的固定数据，用(m)中示出的接收采样脉冲信号 S107d、(o)中示出的接收位计数信号 S107c、(p)中示出的接收字节计数信号 S107b、(h)和(i)中示出的追加序列时序脉冲信号 S307a，装入(n)中示出的并行变换后接收数据 S310a，当该装入后的值与3位固定数据“110”一致时，使(h)中示出的追加序列时序脉冲(起动序列)信号 S307a 置位为1，生成(j)中示出的开始检测信号 S106。

在时刻 T4，根据在时刻 T3 生成的开始检测信号 S106，状态信号 S105 变为“接收”状态。而且，(o)中示出的接收位计数信号 S107c，为接收作为起动序列应用识别数据而置位为1，对于(s)和(t)中

示出的地址译码信号 S110a，都复位到 0。

在时刻 T5，根据 (m) 中示出的接收采样脉冲信号 S107d、(o) 中示出的接收位计数信号 S107c、(p) 中示出的接收字节计数信号 S107b、(h) 和 (i) 中示出的追加序列时序脉冲信号 S307a。将 (n) 中示出的并行变换后接收数据 S310a 存储到 (k) 中示出的接收应用识别数据 S315b 内。

在时刻 T6，来自 (b) 中示出的通信对方侧的应用识别数据的发送结束，同时使 (i) 中示出的追加序列时序脉冲（应用识别数据）信号 S307a 置位为 1。

在时刻 T7，(o) 中示出的接收位计数信号 S107c，为接收启动程序地址而置位为 1。而且，关于之后的接收处理动作，进行与实施方式 1 相同的动作。

如上所述，按照本实施方式 3 的 CEC/AV. Link 通信电路 300，在 CEC/AV. Link 通信电路 300 内的计数器等测量时间的功能中，对于 2 种通信功能中的共用格式部的处理能够在 1 个电路中进行，因而只进行与 AV. Link 通信的追加序列对应的少量的电路变更和电路追加，因此，能以大幅度削减电路规模的形式应对 CEC 通信和 AV. Link 通信这 2 种通信格式。

《实施方式 4》

图 14 是表示本发明的实施方式 4 的单线双向通信装置的结构框图，在图 14 中，与图 2、图 10 及图 11 相同的符号表示相同或相应的部分。作为具体的通信，假定 CEC 通信和 AV. Link 通信。

控制器 414，输出用于控制 CEC/AV. Link 通信电路 400 的控制数据 S414a。作为该控制数据 S414a 之一，输出波形时序设定信号 S401。该波形时序设定信号 S401 是用于独立地设定以下各值的信号，即发送时的起始位波形时序的上升沿（图 1B 的 T3）和下降沿（图 1B 的 T6）、接收时的起始位波形时序的上升沿 MIN 值（图 1B 的 T2）、上升沿 MAX 值（图 1B 的 T4）、下降沿 MIN 值（图 1B 的 T5）和下降沿 MAX 值（图 1B 的 T7）、发送时的数据位波形时序的输出“0”

时的上升沿（图 1C 的 T14）、输出“1”时的上升沿（图 1C 的 T10）和输出“0”和“1”时的下降沿（图 1C 的 T17）、接收时的数据位波形时序的接收“0”输出时的上升沿 MIN 值（图 1C 的 T13）和上升沿 MAX 值（图 1C 的 T15）、接收“1”输出时的上升沿 MIN 值（图 1C 的 T9）和上升沿 MAX 值（图 1C 的 T11）、接收“0”和“1”输出时的下降沿 MIN 值（图 1C 的 T16）和下降沿 MAX 值（图 1C 的 T18）、以及接收采样点（图 1C 的 T12）的时序，进一步，还包含关于进行强制 LOW 发送的时间、识别强制 LOW 发送的时刻、等待下一个接收数据的极限时间的时刻设定信号。

状态确定电路 405，除实施方式 2 中示出的输入输出信号以外，还被输入作为来自控制器 414 的控制数据 S414a 之一的波形时序设定信号 S401。输入到该状态确定电路 405 的波形时序设定信号 S401，所输入的是设定如上所述的进行强制 LOW 发送的时间的波形时序设定信号 S401，由此能够任意地设定从向“强制 LOW 发送”状态的转移到向“IDLE”状态的转移的时间。

接收开始检测电路 406，除实施方式 3 中示出的输入输出信号以外，还被输入作为来自控制器 414 的控制数据 S414a 之一的波形时序设定信号 S401。输入到该接收开始检测电路 406 的波形时序设定信号 S401，所输入的是设定如上所述的接收时的起始位波形时序的上升沿 MIN 值（图 1B 的 T2）、上升沿 MAX 值（图 1B 的 T4）、下降沿 MIN 值（图 1B 的 T5）、下降沿 MAX 值（图 1B 的 T7）的时刻的 4 个波形时序设定信号 S401，由此能够任意地设定起始位接收识别条件。

波形时序判断电路 407，除实施方式 3 中示出的输入输出信号以外，还被输入作为来自控制器 414 的控制数据 S414a 之一的波形时序设定信号 S401。输入到该波形时序判断电路 407 的波形时序设定信号 S401，所输入的是设定如上所述的接收时的数据位波形时序的接收“0”输出时的上升沿 MIN 值（图 1C 的 T13）和上升沿 MAX 值（图 1C 的 T15）、接收“1”输出时的上升沿 MIN 值（图 1C 的 T9）和上

升沿 MAX 值（图 1C 的 T11）、接收“0”和“1”输出时的下降沿 MIN 值（图 1C 的 T16）和下降沿 MAX 值（图 1C 的 T18）、以及接收采样点（图 1C 的 T12）的时刻和关于识别强制 LOW 发送的时间、等待下一个接收数据的极限时间的时刻的 9 个波形时序设定信号 S401，由此能够任意地设定数据位的波形时序检查条件、强制 LOW 发送识别条件，而且，能够任意地设定直到从“接收”状态转移到“IDLE”状态为止的时间、即接收数据等待时间结束信号 S107e 的产生。

发送控制电路 409，除实施方式 3 中示出的输入输出信号以外，还被输入作为来自控制器 414 的控制数据 S414a 之一的波形时序设定信号 S401。输入到该发送控制电路 409 的波形时序设定信号 S401，所输入的是设定如上所述的发送时的起始位波形时序的上升沿（图 1B 的 T3）和下降沿（图 1B 的 T6）、发送时的数据位波形时序的输出“0”时的上升沿（图 1C 的 T14）、输出“1”时的上升沿（图 1C 的 T10）和输出“0”和“1”时的下降沿（图 1C 的 T17）的时刻的 5 个波形时序设定信号 S401，由此能够任意地设定发送时的起始位和数据位的所有发送时刻。

接收控制电路 410，除实施方式 3 中示出的输入输出信号以外，还被输入作为来自控制器 414 的控制数据 S414a 之一的波形时序设定信号 S401。输入到该接收控制电路 410 的波形时序设定信号 S401，所输入的是设定如上所述的 ACK 发送时的数据位波形时序的输出“0”时的上升沿（图 1C 的 T14）的时刻，由此能够任意地设定在 ACK 发送中输出“0”时的上升沿的时刻。

如上所述，按照本实施方式 4 的 CEC/AV. Link 通信电路 400，即使是必须与输出不满足标准的波形的对方进行通信时，也能够任意地设定接收时的数据时序检查条件，能够进行由波形时序设定信号 S401 调整了时序的通信。

另外，即使在发送正常信号的情况下，也会由于与通信对方连接的电缆等而在传输到通信对方之前产生波形恶化等，因此将导致异常

的通信,但即使在这种情况下,也能够任意地设定发送时的时序,因此,能够考虑连接环境等,能够进行了发送边沿的时序的通信以使得能进行正常的发送。

进一步,今后,即使是通信协议相同但提出了加快通信速度的标准等时,由于能够任意地设定收发的所有的波形时序,因此,例如,当想要以双倍速度进行通信时,也能够将所有的波形时序设定为 1/2,据此能够适应新的通信。

《实施方式 5》

图 15 是表示本发明的实施方式 5 的单线双向通信装置的结构框图,在图 15 中,与图 2、图 10、图 11 及图 14 相同的符号表示相同或相应的部分。作为具体的通信,假定 CEC 通信和 AV.Link 通信。

控制器 514,输出用于控制 CEC/AV.Link 通信电路 500 的控制数据 S514a。

作为该控制数据 S514a 之一,输出仲裁期间设定信号 S501。该仲裁期间设定信号 S501,是用于设定从下降沿起不进行仲裁监视处理的期间和从上升沿起不进行仲裁监视处理的期间。

仲裁期间调整电路(PER)516,被输入仲裁期间设定信号 S501、同步化 CEC/AV.Link 输入信号 S302 和仲裁期间选通脉冲信号 S109c,根据仲裁期间选通脉冲信号 S109c 进行调整,以便从同步化 CEC/AV.Link 输入信号 S302 的下降沿起开始内部计数器的递增计数,在达到仲裁期间设定信号 S501 的设定值之前使仲裁期间无效,并且,从上升沿起开始内部计数器的递增计数,在达到仲裁期间设定信号 S501 的设定值之前使仲裁期间无效,生成和输出调整后仲裁期间选通脉冲信号 S516。

仲裁监视电路 504,被输入 CEC/AV.Link 输出信号 S311 和同步化 CEC/AV.Link 输入信号 S302,调整这 2 个信号的时序,在调整为相同的时序后进行这 2 个信号的比较,进一步,假定所输入的调整后仲裁期间选通脉冲信号 S516 为有效期间,使上述 2 个信号的比较结果反映到驱动时钟脉冲 S101b 的每个脉冲。当这 2 个信号的比较结

果不相等时，识别为总线损失，输出总线损失检测信号 S104。

如上所述，在 CEC 通信中，由标准确定信号的上升沿和下降沿的波形恶化的容许范围，在实施方式 4 中，与容许范围无关地进行固定采样点的仲裁监视，因此不能对超出容许范围的波形恶化进行总线损失的处理，另外，在超出容许范围的时刻，如果作为 CEC/AV. Link 通信电路 400 的输入输出信号的 CEC/AV. Link 输出信号 S311 和 CEC/AV. Link 输入信号 S313b 的比较为彼此不同时，能够认为是从其他方进行发送，因此，在这种情况下不能识别总线损失，最坏的情况甚至是不能进行仲裁监视，因而有可能使多个发送成立而成为异常通信状态，但是，按照本实施方式 5 的 CEC/AV. Link 通信电路 500，仅在容许范围内不进行仲裁监视处理，在超出该容许范围的时刻，能够按每个驱动时钟脉冲 S101b 进行仲裁监视处理，因此能够避免引起如上所述的异常通信。

《实施方式 6》

图 16 是表示本发明的实施方式 6 的单线双向通信装置的结构框图，在图 16 中，与图 2、图 10、图 11、图 14 及图 15 相同的符号表示相同或相应的部分。作为具体的通信，假定 CEC 通信和 AV. Link 通信。

波形恶化检测电路 (DEG) 617，根据所输入的状态信号 S105 的状态而被输入 CEC/AV. Link 输出信号 S311 和同步化 CEC/AV. Link 输入信号 S302，调整这 2 个信号的时序，在调整为相同的时序后，检测这 2 个信号的上升沿和下降沿的差分，输出波形恶化值检测信号 S617。

发送时序设定值调整电路 (SET) 618，输入波形恶化值检测信号 S617 和波形时序设定信号 S401 中只设定发送时序的信号，具体地说，是设定发送时的起始位波形时序的上升沿 (图 1B 的 T3) 和下降沿 (图 1B 的 T6)、发送时的数据位波形时序的输出 “0” 时的上升沿 (图 1C 的 T14)、输出 “1” 时的上升沿 (图 1C 的 T10)、输出 “0” 和 “1” 时的下降沿 (图 1C 的 T17)、进行强制 LOW 发送的时间的时

序设定信号。因此，在所输入的波形恶化值检测信号 S617 中，从所输入的形成下降沿的波形时序设定值减去下降沿波形恶化值，并且，在所输入的波形恶化值检测信号 S617 中，从所输入的形成上升沿的波形时序设定值减去上升沿波形恶化值，从而生成调整后发送波形时序设定信号 S618 并将其输出。

对状态确定电路 405，代替实施方式 4 中输入的波形时序设定信号 S401，输入调整后发送波形时序设定信号 S618。

对发送控制电路 409，代替实施方式 4 中输入的波形时序设定信号 S401，输入调整后发送波形时序设定信号 S618。

对接收控制电路 410，代替实施方式 4 中输入的波形时序设定信号 S401，输入调整后发送波形时序设定信号 S618。

如上所述，按照本实施方式 6 的 CEC/AV. Link 通信电路 600，能够进行考虑了因与通信对方的连接状况而引起的信号恶化的发送，因而能够使接收方接收的波形为由标准确定的基准的波形，因此能够在各种通信环境下进行最佳的通信。

《实施方式 7》

图 17 是表示使用了本发明的实施方式 3~6 的任一个的单线双向通信装置的系统的结构的框图，作为具体的通信，假定 CEC 通信和 AV. Link 通信。

在图 17 的 CEC/AV. Link 通信系统 700 中，从基准时钟脉冲输入端子 704 接收基准时钟脉冲 S700a，并输入到后述的控制器 703 和驱动时钟脉冲生成电路 702。控制器 703，也进行所组成的一组系统控制器的动作。

CEC/AV. Link 通信输入端子 705，通过 CEC 通信或 AV. Link 通信总线将 CEC/AV. Link 输入信号 S700b 输入到系统内部，并输入到后述的 CEC/AV. Link 通信电路 701。此处，CEC/AV. Link 通信输入端子 705，实际上是如实施方式 3~6 所示的双向端子，为方便起见只作为输入端子。

驱动时钟脉冲生成电路 702，被输入来自控制器 703 的控制数据

S703 作为在实施方式 3 中说明过的 CEC/AV. Link 通信选择信号 S301, 输出驱动时钟脉冲 S702, 输入到 CEC/AV. Link 通信电路 701。

CEC/AV. Link 通信电路 701, 被输入驱动时钟脉冲 S702、CEC/AV. Link 输入信号 S700b 和控制数据 S703。该 CEC/AV. Link 通信电路 701, 输出观测数据 S701a 和中断信号 S701b, 输入到控制器 703。

控制器 703, 根据所输入的基准时钟脉冲 S700a, 在内部生成驱动该控制器 703 的时钟脉冲。而且, 控制器 703, 具有多个动作模式, 包括通常模式、低速模式、特别是用于实现低功耗的停止模式。另外, 还具有根据从 CEC/AV. Link 通信电路 701 输入的中断信号 S701b 从停止模式返回到通常模式或低速模式的功能。

以往, 当由软件处理实现通信功能时, 由于在接收等待状态下也进行软件处理, 必须使控制器总是按通常模式动作, 因此, 增加了控制器的功耗, 但是, 按照本实施方式 7 的 CEC/AV. Link 通信系统 700, 只是使 CEC/AV. Link 通信电路 701 始终动作, 而在接收等待状态下能够使控制器 703 为停止模式, 因此, 能够实现功耗的降低。而且, 还能够进行利用接收数据的模式返回。

此外, 当用实施方式 1 和 2 中说明过的只适应 CEC 通信的电路结构代替 CEC/AV. Link 通信电路 701 时, 不需要从控制器 703 到驱动时钟脉冲生成电路 702 的控制数据 S703。

本发明的单线双向通信装置和系统, 尤其适用于实现 CEC 通信和 AV. Link 通信, 而且, 能够广泛地应用于具有与其相同的通信格式的通信。

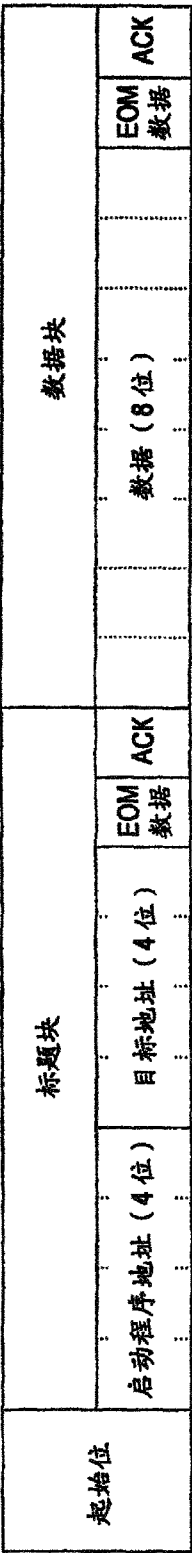
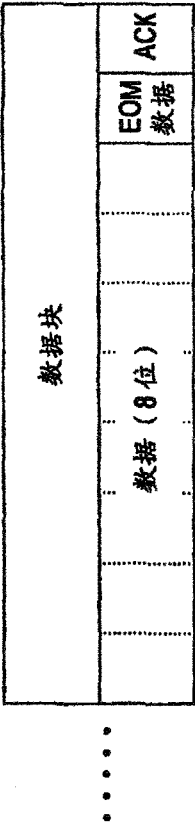


图 1A



图 1B

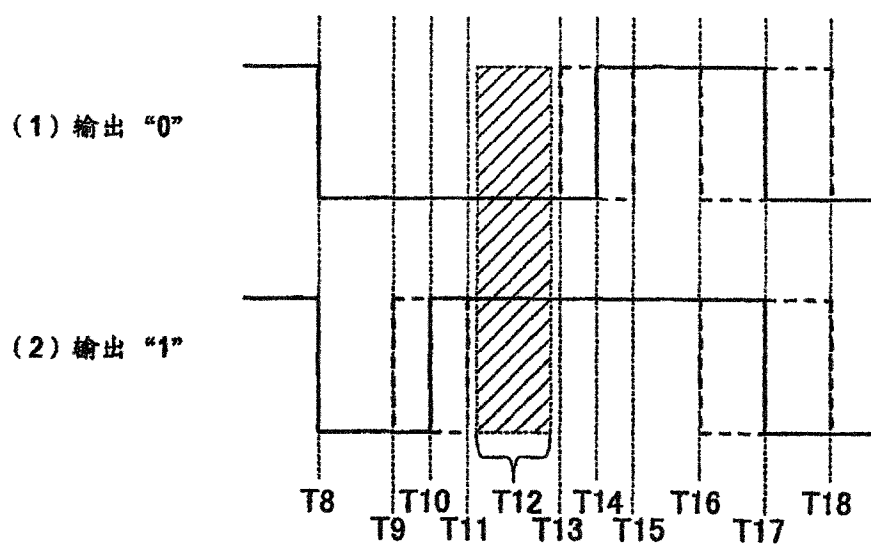


图 1C

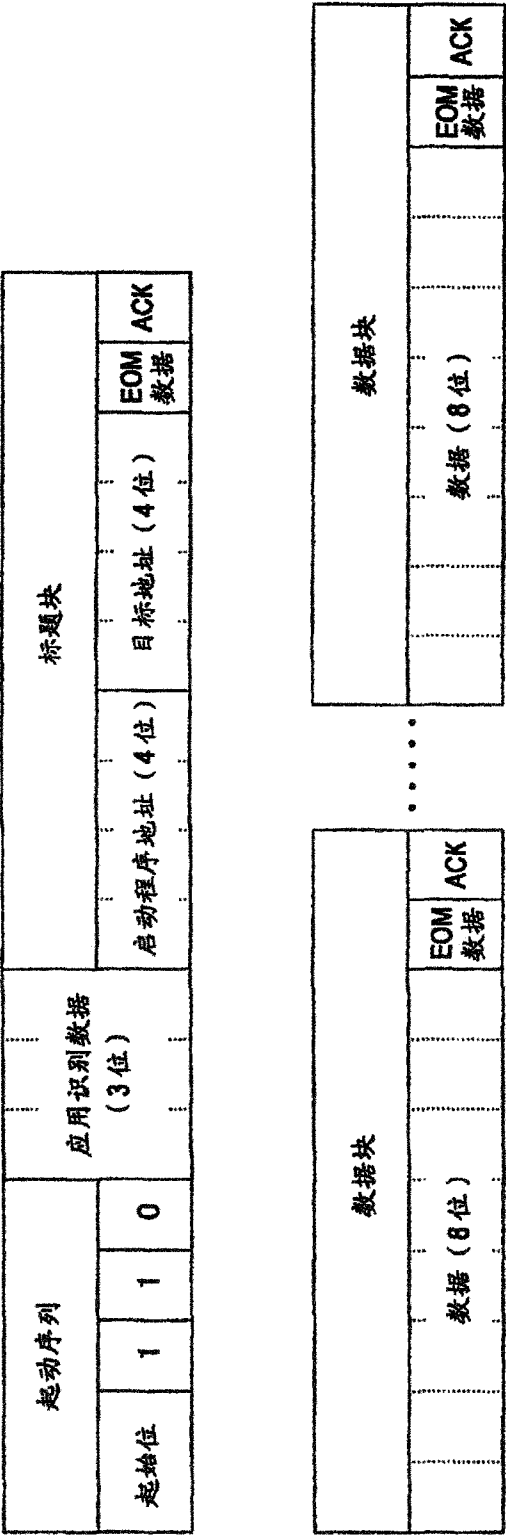


图 1D

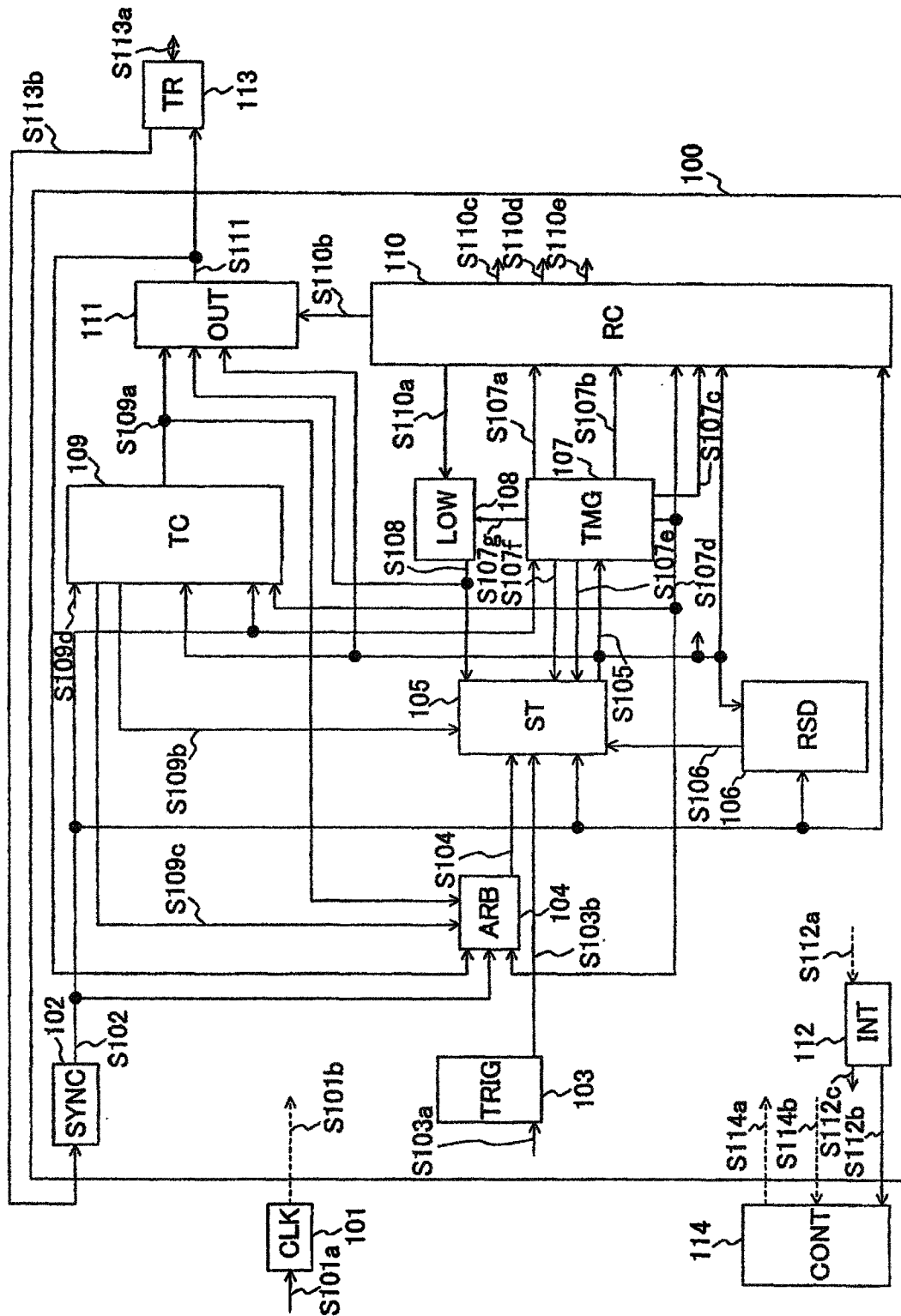


图 2

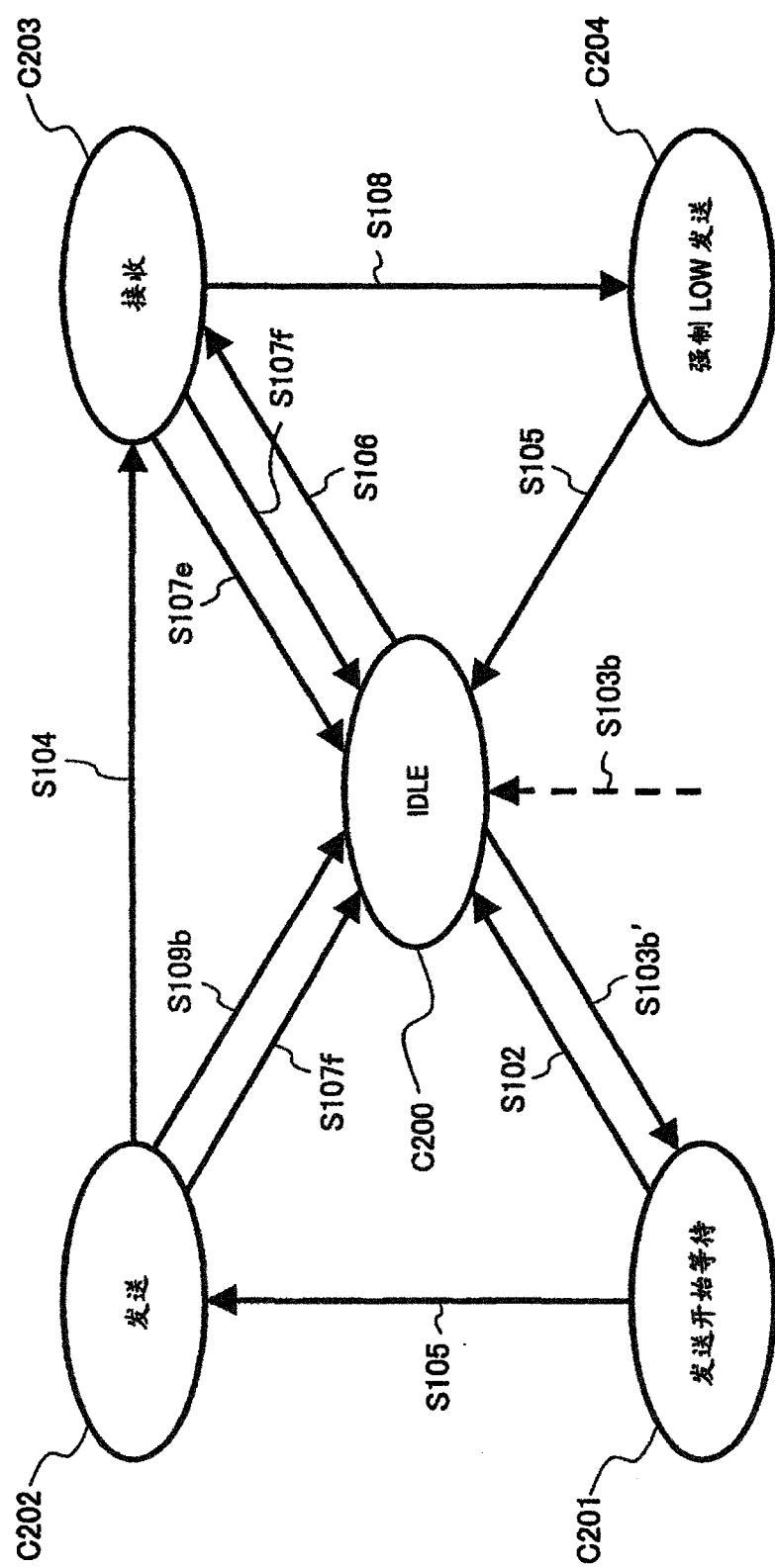


图 3

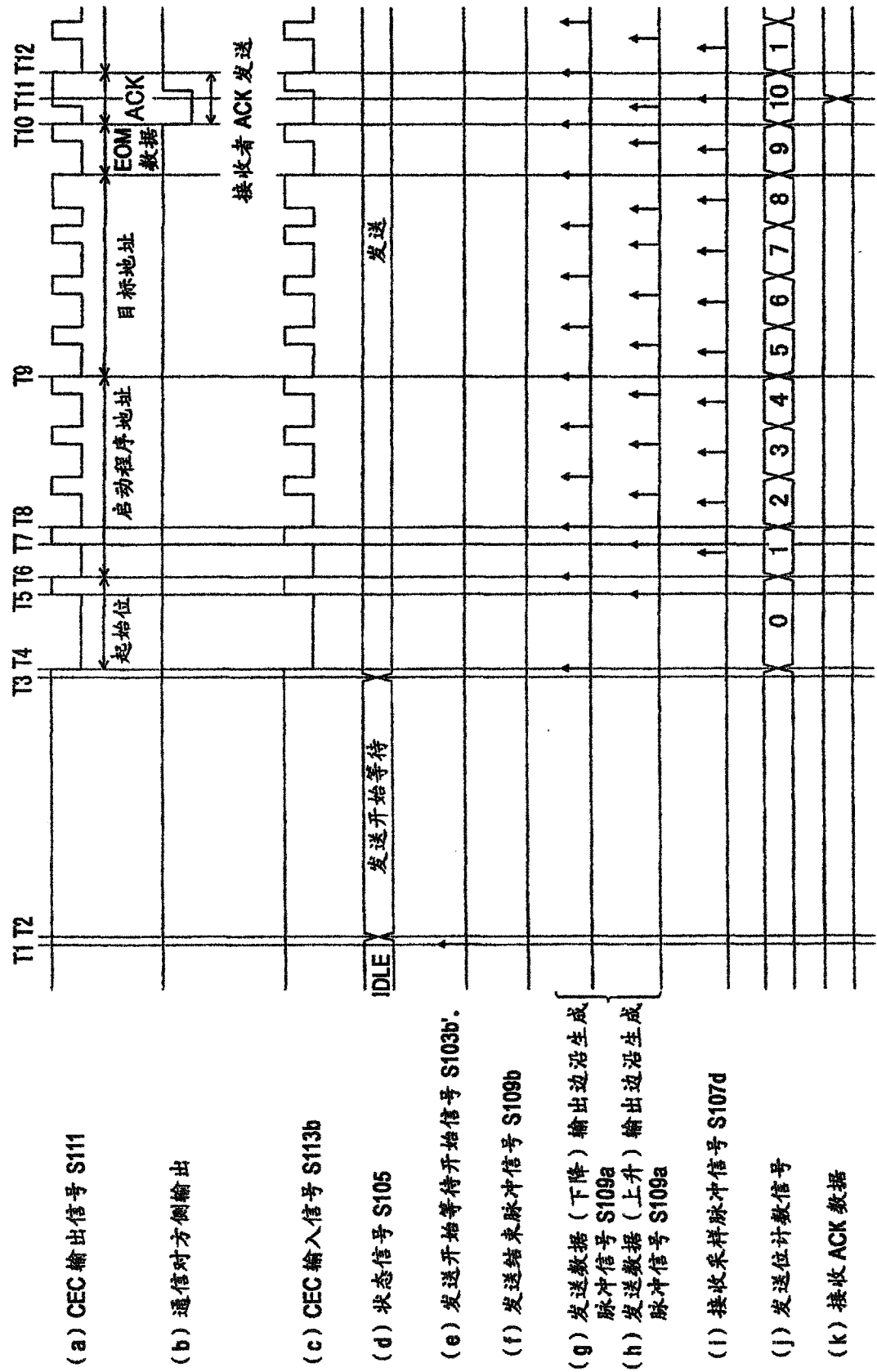


图 4A

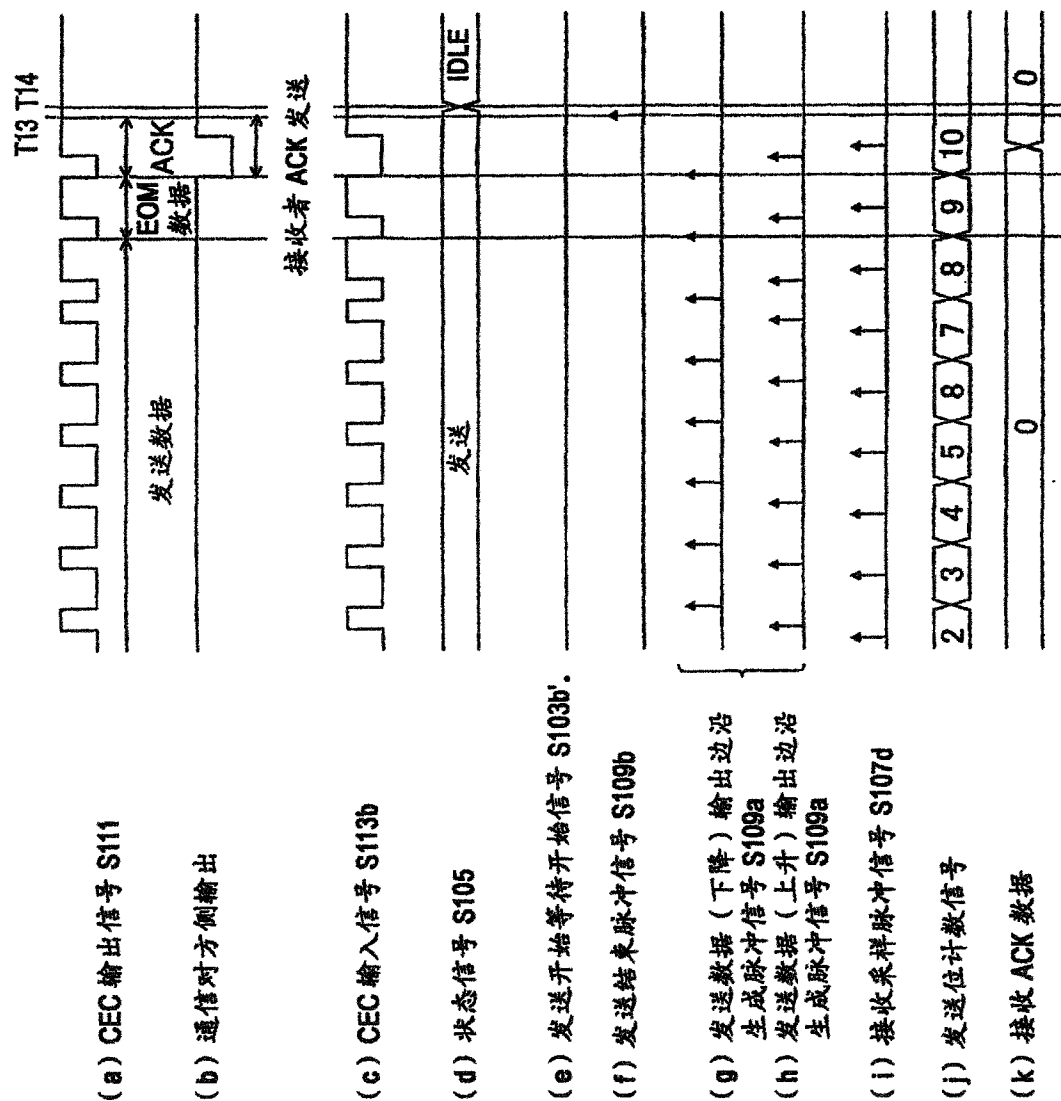


图 4B

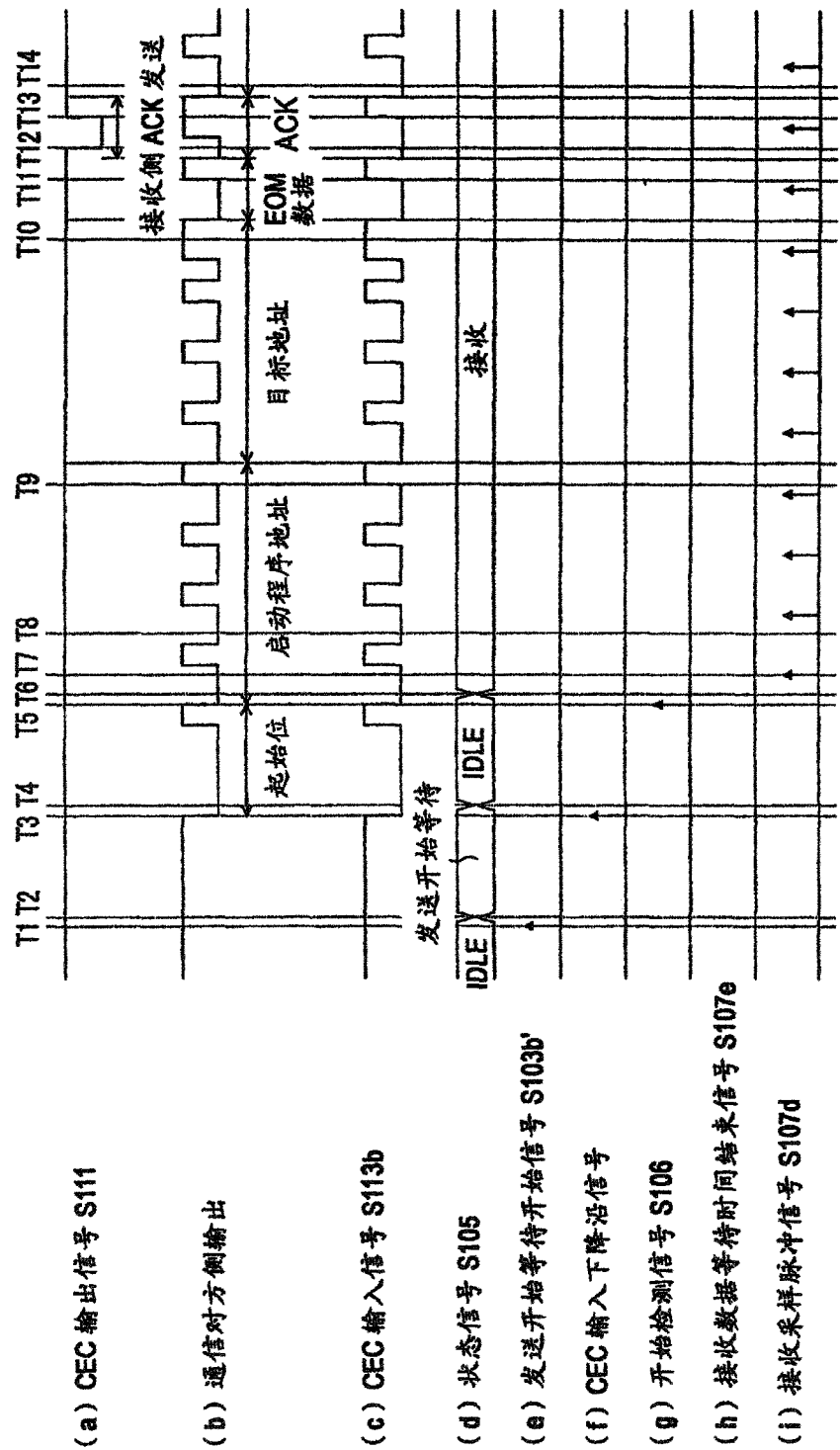


图 5A

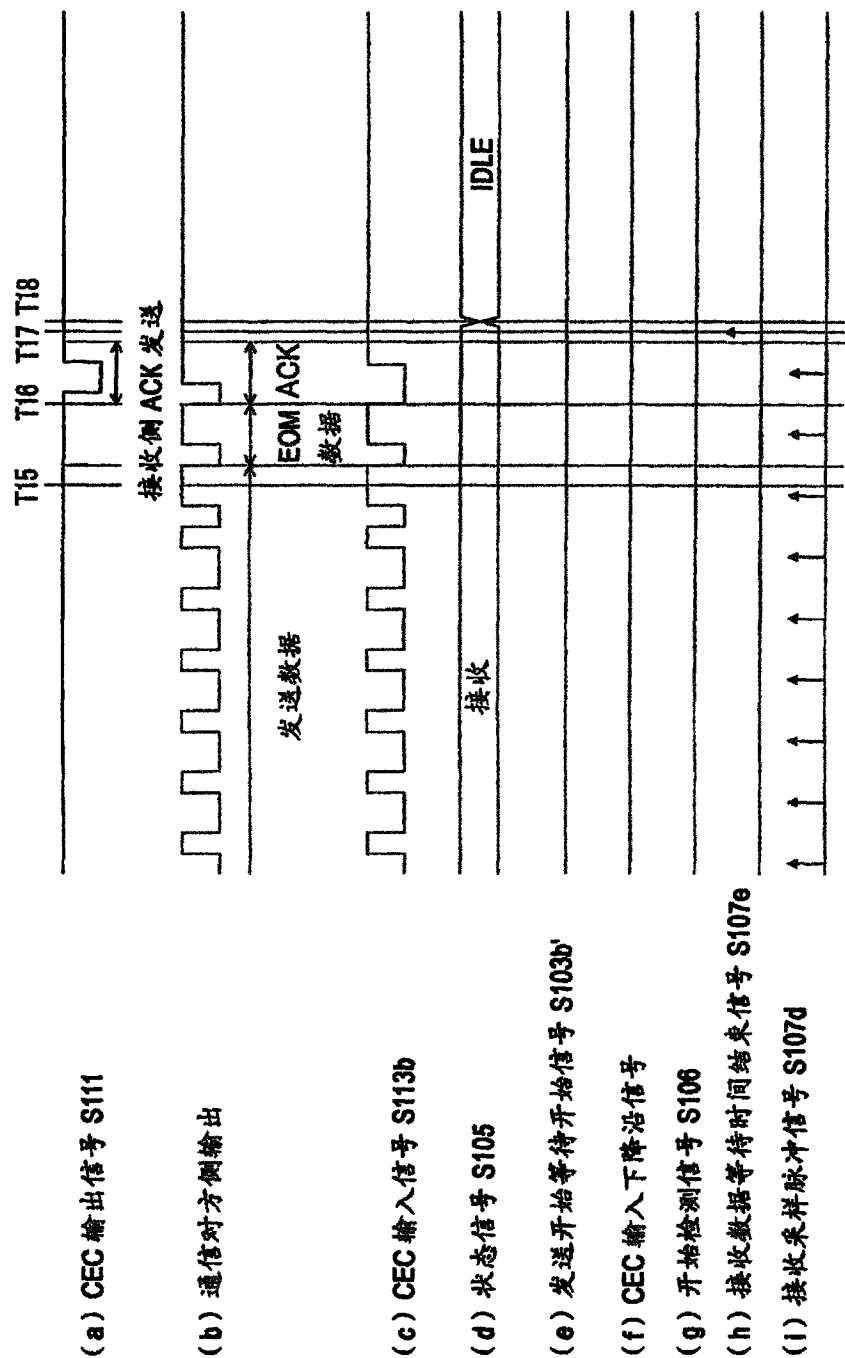


图 5B

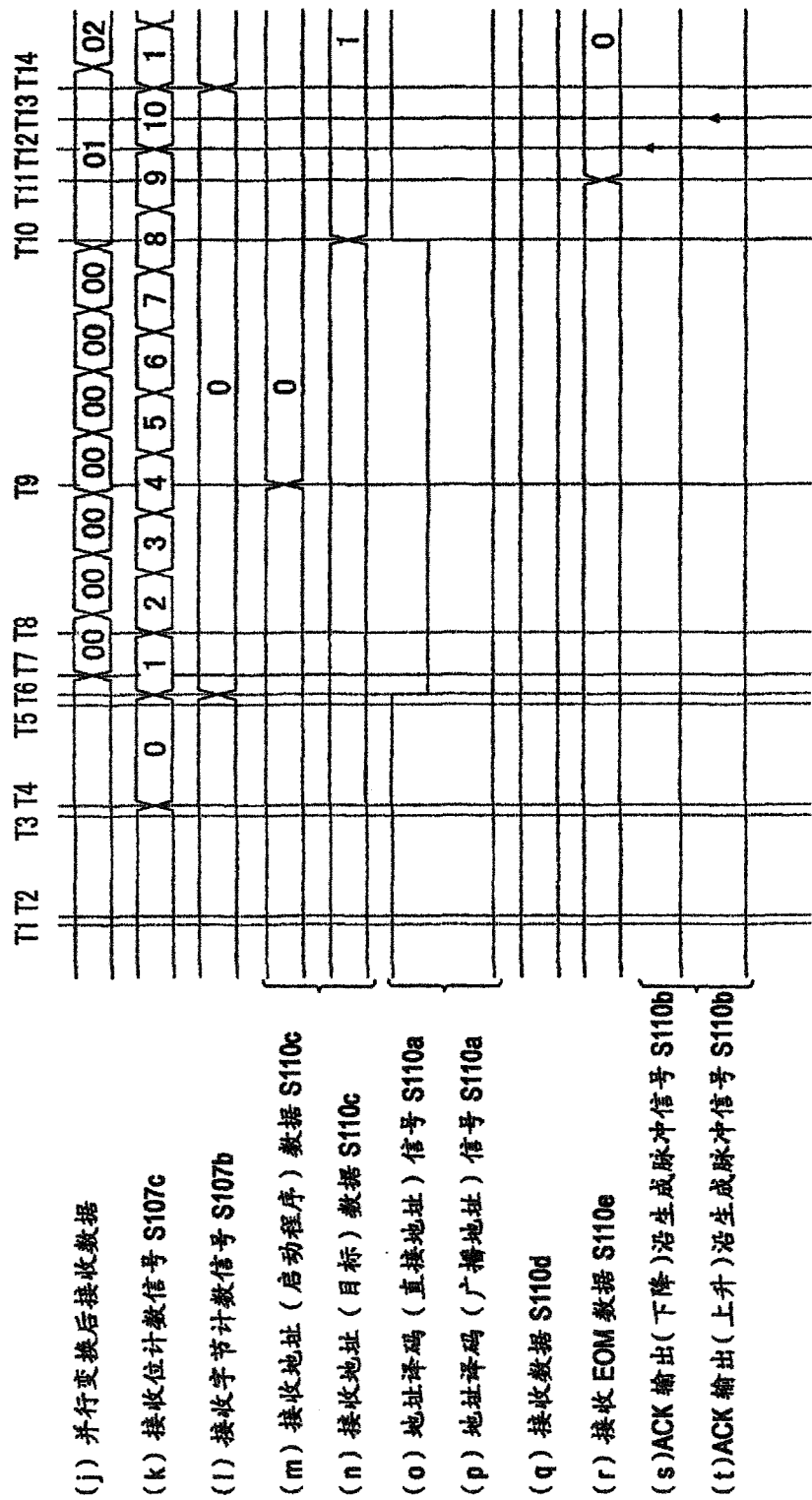
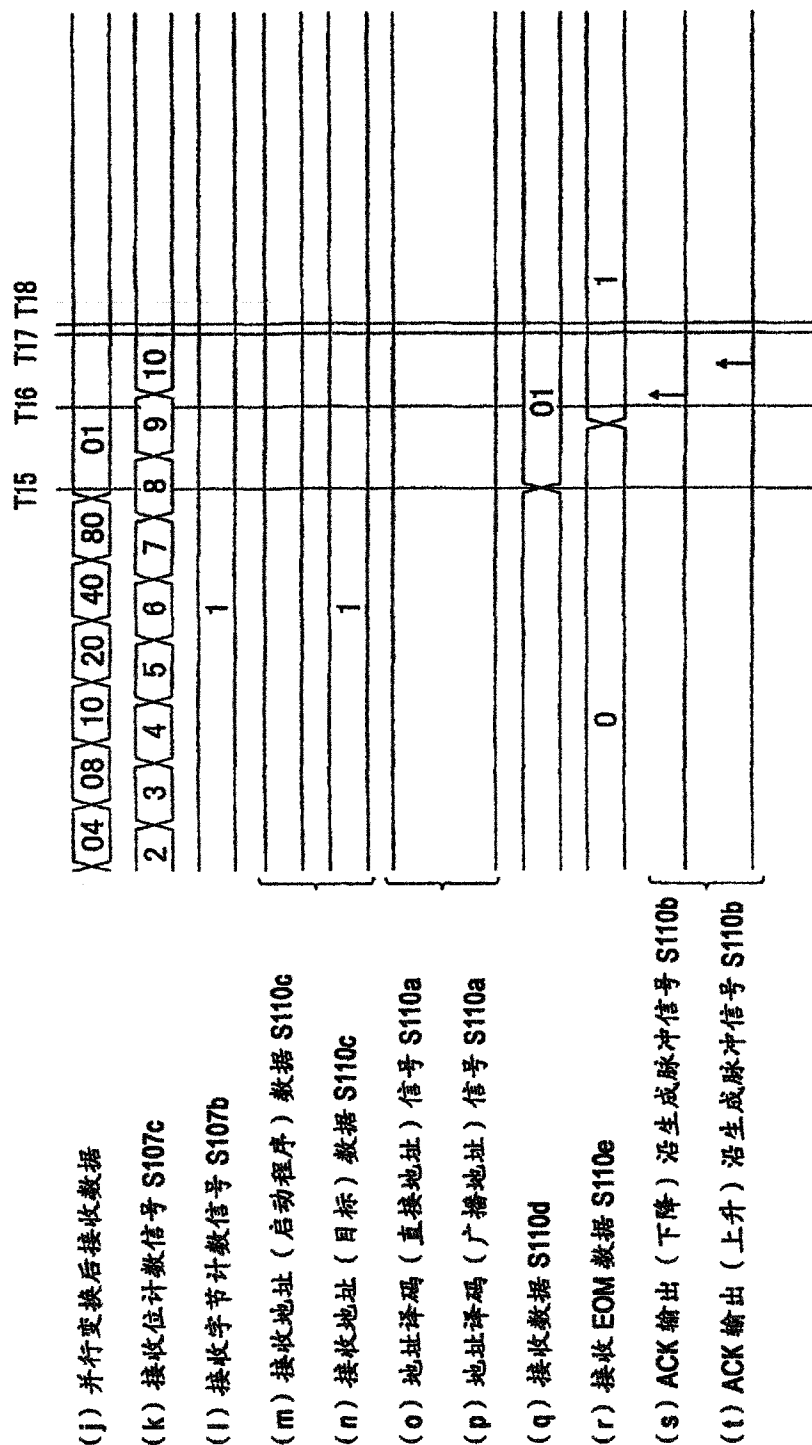


图 5C



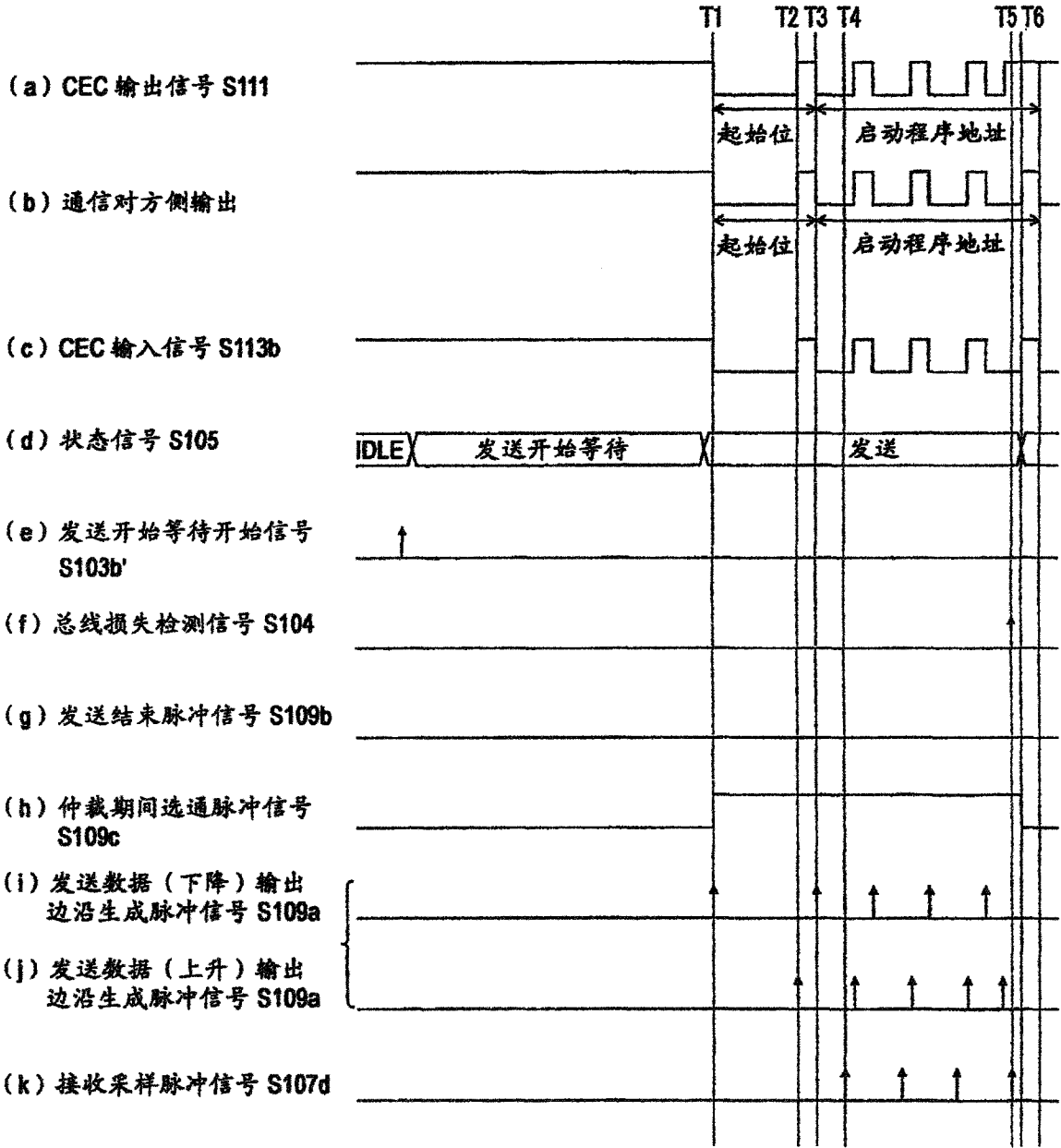
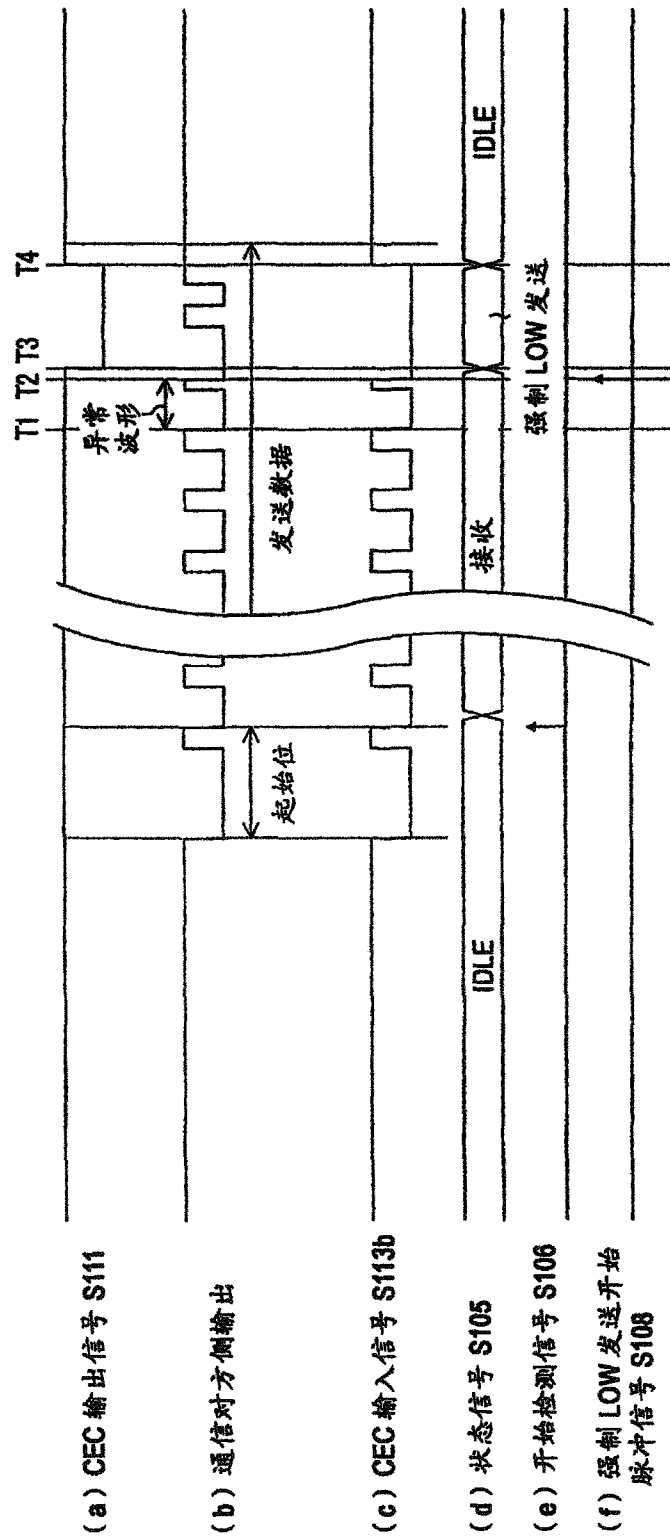


图 6



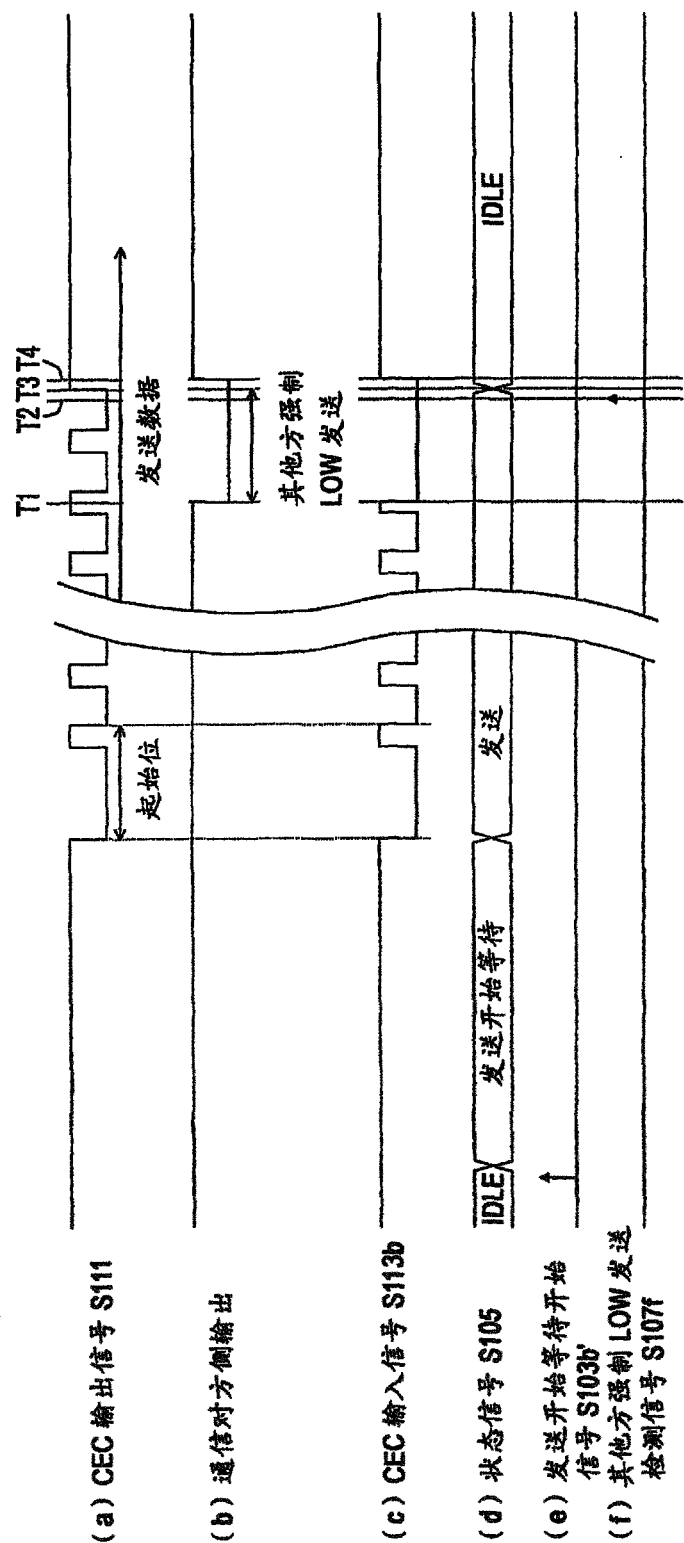


图 8

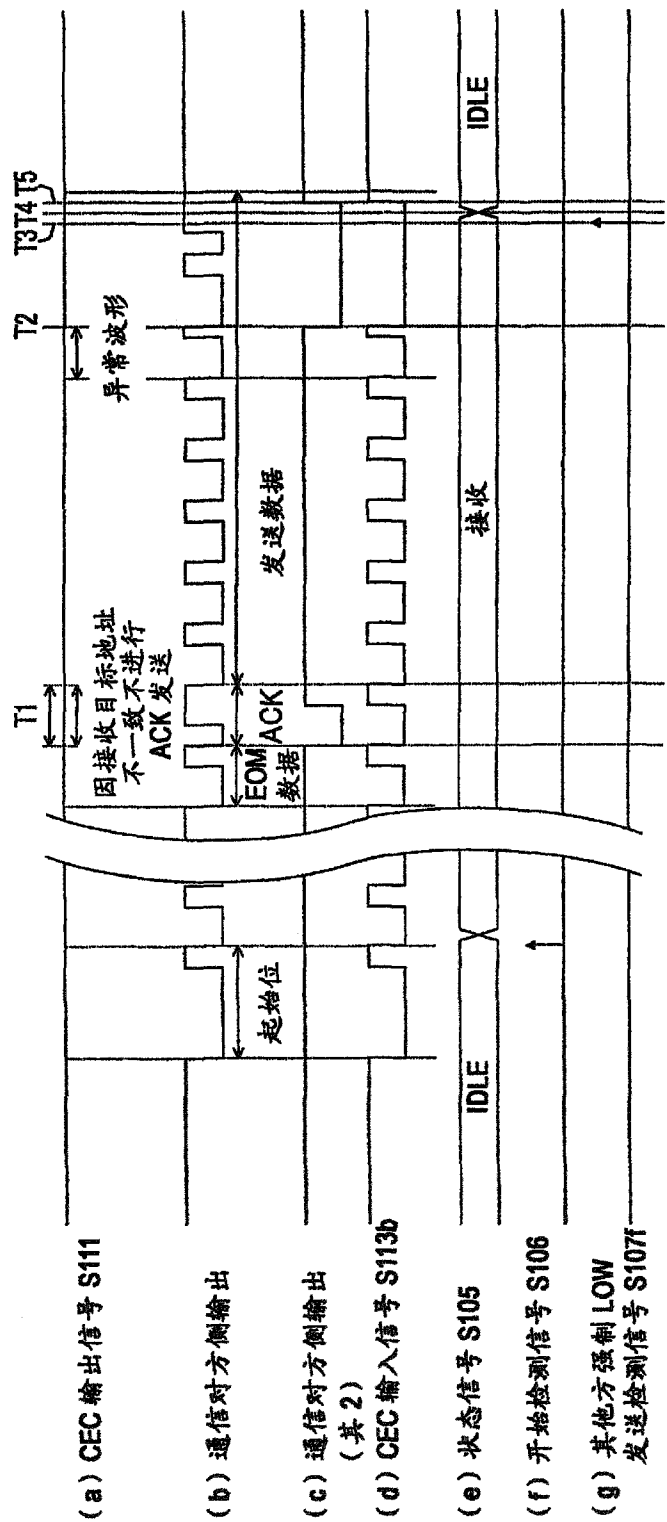


图 9

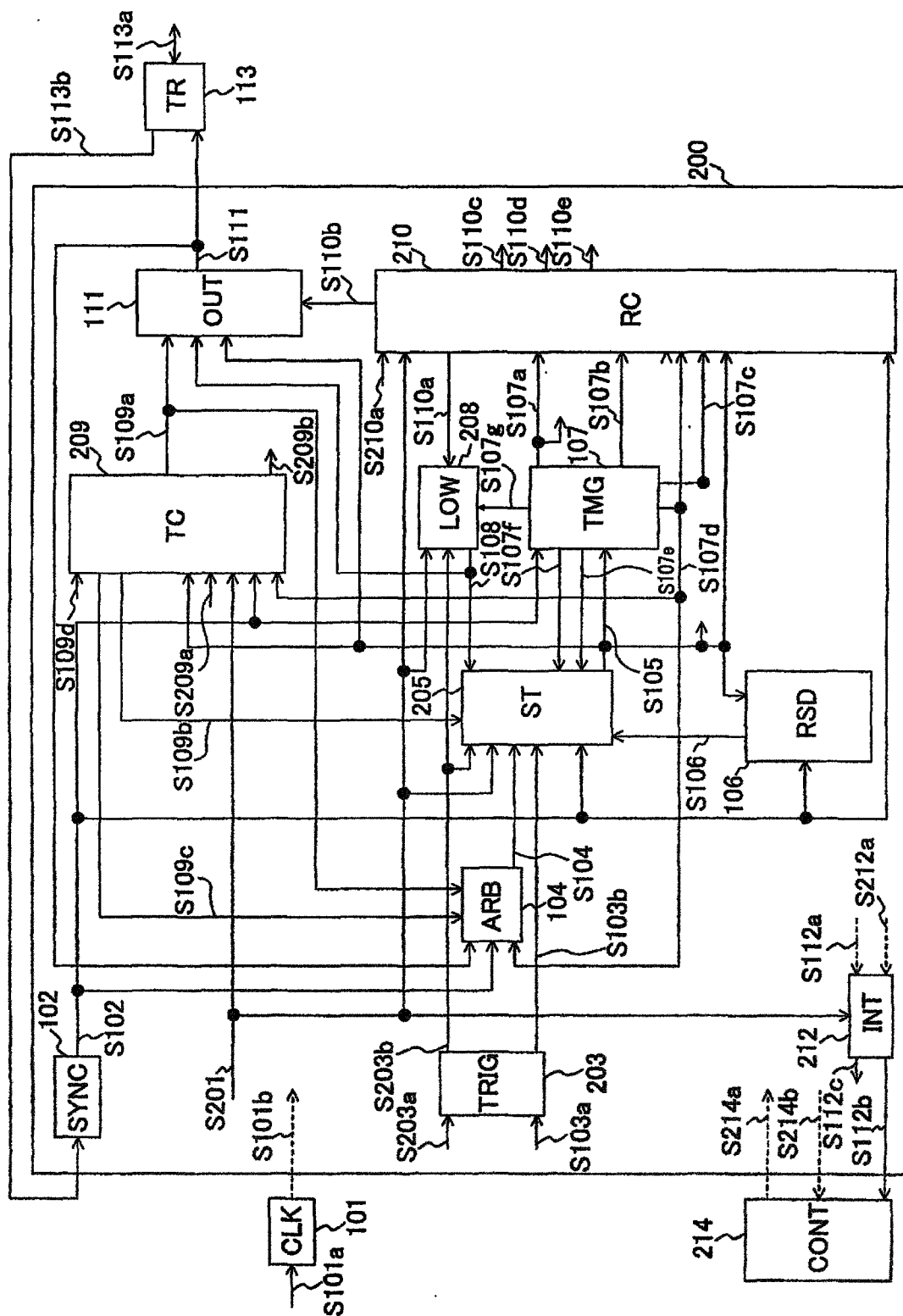


图 10

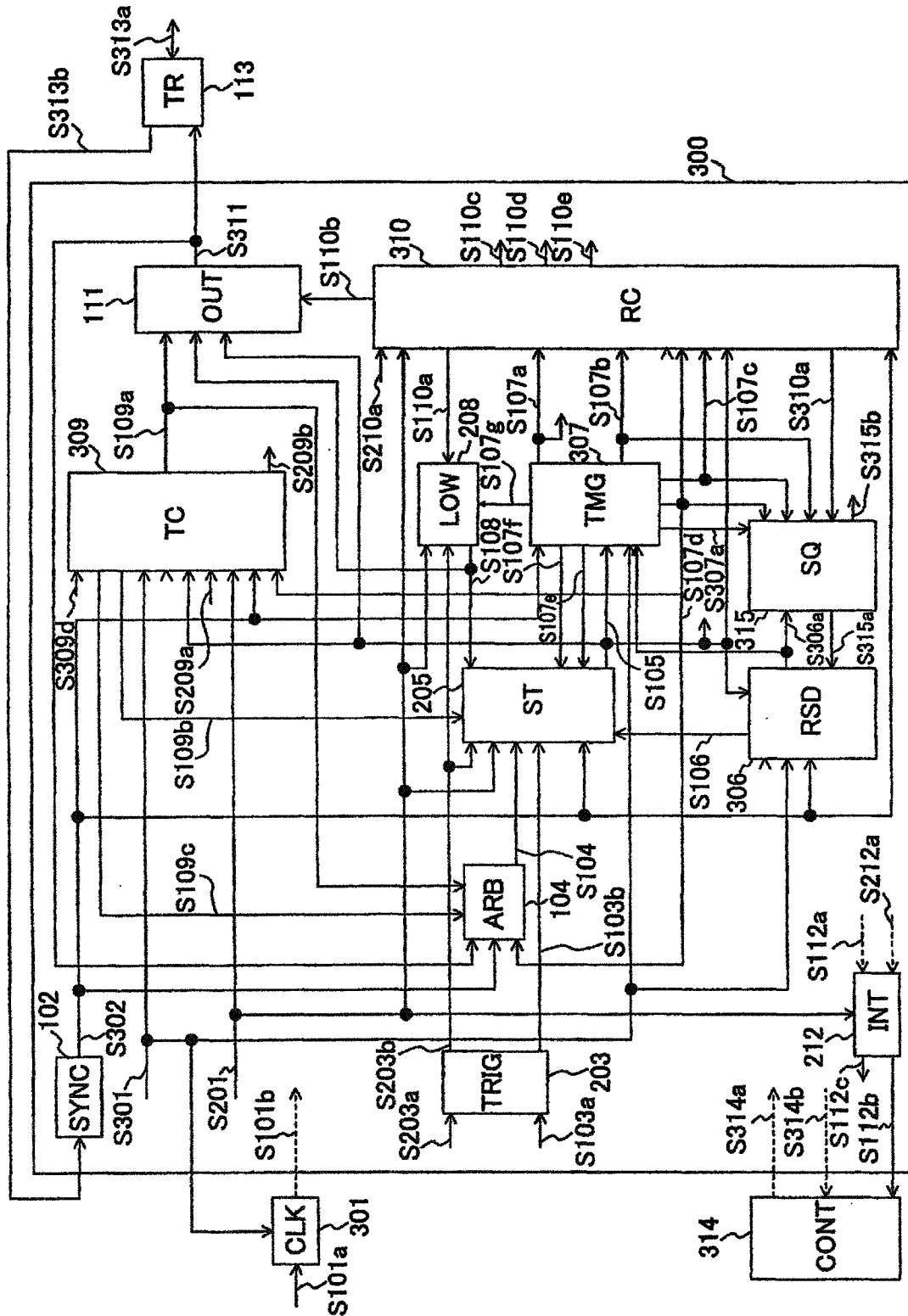


图 11

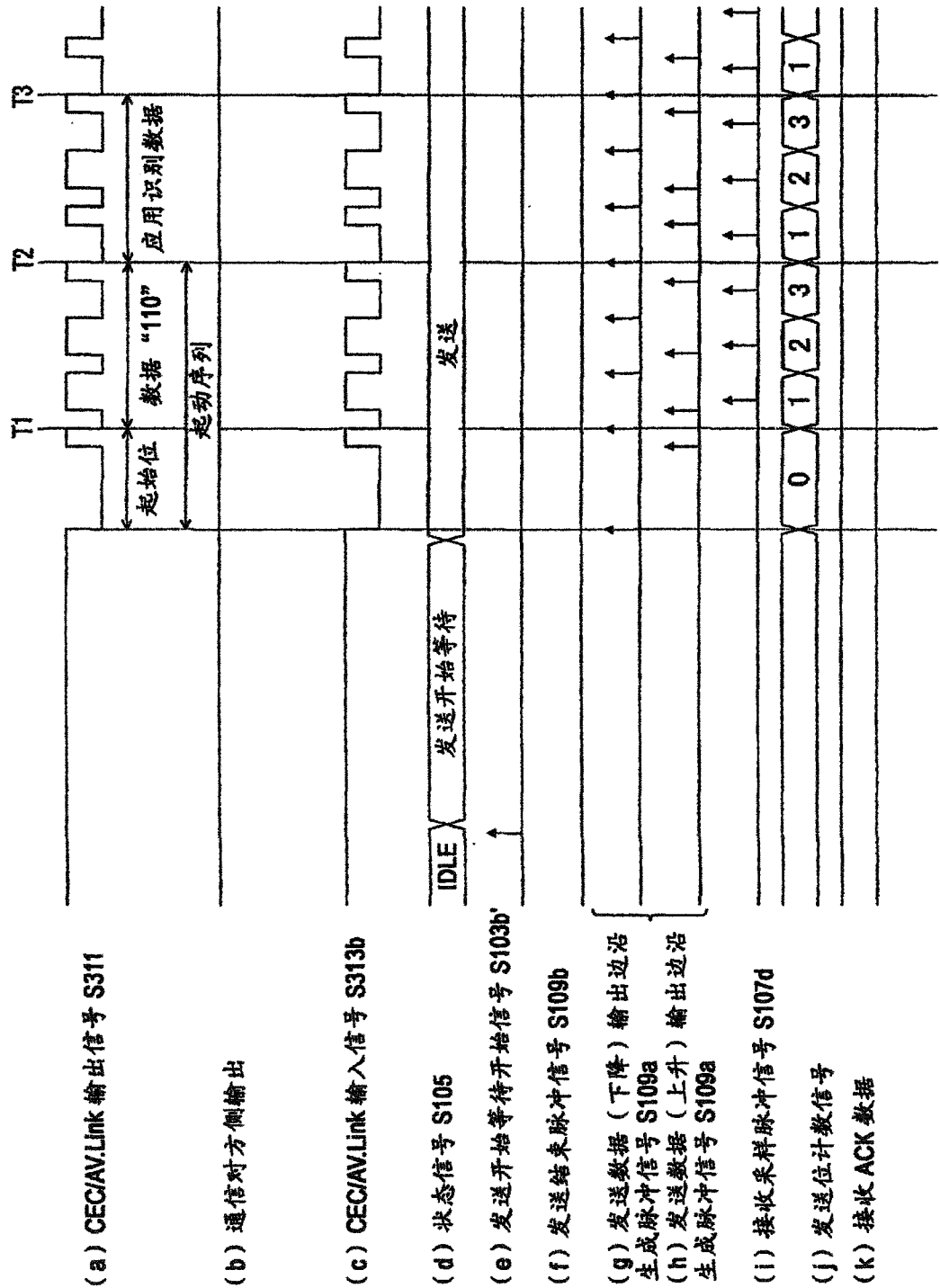


图 12

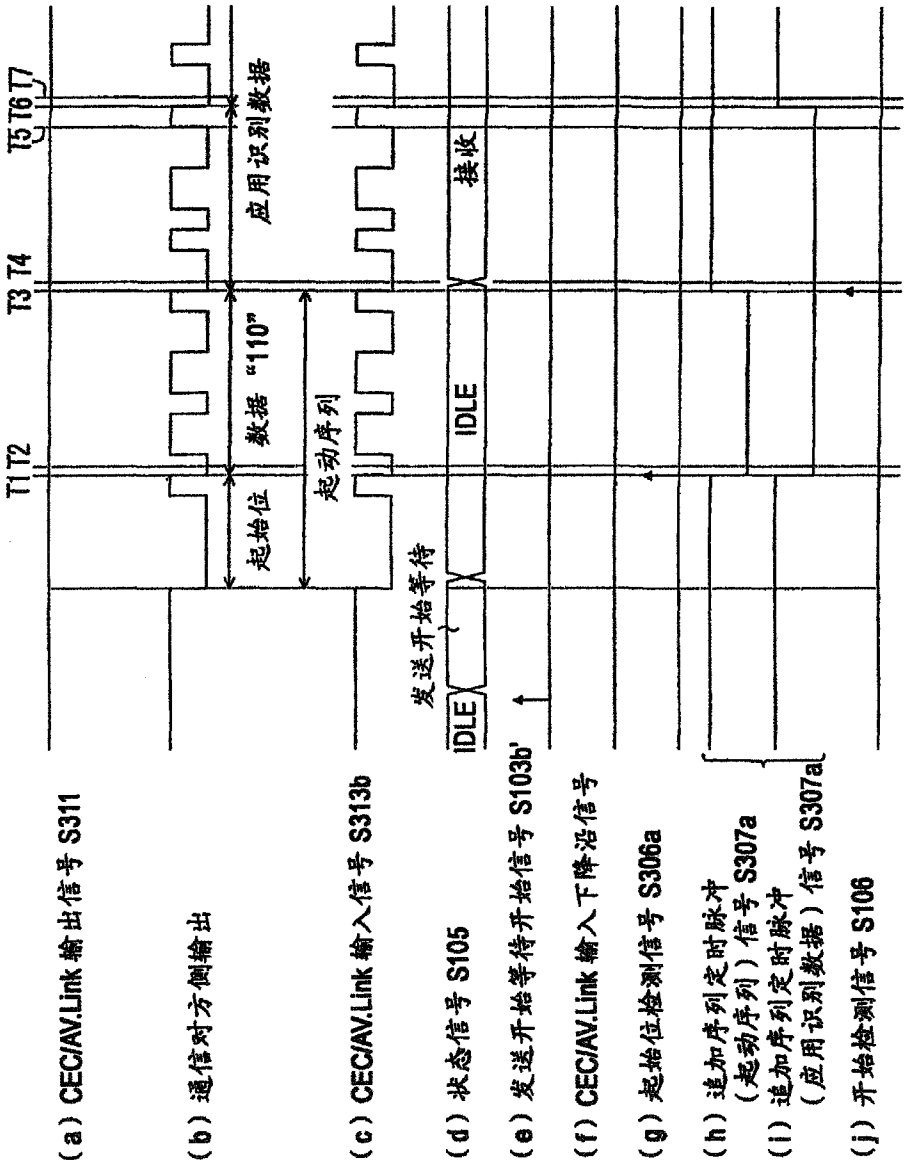


图 13A

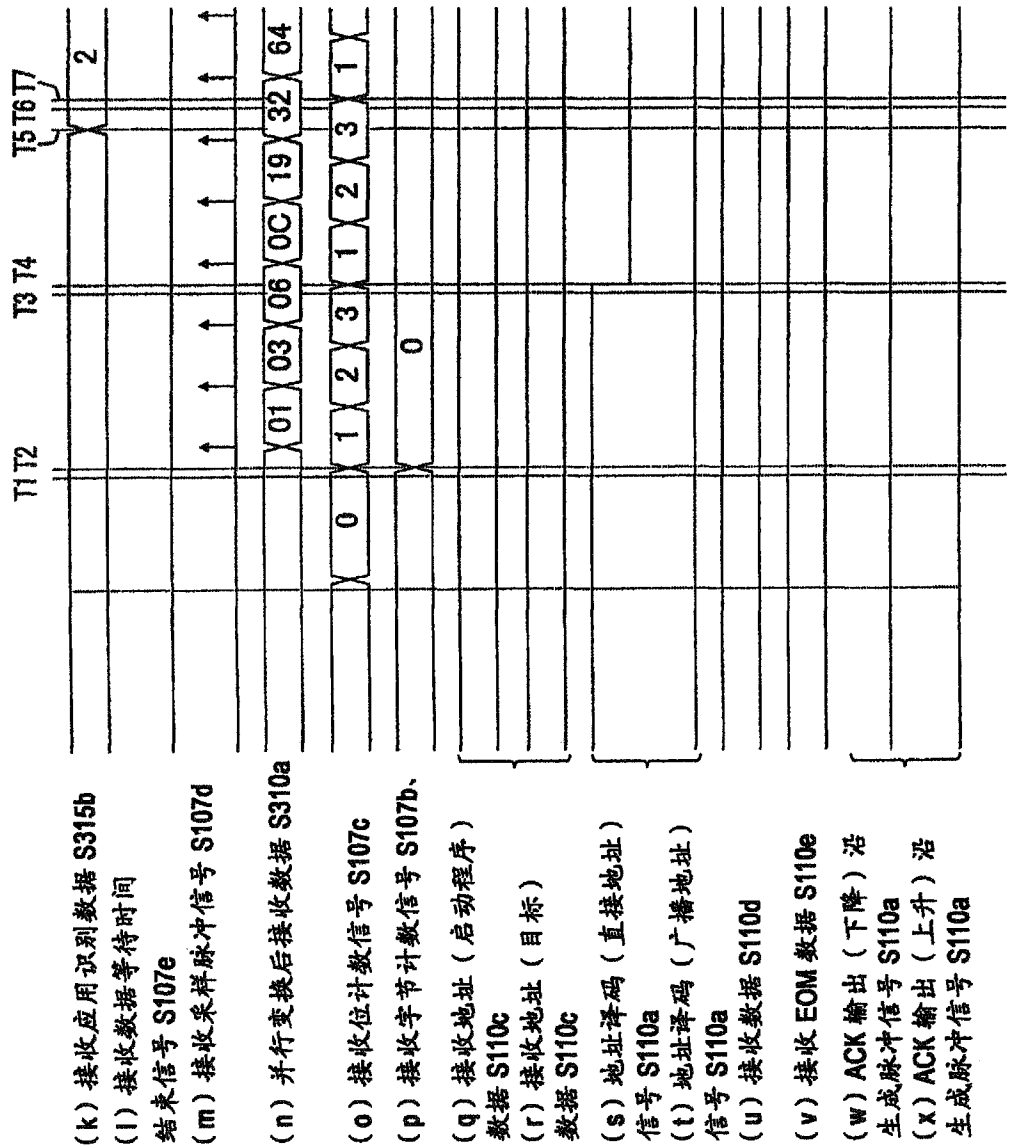


图 13B

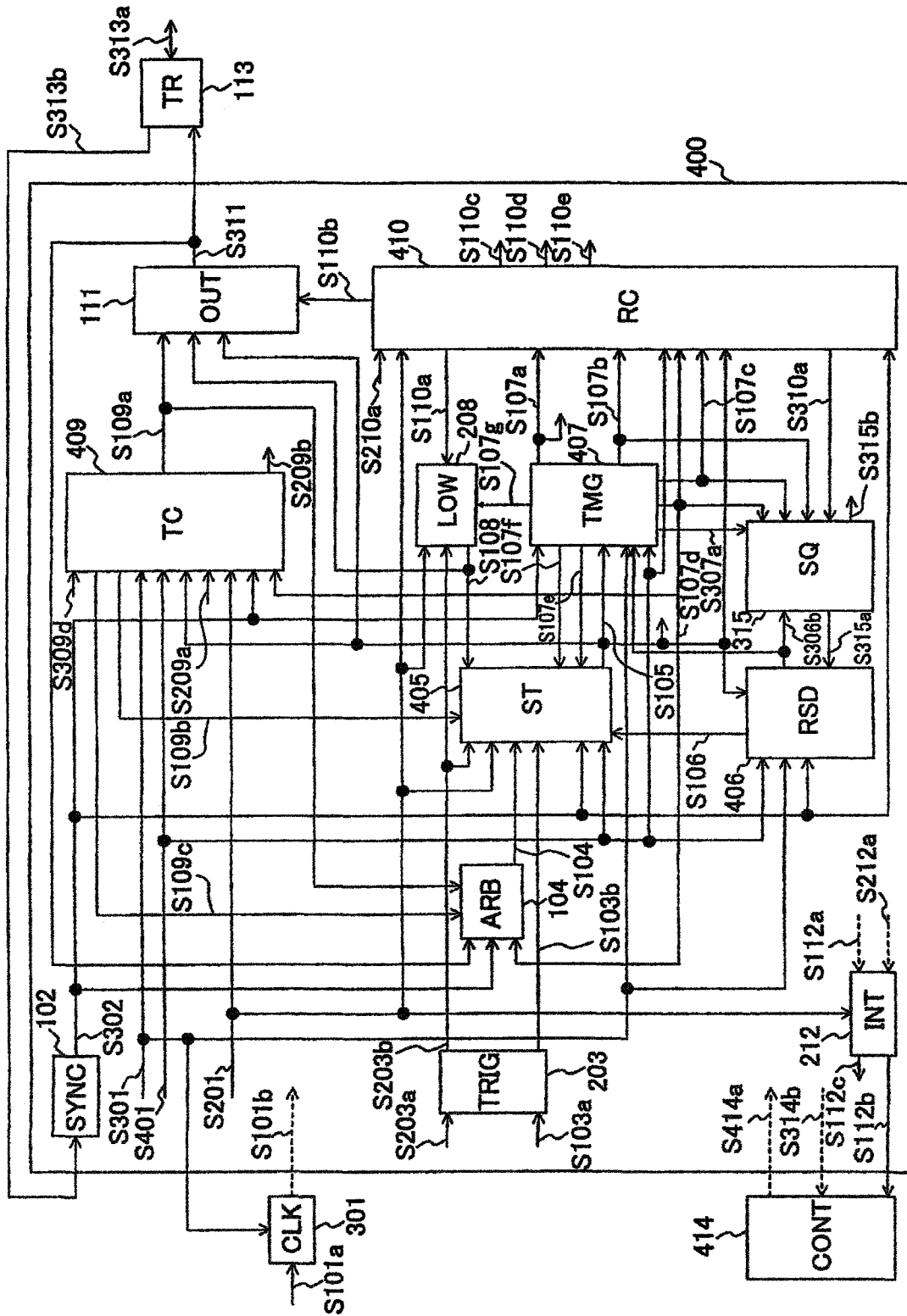


图 14

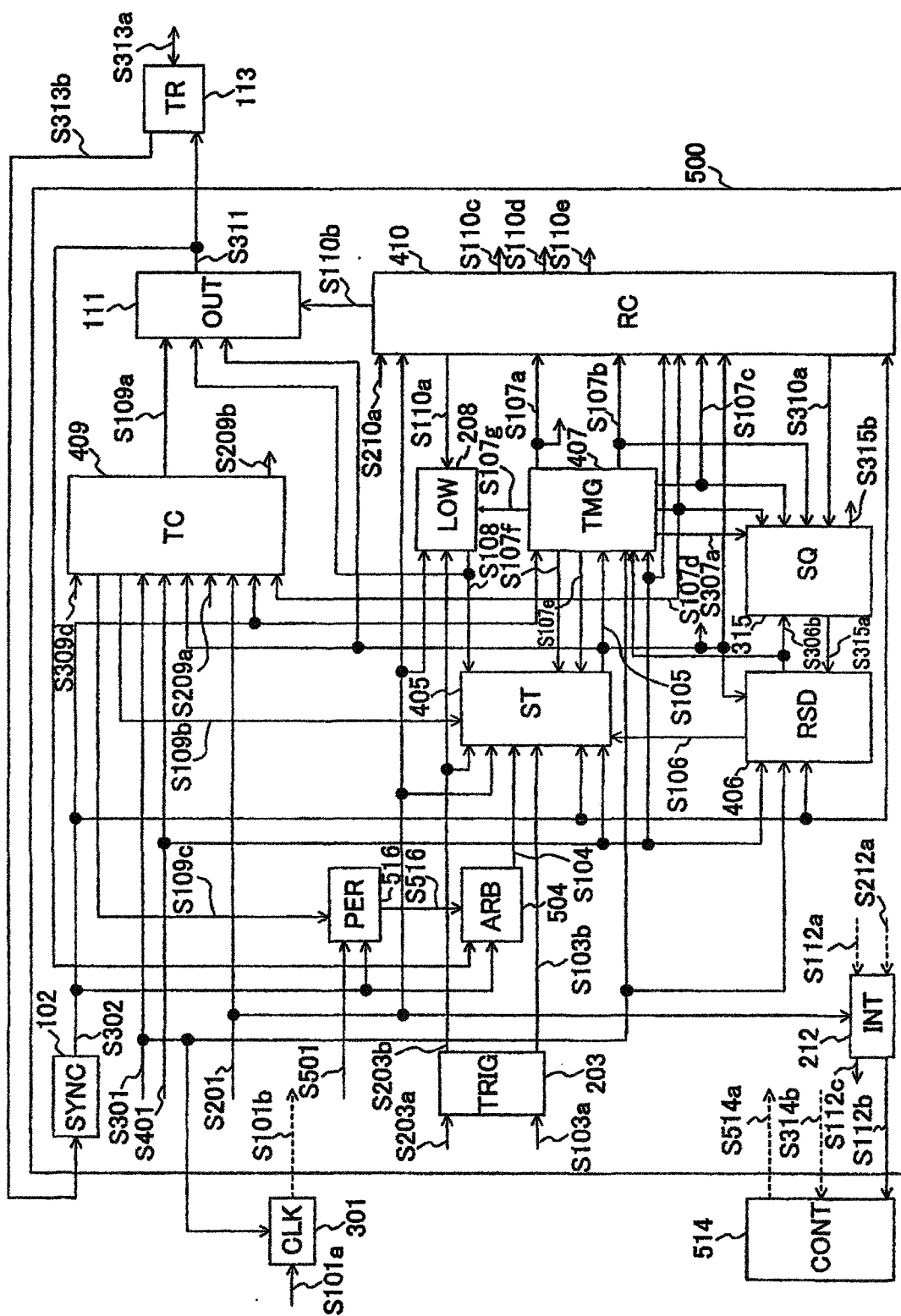


图 15

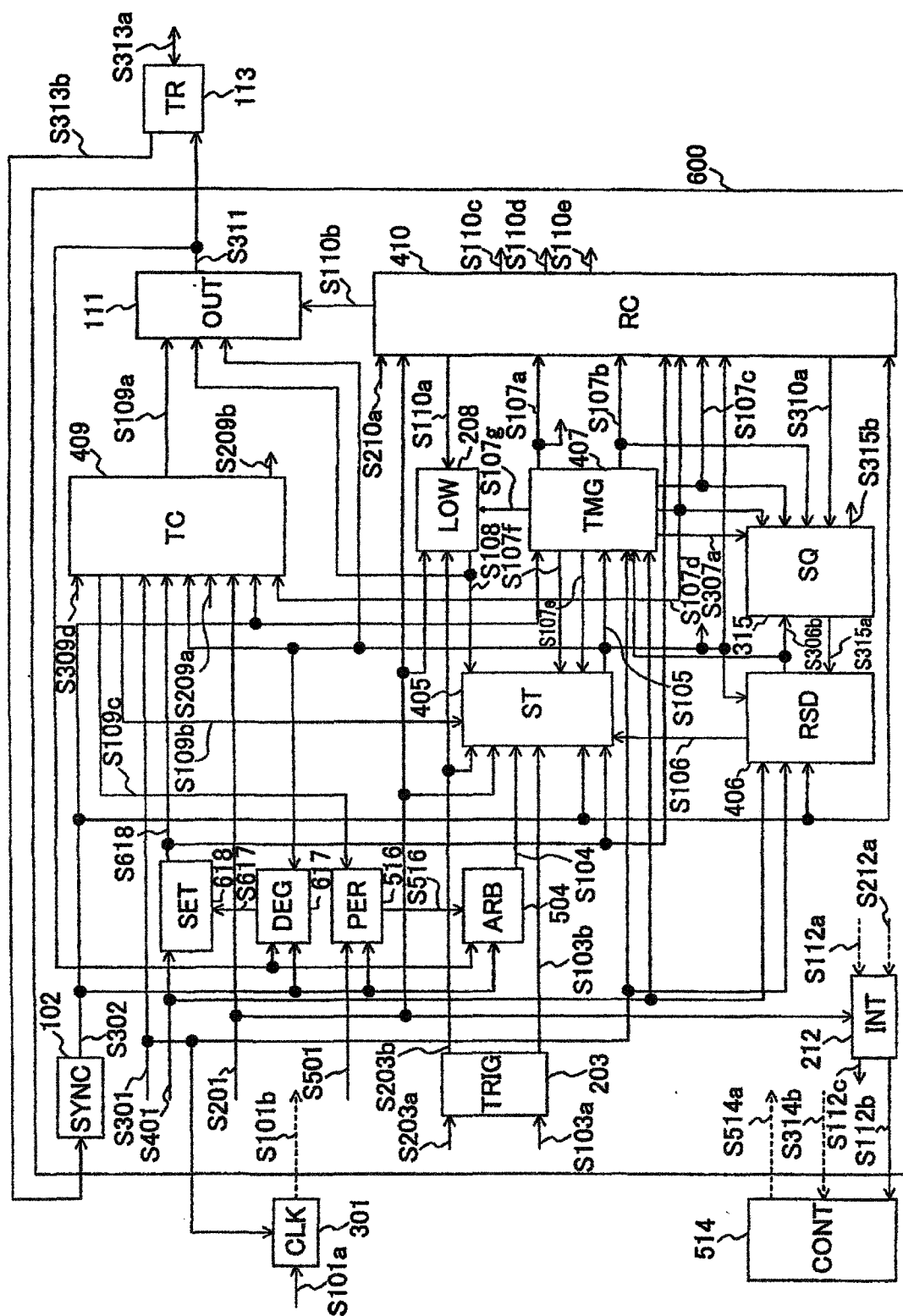


图 16

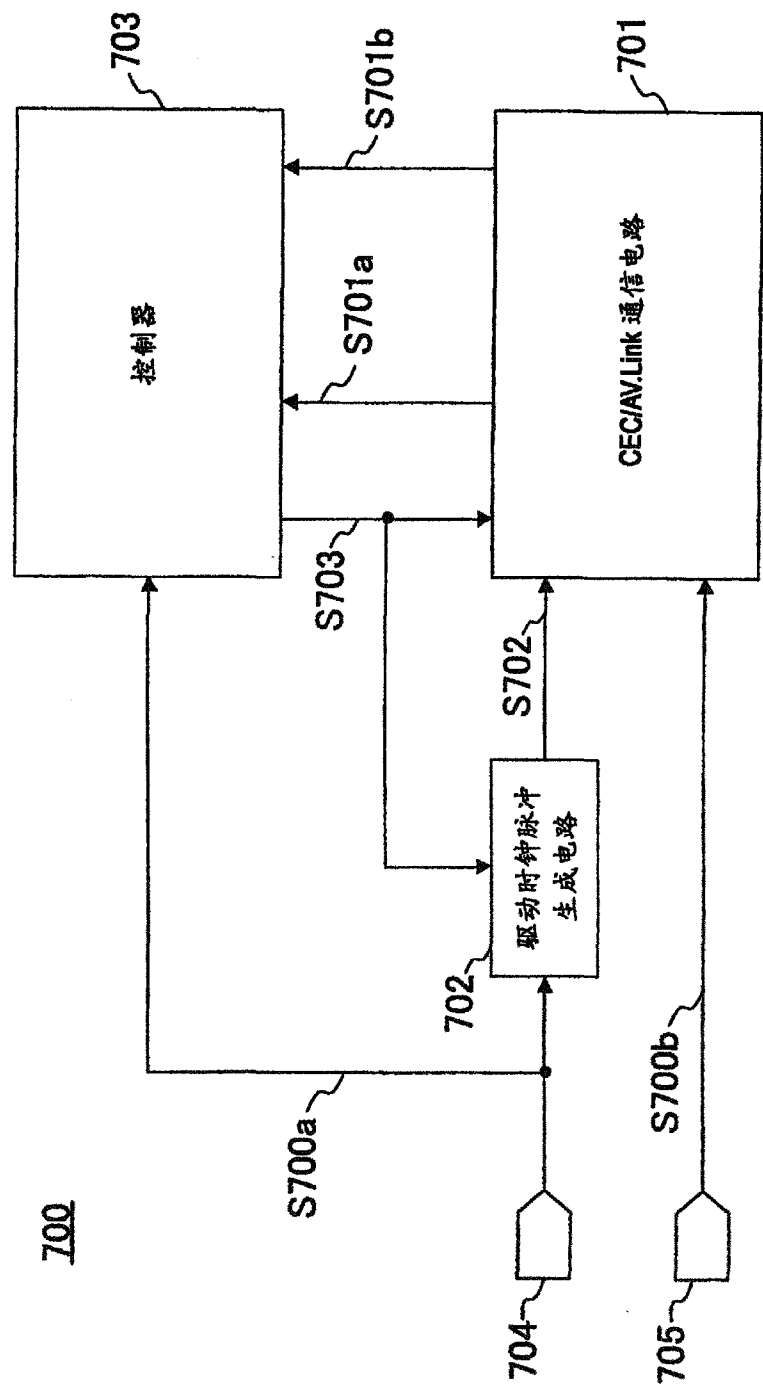


图 17

(12)

EUROPEAN PATENT APPLICATION

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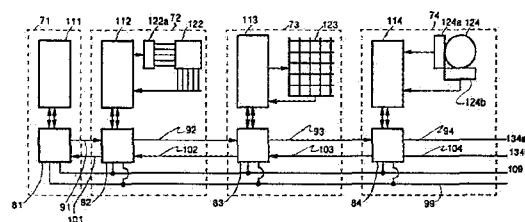
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(84) Designated Contracting States: **DE FR GB IT NL**

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(54) **Computer network.**

(57) A network is presented which can be used to link user oriented network devices (42,43,44,45) together in serial fashion. If data is transmitted bit-serially, an interface between two devices requires only two wires. Additionally, a wire (109) for power and a wire (99) for ground may be added so that each individual network device does not need to have its own power supply.



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TITLE MODIFIED
see front page

June 25, 1985

NETWORK

The invention relates to a network according to the preamble of claim 1.

5 Prior art networks are shown in Figures 1-3. Figure 1 shows a star network where a plurality of network devices 11 through 16 are coupled as shown to a central device 10. Figure 2 shows a bus network where central device 10 and network devices 11 through 16 are all coupled as shown to a bus 20. In Figure 3, central device 10 and network devices 11 through 16 are coupled in a loop network wherein information flows around the loop in a specified direction.

10 In accordance with claim 1, a network is presented having substantial advantages over each of the above-mentioned networks. According to an underlying concept of the invention, each network device of the network is provided with a send path comprising a send input and a send output for receiving data signals from the preceding device in the chain and for transmitting data signals to the succeeding device in
15 the chain as well as with a return path comprising a return input and a return output for receiving data signals from the succeeding device and for transmitting data signals to the preceding device. Each network device comprises means for selectively connecting its send path
20 to its return path such that data signals coming from a preceding device can be directed to the return path of the device, thus providing a transmission path for the data signals back through all preceding devices of the network and finally into the central device.

25 In the network according to the invention, the network devices are coupled serially, thus forming a chain of devices. Data signals are transferred from the central device through each network device until a last network device in the chain is reached. The last network device

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returns the data signals to the central device back through the network devices.

5 If a new device is to be added to the chain, the send input and the return output of the new device are connected to the send output and the return input, respectively, of the last device in the chain, and the connection between the send output and the return input of the last device is opened and a connection between the send output and the return input of the added device is established. Thus, a new device can simply be attached just by connecting the send output and the re-
10 turn input of the last device with the send input and the return output of the new device, respectively.

15 Relative to the star and the bus networks, the network according to claim 1 has the advantage that there need not exist an information path for every network device directly to the central device and that the addition of network devices to the network is not limited by the number of available connection ports to the central device or to the bus.

20 Relative to the loop network, the network according to claim 1 has the advantage that network devices can be added without requiring to break prior connections and that the network device to be added has to be coupled only to a single device.

25 According to claim 2, data signals between the network devices can be transmitted in a bit serial manner, so that the interconnection between devices requires only two lines, one for the send path and one for the return path.

30 According to claim 4, the power lines for the various devices and the two data transmission lines can be combined in one cable. In this case, each device comprises a first receptacle for accepting the two data lines and the power lines from the preceding device and a second receptacle for accepting the two data lines and the power lines extending to the succeeding device. Thus, a new device can be added to the network and power can be supplied to the new device simply by

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plugging one end of a cable into the device to be added and the other end into the last device in the chain of network devices.

Subsequently, an embodiment of the invention is explained in detail with reference to the drawings.

5 Figure 1, Figure 2, and Figure 3 show prior art networks.

Figure 4 shows a network in accordance with the preferred embodiment of the present invention.

Figure 5 shows a network in accordance with the preferred embodiment of the present invention incorporated in user oriented devices.

10 Figure 6A and Figure 6B show a network device in accordance with the preferred embodiment of the present invention.

Figure 7 shows a 15-bit data frame used with the network shown in Figure 5.

15 Figure 4 shows a network architecture in accordance with a preferred embodiment of the present invention. A central device 41 is coupled serially to network devices 42, 43, 44, and 45. Information from central device 41 flows through data paths 51, 52, 53, and 54. Network device 45 receives information from data path 54 and returns information through network devices 44, 43, and 42 to central device 41, by
20 way of data paths 64, 63, 62, and 61.

Figure 5 shows how the network architecture shown in Figure 4 may be incorporated in a network for user oriented devices. A network interface device 71 may form part of a computer system. Within network interface device 71 may reside, for instance, a microprocessor 111 such
25 as a 8086 manufactured by Intel Corporation of Santa Clara, California, and a central processor 81. Central processor 81 may be any processor or series of processors capable of handling the protocol described below. Through a send data path 91 and a return data path 101, central processor 81 is coupled to a network processor 82. Network processor 82 is coupled to a network processor 83 through a send
30

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data path 92 and a return data path 102. Network processor 83 is coupled to a network processor 84 through a send data path 93 and a return data path 103. Network processors 82, 83, and 84 may each be any processor or series of processor capable of handling the protocol described below.

5

Network processor 82 is coupled to a microcontroller 112 within a user oriented device (touchscreen circuit) 72, network processor 83 is coupled to a microcontroller 113 within a user oriented device (keyboard circuit) 73, and network processor 84 is coupled to a microcontroller 114 within a user oriented device (mouse circuit) 74. Microcontrollers 112-114 may each be, for instance, a COP 420, a COP 440 or a COP 2440, all of which are manufactured by National Semiconductor Corporation of Santa Clara, California. Microcontroller 112 is shown coupled to a touchscreen 122 through a touchscreen interface 122a. Microcontroller 113 is shown coupled to a keyboard 123, and microcontroller is shown coupled to a ball 124 through encoders 124a and 124b.

10

15

Additional network devices can be added to the network shown in Figure 5 through a port 134a and a port 134b. Port 134a is coupled to network processor 84 through a send data path 94, and port 134b is coupled to network processor 84 through a return data path 104. Network processors 82-84 along with any other processors added are collectively referred to as a (the) link. A power line 109 and a ground line 99 may also be coupled from network interface device 71 to each user oriented device 72-74 so that user oriented devices 72 - 74 do not need a separate power supply.

20

25

Figure 6A shows how information flows through network processor 83. Information from send data path 92 flows in into network processor 83, is processed by an information processor 83a and flows out to send data path 93. Information from return data path 103 flows directly through network processor 83 to return data path 102. Because network processor 83 sends information it receives to data path 93, it is said to be in passthrough mode.

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Figure 6B shows how information flows through network processor 84. Information from send data path 93 flows into network processor 84, is processed by an information processor 84a and is directed to flow out to return data path 103. If another network processor were added to
5 ports 134a and 134b (shown in Figure 5), then information paths within network processor 84 would be configured to be similar to the information paths within network processor 83 (as shown in Figure 6A). Because network processor 84 sends information back on return data path 103 it is said to be in loop back mode.

10 Many different protocols may be used by the network architecture. One embodiment, given as an example, sends data serially in fifteen bit data "frames". A frame 140 is shown in Figure 7. Bit 141 is a start bit indicating that a frame follows. In this embodiment, start bit 141 is always a "0".

15 Bits 142-144 are address bits. Address bits 142-144 may be used to address up to seven user oriented devices, leaving an address (000) to be used as a universal address.

A bit 145 is a "1" if frame 140 contains data and a "0" if frame 140 contains an encoded command. Bits 146 - 153 contain a byte of data or
20 an encoded command as indicated by bit 145. Bit 154 is a parity bit used for error detection. Bit 155 is a stop bit, in this embodiment always a "1".

Upon initial activation, or whenever user oriented devices are added or subtracted from the network shown in Figure 5, each user oriented
25 device needs to be assigned an address. The process of assigning addresses to each user oriented device in the network is called configuration. Configuration may be performed as follows.

Central processor 81 first sends out a Device Hard Reset command (FE_{hex}, see below for a table of commands and their hexadecimal representation). The Device Hard Reset command is sent with the universal
30 address (000). Network processor 82 receives the Device Hard Reset command, resets microcontroller 112, and retransmits the Device Hard

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Reset Command to Network processor 83. Network processor 83 resets microcontroller 113 and retransmits the Device Hard Reset Command to Network processor 84, and so on. Upon receipt of the Device Hard Reset Command each network processor 82-84 goes into loop back mode.

5 Central processor 81 then individually assigns each network processor 82-84 an address. Central processor 81 sends an Interface Clear (IFC) Command (00_{hex}) with a universal address. Upon receipt and after performing a self test operation to assure its interface with microcontroller 112, network processor 82 loops the IFC command directly
10 back to central processor 81.

Central processor 81 then sends an Auto Configure command (09_{hex}), using the universal address. Network processor 82 receives the Auto Configure command, notes that it is device #1, increments the Auto Configure command from 09_{hex} to 0A_{hex}, and loops the Auto Configure
15 command directly back to central processor 81.

At this point central processor is done configuring network processor 82, so it sends to network processor 82 an Enter Passthrough Mode command (01) with an address (in address bits 142-144) of 1_{hex}. Network processor 82 then goes into passthrough mode (meaning it will then
20 pass through all messages it receives to Network processor 83). The Passthrough Mode command is forwarded to network processor 83, which loops the message back to central processor 81 through network processor 82.

Central processor 81 is now ready to configure network processor 83.
25 Central processor 81 sends an IFC command to network processor 82. Since network processor is already configured it ignores this command and forwards the IFC command to network processor 83. Network processor loops the IFC command back to central processor 81.

Central processor 81 then sends an Auto Configure command (09). Network processor 82 receives the command, increments the 09_{hex} to 0A_{hex}, and retransmits the command to network processor 83. Network processor
30 83 receives the Auto Configure command, notes that it is device #2.

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Network processor 83 then increments the Auto Configure command from 0A_{hex} to 0B_{hex} and loops the command back to central processor 81.

At this point central processor is done configuring network processor 83, so it sends to network processor 83 an Enter Passthrough Mode command (01) with an address (in address bits 142-144) of 2_{hex}. Network processor 82 receives this command, notes that it is not addressed to Device #1, and so merely passes the message on to Network processor 83. Network processor 83 sees that the Enter Passthrough Mode command is addressed to it (Device #2), so it goes into passthrough mode (meaning it will then pass through all messages it receives to Network processor 84).

Central processor repeats the above configuring sequence with network processor 84, and with as many other network processors as are coupled to the network. The Auto Configure command is incremented by each network processor before sending it to the next network processor (if it is in passthrough mode) or back to the central processor (if it is in loopback mode). The Auto Configure command is incremented in the following sequence as it travels through each network processor:

09 -> 0A -> 0B -> 0C -> 0D -> 0E -> 0F -> 08

If a network processor receives an Auto Configure command which has been incremented to (08), then it knows that there are more than seven devices on the line. The network processor receiving a 08_{hex} in bits 146-153 would generate a Configure Error command (FD_{hex}) and sends it back to central processor 81. Presumably, at this point an error message is sent to a user who would remove some user oriented device from the network, limiting the number to 7.

If in the course of configuring the network, central processor 81 sends out an Enter Passthrough Mode command to a network processor, which is device #n (where n is a positive integer less than or equal to 7), and does not get a command back, then that means that device #n is the last device on the chain. So, after waiting for a specified length of time (e.g. 1/60 of a second), central processor 81 sends out

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an Enter Loopback Mode command (02) with addressed to device #n. At this point the network has been configured. Now central processor can send an Identify and Describe command (03) to each network processor 82-84, to find out what kind of device it is and what information it provides. The device will respond with a descriptor in an agreed upon format.

Once central processor 81 is ready to receive data from the link, it sends a Poll command (10_{hex}) with the universal address field. Network processor 82 receives this command, and if it has no data for central processor 81, it immediately forwards the Poll command to network processor 83. If network processor 82 does have information to return it performs the following sequence:

- (1) transmits a poll response header frame with an address of 1_{hex} indicating the data is from device #1. The frame would include 8 bits of data in bits 146 - 153 which would inform central processor 81 and/or microprocessor 111 the format of the data bits to follow.
- (2) transmits data frames (with an address of 1_{hex}).
- (3) adds a number equal to the number of data frames (the number of data frames would include the poll response frame) transmitted to the low nibble (bits 150-153) of the original Poll command, and then forwards the modified Poll command to network processor 83. For instance, if network processor 82 sent out 8 frames, it would increment bits 146-153 to be 18_{hex}.

Network processor 83 performs in a manner similar to network processor 82. However, no more than fifteen frames may be sent in response to a Poll command. So, if network processor 83 sees that its response to the Poll command would require it to increment bits 150-153 to be greater than 15 (e.g., if network processor 82 sent out 8 frames, network processor 83 could send out 7 or fewer frames), then it will send the Poll command on to network processor 84 unmodified, and wait for the next Poll command.

Central processor 81 receives this data and forwards it to microprocessor 111. Central processor 81 may be prompted by microprocessor

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111 to issue additional Poll commands, or central processor 81 may do so automatically.

The following table gives a summary of the commands listed with the hexadecimal encoded values within bits 146-153.

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Table 1

Command (hex value):	Name:
00	Interface Clear (IFC)
01	Enter Passthrough Mode
02	Enter Loopback Mode
03	Identify & Describe
04	Device Soft Reset
05	Perform Self Test
06	Command Trailer
07	Data Trailer
09 (08 -> 0F)	Auto Configure
10 (-> 1F)	Poll
20 (-> 2F)	Repoll
30	Report Name
31	Report Status
32 -> 3C	not used / reserved
3D	Disable Autorepeat
3E	Enable Autorepeat, Cursor Rate = 1/30 second
3F	Enable Autorepeat, Cursor Rate = 1/60 second
40 -> 47	Prompt 0 -> 7
48 -> 4F	Acknowledge 0 -> 7
50 -> 5F	not used / reserved
FB	Master Hard Reset
FC	Data Error
FD	Configure Error
FE	Device Hard Reset
FF	not used / prohibited

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June 25, 1985

CLAIMS

1. A network for the transmission of data signals between network devices (42,43,44,45) and at least one central device (41) for controlling the network devices and for processing data signals received from the network devices,
5 c h a r a c t e r i z e d in that each network device comprises:
 - a send input connectable to a send output of the central device (41) for receiving data signals from the central device,
 - a send output having a transmission path to the send input of the network device (42), the send output being connectable to the
10 send input of a further network device (43) for transmitting data signals thereto,
 - a return output connectable to a return input of the central device for transmitting data signals thereto,
 - a return input having a transmission path to the return output of
15 the network device, the return input being connectable to the return output of a further network device (43) for receiving data signals therefrom, and
 - means for selectively interconnecting the send output of a network device with its return input such that an interconnection is
20 established only between the send output and the return input of the last network device in the network and data signals transmitted to this network device from the preceding device of the network are transmitted back to the return input of the preceding device.
- 25 2. A network according to claim 1,
c h a r a c t e r i z e d in that the data signals are transmitted bit-serially between the devices (41,42,43,44,45) of the network.

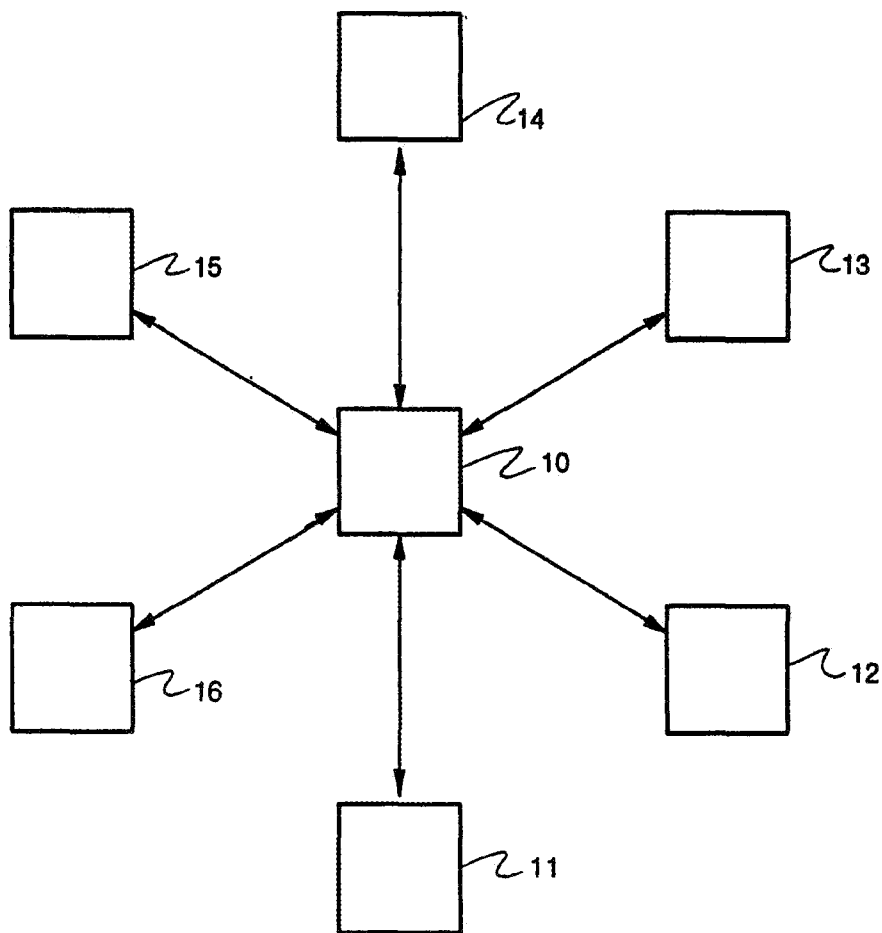
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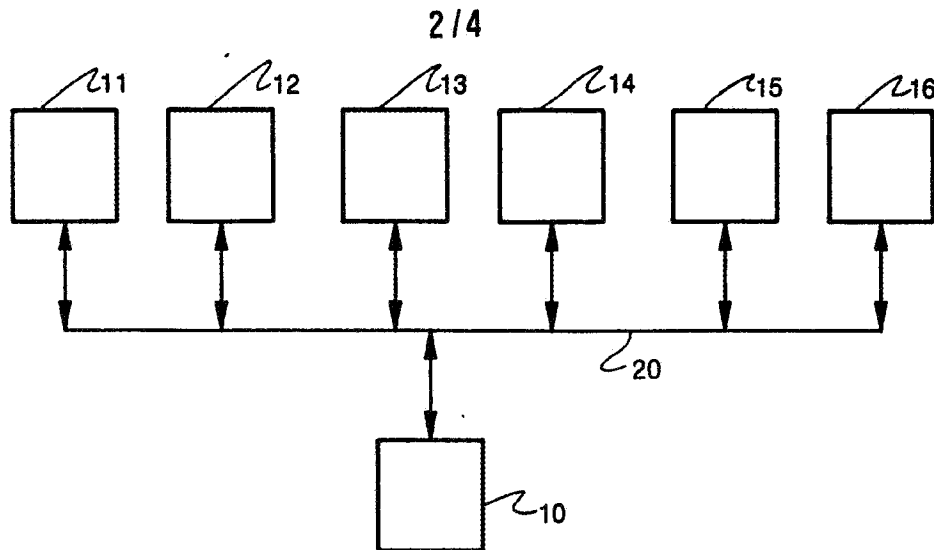
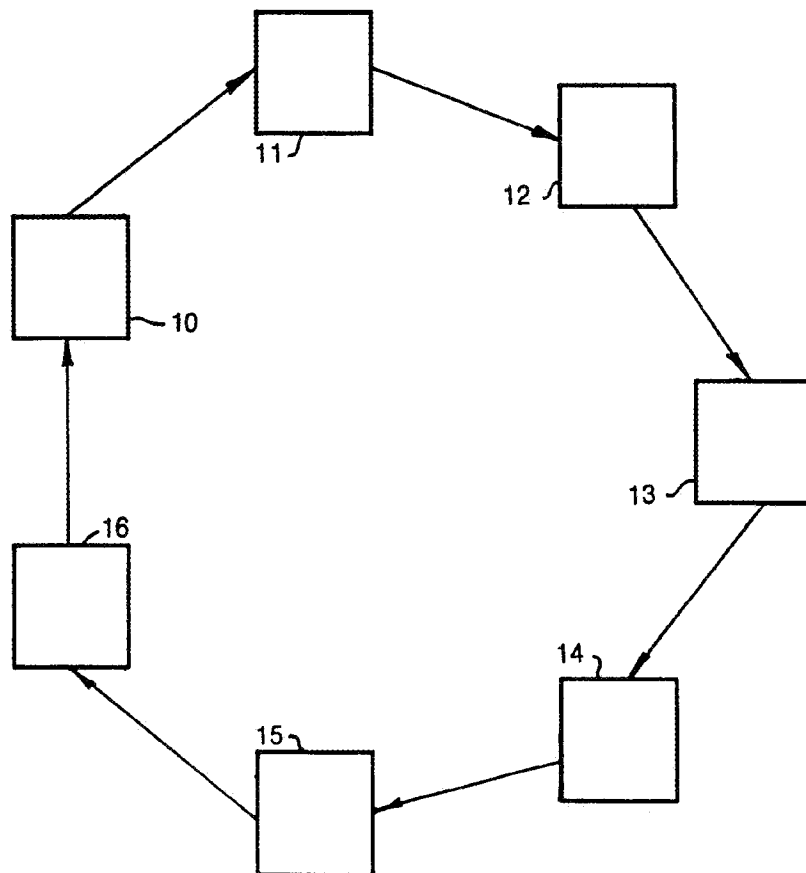
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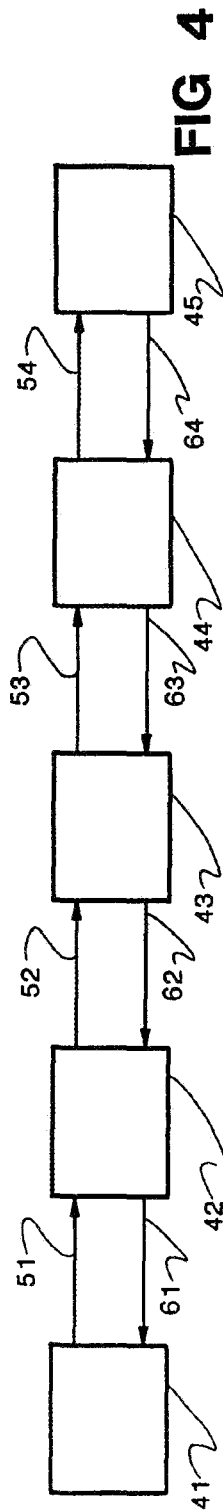
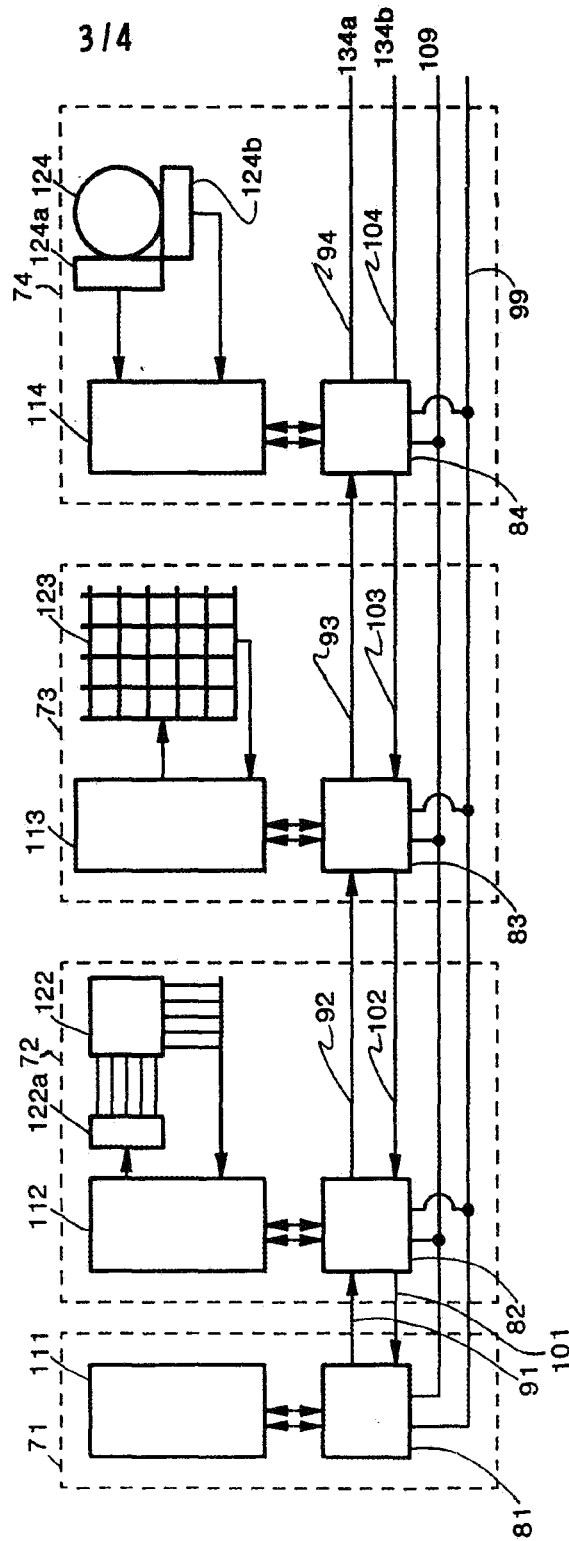
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3. A network according to claims 1 or 2,
c h a r a c t e r i z e d in that the central device (41) and
each network device (42,43,44,45) comprise means to supply power to
the subsequent device in the network.
- 5 4. A network according to any of the preceding claims,
c h a r a c t e r i z e d in that for supplying power from one
device of the network to a subsequent device, a pair (99,109) of
power lines is connectable with its one end to an output of the
device and with its other end to an input of the subsequent device,
10 one power line (99) providing a reference potential and the other
power line (109) providing a supply voltage.
- 15 5. A network according to any of the preceding claims,
c h a r a c t e r i z e d in that each network device comprises an
information processor (83a) for processing data signals, the infor-
mation processor having an input coupled to the send input of the
network device and an output coupled to the send output of the net-
work device.

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**FIG 1 (PRIOR ART)**

**FIG 2 (PRIOR ART)****FIG 3 (PRIOR ART)**



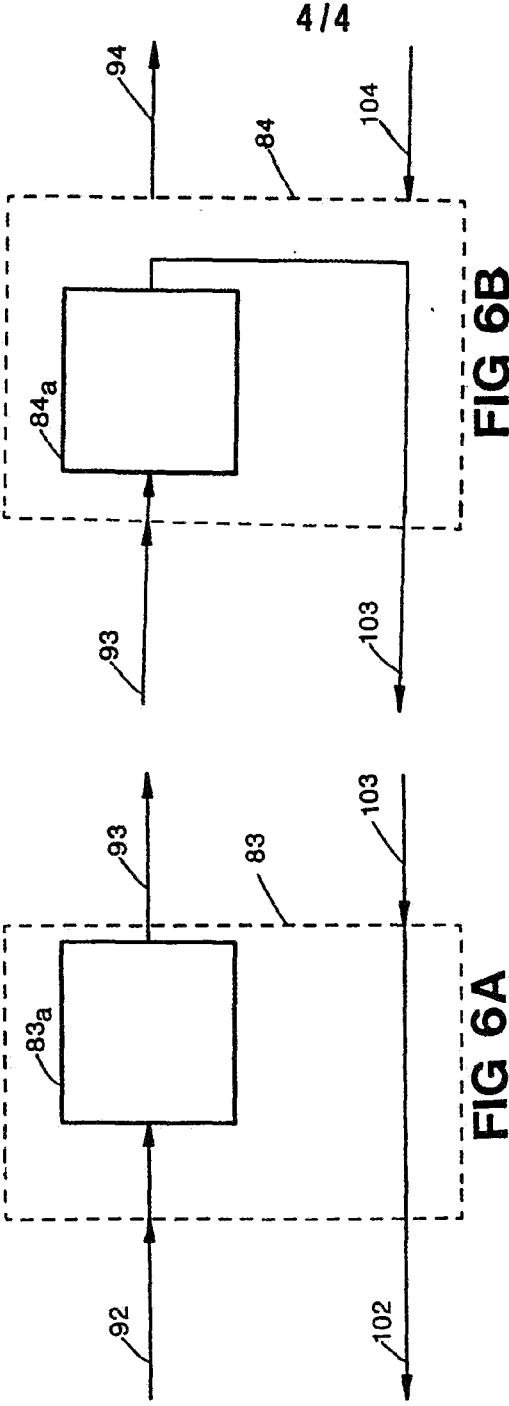
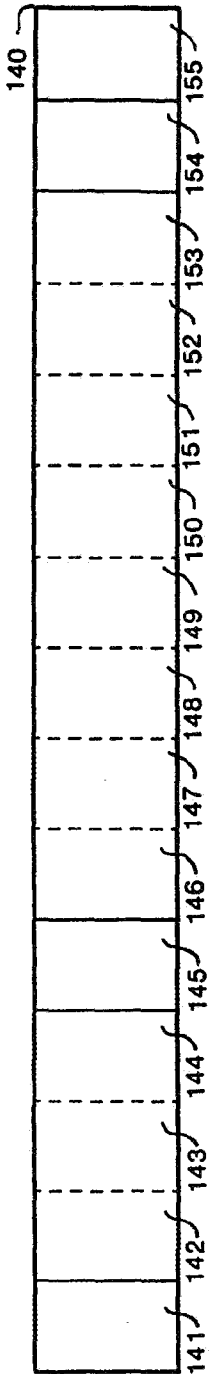


FIG 7

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<div>(30) Priority: 01.05.2003 US 467804 P 28.05.2003 US 474084 P 28.05.2003 US 474085 P 18.09.2003 US 504060 P 02.12.2003 US 727131</div>	

(54) **Using an auxiliary channel for video monitor training**

(57) In a system having a bi-directional auxiliary channel arranged to transfer information between a video source and a video display and vice versa and a uni-directional main link arranged to carry a number multimedia data packets from the video source to the video display, a method of establishing a stable main link. The method is carried out by performing a link training session carried out over the auxiliary channel to establish the stable main link, prior to starting transmission of multimedia data packet streams from a video transmitter to a video receiver over the main channel.

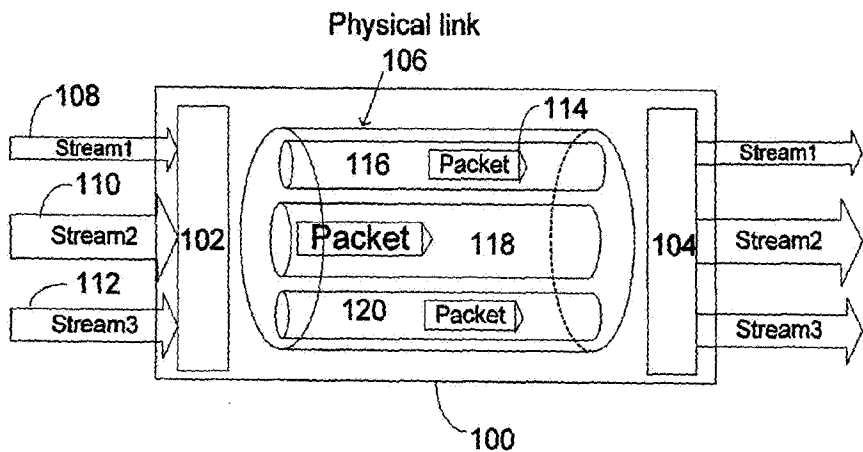


Fig. 1

DescriptionFIELD OF THE INVENTION

- 5 **[0001]** The invention relates to display devices. More specifically, the invention relates to digital display interface suitable for coupling video sources to video display devices.

BACKGROUND OF THE INVENTION

- 10 **[0002]** Currently, video display technology is divided into analog type display devices (such as cathode ray tubes) and digital type display devices (such as liquid crystal display, or LCD, plasma screens, etc.), each of which must be driven by specific input signals in order to successfully display an image. For example, a typical analog system includes an analog source (such as a personal computer, DVD player, etc.) coupled directly to a display device (sometimes referred to as a video sink) by way of a communication link. The communication link typically takes the form of a cable (such as an analog VGA cable in the case of a PC, otherwise referred to as VGA DB15 cable) well known to those of skill in the art. For example, the VGA DB15 cable includes 15 pins, each of which is arranged to carry a specific signal.

- 15 **[0003]** One of the advantages of the VGA DB15 cable is the ubiquitous nature of the cable, due to the large and ever-expanding installed base. As long as the analog systems described above predominate, there is little incentive to migrate away from any other cable form than the VGA DB15.

- 20 **[0004]** However, in recent years, the exploding growth of digital systems has made the use of digital capable cables such as Digital Visual Interface (DVI) cable more desirable. It is well known that DVI is a digital interface standard created by the Digital Display Working Group (DDWG). Data are transmitted using the transition minimized differential signaling (TMDS) protocol, providing a digital signal from the PC's graphics subsystem to the display. DVI handles bandwidths in excess of 160 MHz and thus supports UXGA and HDTV with a single set of links.

- 25 **[0005]** Today's display interconnect landscape includes the VGA (analog) and DVI (digital) for desktop display interconnect applications as well as LVDS (digital) for internal connectivity applications within laptops and other all-in-one devices. Graphics IC vendors, display controller IC vendors, monitor manufacturers and PC OEMs as well as desktop PC consumers, to one degree or another, must factor interface choice into their design, product definition, manufacturing, marketing and purchase decisions. For example, if a consumer purchases a PC with an analog VGA interface then the consumer must either purchase an analog monitor or a digital monitor in which the analog video signal provided by the VGA interface has been digitized by way of an inline analog to digital converter (ADC) or an ADC built into the particular monitor.

- 30 **[0006]** Unfortunately, however, the ability to recognize and train a particular video monitor is sorely lacking.

35 **SUMMARY OF THE INVENTION**

- 40 **[0007]** In a system having a bi-directional auxiliary channel arranged to transfer information between a video source and a video display and vice versa and a unidirectional main link arranged to carry a number multimedia data packets from the video source to the video display, a method of establishing a stable main link. The method is carried out by performing a link training session carried out over the auxiliary channel to establish the stable main link, prior to starting transmission of multimedia data packet streams from a video transmitter to a video receiver over the main channel.

- 45 **[0008]** In another embodiment, a video monitor training system is disclosed that includes a bi-directional auxiliary channel arranged to transfer information between the video source and the video display device and vice versa, a unidirectional main link arranged to carry a number multimedia data packets from the multimedia source device to the multimedia sink device, a main link receiver unit at the video display and a main link transmitter unit at the video source each coupled to the main link, an auxiliary channel slave unit coupled to the auxiliary channel wherein both the main link receiver unit and the auxiliary channel slave unit are each in an electrically idle state in a monitor standby mode and wherein when a hot plug event has been detected, then the system moves to a display state at which time the auxiliary channel slave unit is turned on and the main link transmitter unit responds to a receiver link capability read command, and a training pattern unit arranged to generate a training pattern used by the transmitter in a training phase to adjust an equalizer which is updated based upon a result for each training phase.

- 50 **[0009]** In yet another embodiment, computer program product for establishing a stable main link in a system having a bi-directional auxiliary channel arranged to transfer information between a video source and a video display and vice versa and a unidirectional main link arranged to carry a number multimedia data packets from the video source to the video display is disclosed. The computer program product includes computer code for using a link training session carried out over the auxiliary channel to establish the stable main link prior to starting transmission of multimedia data packet streams from a video source to the video display over the main channel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

- 5 Fig. 1 shows a generalized representation of a cross platform display interface 100 in accordance with an embodiment of the invention.
- Figs. 2A - 2C illustrates a video interface system that is used to connect a video source and a video display unit in accordance with a number of embodiments of the invention.
- Fig. 3 shows exemplary main link rates in accordance with an embodiment of the invention.
- 10 Fig. 4A shows a main link data packet in accordance with an embodiment of the invention.
- Fig. 4B shows a main link packet header in accordance with an embodiment of the invention.
- Fig. 5A shows a system arranged to provide sub-packet enclosure and multiple-packet multiplexing in accordance with an embodiment of the invention.
- Fig. 5B shows another implementation of the system shown in Fig. 5A.
- 15 Fig. 6 shows a high-level diagram of the multiplexed main link stream as an example of the stream shown in Fig. 5.
- Fig. 7 show another example of a data stream in accordance with the invention.
- Fig. 8 shows yet another example of a multiplexed data stream in accordance with an embodiment of the invention.
- Fig. 9A shows a representative sub-packet in accordance with an embodiment of the invention.
- Fig. 9B shows a representative main link data packet in accordance with an embodiment of the invention.
- 20 Fig. 10 shows an example of a selectively refreshed graphics image.
- Fig. 11 shows an exemplary link training pattern in accordance with an embodiment of the invention.
- Fig. 12 illustrates a logical layering of the system in accordance with an embodiment of the invention.
- Fig. 13 shows an exemplary special character mapping using 8B/10B in accordance with an embodiment of the invention.
- 25 Fig. 14 shows an exemplary Manchester II encoding scheme in accordance with an embodiment of the invention.
- Fig. 15 shows a representative auxiliary channel electrical sub layer in accordance with an embodiment of the invention.
- Fig. 16 shows a representative main link electrical sub layer in accordance with an embodiment of the invention.
- Fig. 17 shows a representative connector in accordance with an embodiment of the invention.
- 30 Fig. 18 shows a source state diagram in accordance with an embodiment of the invention.
- Fig. 19 shows a display state diagram in accordance with an embodiment of the invention.
- Figs. 20 - 24 illustrate various computer based implementations of the invention.
- Fig. 25 shows a flowchart detailing a process for determining an operational mode of the interface in accordance with an embodiment of the invention.
- 35 Fig. 26 shows a flowchart detailing a process for providing a real time video image quality check in accordance with some aspects of the invention.
- Fig. 27 shows a flowchart for a link set up process in accordance with an embodiment of the invention.
- Fig. 28 shows a flowchart detailing a process for performing a training session in accordance with an embodiment of the invention.
- 40 Fig. 29 illustrates a computer system employed to implement the invention.

DETAILED DESCRIPTION OF SELECTED EMBODIMENTS

- 45 [0011] Reference will now be made in detail to a particular embodiment of the invention an example of which is illustrated in the accompanying drawings. While the invention will be described in conjunction with the particular embodiment, it will be understood that it is not intended to limit the invention to the described embodiment. To the contrary, it is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.
- [0012] The inventive interface is a point-to-point, packet-based, plug & play, serial digital display interface that is both open and scalable that is suitable for use with, but not limited to, desktop monitors as well as providing LCD connectivity within notebook/all-in-one PC's, and consumer electronics display devices including HDTV displays and the like. Unlike conventional display interfaces that transmit a single video raster plus timing signals such as Vsync, Hsync, DE, etc., the inventive interface provides a system of multi-stream packet transfer capable of transferring one or more packet streams simultaneously in the form of "virtual pipes" established within a physical link.
- 50 [0013] For example, Fig. 1 shows a generalized representation of a cross platform packet based digital video display interface 100 in accordance with an embodiment of the invention. The interface 100 connects a transmitter 102 to a receiver 104 by way of a physical link 106 (also referred to as a pipe). In the described embodiment, a number of data streams 108 - 112 are received at the transmitter 102 that, if necessary, packetizes each into a corresponding number
- 55

of data packets 114. These data packets are then formed into corresponding data streams each of which are passed by way of an associated virtual pipe 116 - 120 to the receiver 104. It should be noted that the link rate (i.e., the data packet transfer rate) for each virtual link can be optimized for the particular data stream resulting in the physical link 106 carrying data streams each having an associated link rate (each of which could be different from each other depending upon the particular data stream). The data streams 110 - 114 can take any number of forms such as video, graphic, audio, etc.

[0014] Typically, when the source is a video source, the data streams 110 - 114 include various video signals that can have any number and type of well-known formats, such as composite video, serial digital, parallel digital, RGB, or consumer digital video. The video signal can be an analog video signal provided the source 102 includes some form of an analog video source such as for example, an analog television, still camera, analog VCR, DVD player, camcorder, laser disk player, TV tuner, set top box (with satellite DSS or cable signal) and the like. The source 102 can also include a digital image source such as for example a digital television (DTV), digital still camera, and the like. The digital video signal can be any number and type of well known digital formats such as, SMPTE 274M-1995 (1920 x 1080 resolution, progressive or interlaced scan), SMPTE 296M-1997 (1280 x 720 resolution, progressive scan), as well as standard 480 progressive scan video.

[0015] In the case where the source 102 provides an analog image signal, an analog-to-digital converter (A/D) converts an analog voltage or current signal into a discrete series of digitally encoded numbers (signal) forming in the process an appropriate digital image data word suitable for digital processing. Any of a wide variety of A/D converters can be used. By way of example, other A/D converters include, for example those manufactured by: Philips, Texas Instrument, Analog Devices, Brooktree, and others.

[0016] For example, if the data stream 110 is an analog type signal, the an analog to digital converter (not shown) included in or coupled to the transmitter 102 will digitize the analog data which is then packetize by a packetizer that converts the digitized data stream 110 into a number of data packets 114 each of which will be transmitted to the receiver 104 by way of the virtual link 116. The receiver 104 will then reconstitute the data stream 110 by appropriately recombining the data packets 114 into their original format. It should be noted that the link rate is independent of the native stream rates. The only requirement is that the link bandwidth of the physical link 106 be higher than the aggregate bandwidth of data stream(s) to be transmitted. In the described embodiment, the incoming data (such as pixel data in the case of video data) is packed over the respective virtual link based upon a data mapping definition. In this way, the physical link 106 (or any of the constituent virtual links) does not, as does conventional interconnects such as DVI, carry one pixel data per link character clock.

[0017] In this way, the interface 100 provides a scaleable medium for the transport of not only video and graphics data, but also audio and other application data as may be required. In addition, the invention supports hot-plug event detection and automatically sets the physical link (or pipe) to its optimum transmission rate. The invention provides for a low pin count, purely digital display interconnect for all displays suitable for multiple platforms. Such platforms include host to display, laptop/all-in-one as well as HDTV and other consumer electronics applications.

[0018] In addition to providing video and graphics data, display timing information can be embedded in the digital stream providing essentially perfect and instant display alignment, obviating the need for features like "Auto-Adjust" and the like. The packet based nature of the inventive interface provides scalability to support multiple, digital data streams such as multiple video/graphics streams and audio streams for multimedia applications. In addition, a universal serial bus (USB) transport for peripheral attachment and display control can be provided without the need for additional cabling.

[0019] Other embodiments of the inventive display interface will be discussed below.

[0020] Fig. 2 illustrates a system 200 based upon the system 100 shown in Fig.1 that is used to connect a video source 202 and a video display unit 204. In the illustrated embodiment, the video source 202 can include either or both a digital image (or digital video source) 206 and an analog image (or analog video source) 208. In the case of the digital image source 206, a digital data stream 210 is provided to the transmitter 102 whereas in the case of the analog video source 208, an A/D converter unit 212 coupled thereto, converts an analog data stream 213 to a corresponding digital data stream 214. The digital data stream 214 is then processed in much the same manner as the digital data stream 210 by the transmitter 102. The display unit 204 can be an analog type display or a digital type display or in some cases can process either analog or digital signals provided thereto. In any case, the display unit 204 includes a display interface 216 that interfaces the receiver 104 with a display 218 and a D/A converter unit 220 in the case of an analog type display. In the described embodiment, the video source 202 can take any number of forms (such as a personal desktop computer, digital or analog TV, set top box, etc.) whereas the video display unit 104 can take the form of a video display (such as an LCD type display, CRT type display, etc.).

[0021] Regardless of the type of video source or video sink, however, the various data streams are digitized (if necessary) and packetized prior to transmission over the physical link 106 which includes a uni-directional main link 222 for isochronous data streams and a bi-directional auxiliary channel 224 for link setup and other data traffic (such as various link management information, Universal serial bus (USB) data, etc.) between the video source 202 and the

video display 204.

[0022] The main link 222 is thereby capable of simultaneously transmitting multiple isochronous data streams (such as multiple video/graphics streams and multi-channel audio streams). In the described embodiment, the main link 222 includes a number of different virtual channels, each capable of transferring isochronous data streams (such as un-

[0023] In the described embodiment, the speed, or transfer rate, of the main link 222 is adjustable to compensate for link conditions. For example, in one implementation, the speed of the main link 222 can be adjusted in a range approximated by a slowest speed of about 1.0 Gbps to about 2.5 Gbps per channel in approximately 0.4Gbps increments (see Fig. 3). At 2.5 Gbps per channel, the main link 222 can support SXGA 60Hz with a color depth of 18 bits per pixel over a single channel. It should be noted that a reduction in the number of channels reduces not only the cost of interconnect, but also reduces the power consumption which is an important consideration (and desirable) for power sensitive applications such as portable devices and the like. However, by increasing the number of channels to four, the main link 222 can support WQ SXGA (3200 x 2048 image resolution) with a color depth of 24-bits per pixel at 60Hz, or Q SXGA (2560 x 2048) with a color depth of 18-bits per pixel at 60Hz, without data compression. Even at the lowest rate of 1.0 Gbps per channel, only two channels are required to support an uncompressed HDTV (i.e., 1080i or 720p) data stream.

[0024] In the described embodiment, a main link data rate is chosen whose bandwidth exceeds the aggregate bandwidth of the constituent virtual links. Data sent to the interface arrives at the transmitter at its native rate. A time-base recovery (TBR) unit 226 within the receiver 104 regenerates the stream's original native rate using time stamps embedded in the main link data packets, if necessary. It should be noted, however, that for appropriately configured digital display devices 232 shown in Fig. 2B, time base recovery is unnecessary since display data is sent to the display driver electronics at the link character clock rate, thereby greatly reducing the number of channels required with a commensurate reduction in complexity and cost for the display. For example, Fig. 2C illustrates an exemplary LCD panel 232 configured in such a way that no time base recovery since display data is essentially pipelined to the various column drivers 234 that are used in combination with row drivers 236 to drive selected display elements 238 in the array 240.

[0025] Other embodiments describe a simple enumeration method for the link rate and the pixel/audio clock rate. It has been researched and understood that all the standard pixel/audio clock frequencies that exist today are a subset of the following master frequency:

$$23.76\text{GHz} = 2^{10} \times 3^3 \times 5^7 \times 11^1 \text{ Hz}$$

This means that a pixel (or audio) clock rate can be expressed with four parameters, A, B, C, and D as:

$$\text{Pixel clock rate} = 2^A \times 3^B \times 5^C \times 11^D$$

$$A = 4 \text{ bits}, B = 2 \text{ bits}, C = 3 \text{ bits}, \text{ and } D = 1 \text{ bit.}$$

[0026] Even for a link whose link rate (which is the serial link bit rate / 10 for a link that uses 10-bit character such as 8B/10B characters) may be different from the pixel clock rate, there is a benefit in defining the link rate with these four parameters, A', B', C', and D'. The benefit is the simplicity in regenerating pixel/audio clocks from a link clock. For example, let's say the link rate is set as A' = 6, B' = 3, C' = 7, and D' = 0 and the corresponding link rate is 135MHz. However, suppose the pixel clock rate is set as A = 8, B = 3, C = 6, and D = 0 (= 108MHz), then the pixel clock can be generated from link clock as pixel clock rate is equal to the link rate * 22 / 51.

[0027] Referring back to those systems requiring time base recovery, the time-base recovery unit 226 may be implemented as a digital clock synthesizer. For an uncompressed video stream, the time stamp is stored in the packet header which as described in more detail below, is a 20-bit value. For a given stream, four of 20 bits are stored in each header successively (TS3-0, TS7-4, TS11-8, TS15-12, TS19-16). Native stream frequency (Freq_native) is obtained from link character clock frequency (Freq_link_char) as:

$$\text{Eq(1)} \quad \text{Freq_native} = \text{Freq_link_char} * (\text{TS19-0})/2^{20}$$

[0028] The transmitter 102 generates this time stamp by counting the number of native stream clocks in 220 cycles of the link character clock frequency period. The counter updates the value every 220 cycles of the link character clock. Since these two clocks are asynchronous with each other, the time stamp value will change by 1 over time. Between updates, the transmitter 102 will repeatedly send the same time stamp in the header of the given packet stream. A sudden change of the time stamp value (by more than 1 count) may be interpreted by the receiver as an indication of an unstable condition of the stream source.

[0029] It should be noted that, no time stamp is communicated for an audio stream. In this case, the source device informs the display device of the audio sample rate and number of bits per sample. By determining the audio rate based upon Eq(2) and the link character rate, the display device regenerates the original audio stream rate.

$$\text{Eq(2)} \quad \text{Audio rate} = (\text{audio sample rate}) \times (\# \text{ bits per sample}) \times (\# \text{ channels})$$

[0030] A main link data packet 400 shown in Fig. 4A includes a main link packet header 402 as shown in Fig. 4B that is formed of 16 bits where bits 3-0 are the Stream ID (SID) (indicating that maximum stream count is 16), bit 4 is the Time Stamp (TS) LSB. When bit 4 is equal to 1, this packet header has the least significant 4 bits of Time Stamp value (used only for uncompressed video stream). Bit 5 is a Video frame sequence bit which acts as the least significant bit of the frame counter which toggles from "0" to "1" or from "1" to "0" at the video frame boundary (used only for uncompressed video stream). Bits 7 and 6 are reserved whereas bits 8 through 10 are a 4-bit CRC (CRC) that checks errors for the previous eight bits. Bits 15-12 are Time Stamp/Stream ID Inversion. (TSP/SIDn) which for uncompressed video are used as four bits of 20-bit Time Stamp value.

[0031] One of the advantages of the inventive interface is the ability to multiplex different data streams each of which can be different formats as well as have certain main link data packets include a number of sub packets. For example, Fig. 5 shows a system 500 arranged to provide sub-packet enclosure and multiple-packet multiplexing in accordance with an embodiment of the invention. It should be noted that the system 500 is a particular embodiment of the system 200 shown in Fig. 2 and should therefore not be construed as limiting either the scope or intent of the invention. The system 500 includes a stream source multiplexer 502 included in the transmitter 102 used to combine a stream 1 supplemental data stream 504 with the data stream 210 to form a multiplexed data stream 506. The multiplexed data stream 506 is then forwarded to a link layer multiplexer 508 that combines any of a number of data streams to form a multiplexed main link stream 510 formed of a number of data packets 512 some of which may include any of a number of sub packets 514 enclosed therein. A link layer de-multiplexer 516 splits the multiplexed data stream 510 into its constituent data streams based on the stream IDs (SIDs) and associated sub packet headers while a stream sink de-multiplexer 518 further splits off the stream 1 supplemental data stream contained in the sub-packets.

[0032] Fig. 6 shows a high-level diagram of the multiplexed main link stream 600 as an example of the stream 510 shown in Fig. 5 when three streams are multiplexed over the main link 222. The three streams in this example are: UXGA graphics (Stream ID = 1), 1280x720p video (Stream ID = 2), and audio (Stream ID = 3). The small packet header size of main link packet 400 minimizes the packet overhead, which results in the very high link efficiency. The reason the packet header can be so small is that the packet attributes are communicated via the auxiliary channel 224 prior to the transmission of the packets over main link 222.

[0033] Generally speaking, the sub-packet enclosure is an effective scheme when the main packet stream is an uncompressed video since an uncompressed video data stream has data idle periods corresponding to the video-blanking period. Therefore, main link traffic formed of an uncompressed video stream will include series of Null special character packets during this period. By capitalizing on the ability to multiplex various data streams, certain implementations of the present invention use various methods to compensate for differences between the main link rate and the pixel data rate when the source stream is a video data stream. For example, as illustrated in Fig. 7, the pixel data rate is .5 Gb/sec, such that a bit of pixel data is transmitted every 2 ns. In this example, the link rate has been set to 1.25 Gb/sec, such that a bit of pixel data is transmitted each .8 ns. Here, transmitter 102 intersperses special characters between pixel data as illustrated in Fig. 8. Two special characters are disposed between a first bit of pixel data P1 and a second bit of pixel data P2. The special characters allow receiver 104 to distinguish each bit of pixel data. Interspersing the special characters between bits of pixel data also creates a steady stream of data that allows the link to maintain synchronization. In this example, the special characters are Null characters. No line buffer is needed for such methods, only a small FIFO, because the link rate is sufficiently fast. However, relatively more logic is required on the receiving side to reconstruct the video signal. The receiver needs to recognize when the special characters begin and end.

[0034] An alternative to the interspersing method is to alternate consecutive bits of pixel data with special characters, such as null values. For example, P1 through P4 could be fed into a line buffer included in the transmitter 104, then one or more null values could be fed into the buffer until more pixel data are available. Such implementations require a relatively larger buffer space than the interspersing methods described above. In many such implementations, the time required to fill the line buffer will exceed the time required to transmit the data after the line buffer is full, due to

the relatively high link speeds.

[0035] As discussed with reference to Fig. 5A, one of the advantages of the inventive interface is the ability to not only multiplex various data streams, but also the enclosing of any of a number of sub packets within a particular main link data packet. Fig. 9A shows a representative sub-packet 900 in accordance with an embodiment of the invention. The sub-packet 900 includes a sub-packet header 902 that in the described embodiment is 2 bytes and is accompanied by SPS (Sub-Packet Start) special character. If the main link data packet in which the sub-packet 900 is enclosed contains a packet payload in addition to the sub-packet 900, the end of the sub-packet 900 must be marked by SPE (Sub-Packet End) special character. Otherwise, the end of the main packet (as indicated by ensuing COM character in the example shown in Fig. 9B) marks the end of both the sub-packet 902 and the main packet into which it is enclosed. However, a sub-packet does not need to end with SPE when its enclosing main packet has no payload. Fig 9B shows an exemplary sub-packet format within a main link packet in accordance with an embodiment of the invention. It should be noted that the definition of the header field and sub-packet payload is dependent on the specific application profile that uses the sub-packet 902.

[0036] A particularly useful example of sub-packet enclosure usage is selective refresh of an uncompressed graphics image 1000 illustrated in Fig. 10. The attributes of the entire frame 1002 (Horizontal/Vertical Total, Image Width/Height, etc.) will be communicated via the auxiliary channel 224 since those attributes stay constant as long as the stream remains valid. In selective refresh operation, only a portion 1004 of the image 1000 is updated per video frame. The four X-Y coordinates of the updated rectangle(s) (i.e., the portion 1004) must be transmitted every frame since the values of the rectangle coordinates changes from frame to frame. Another example is the transmission of color look-up table (CLUT) data for required for 256-color graphic data where the 8-bit pixel data is an entry to the 256-entry CLUT and the content of the CLUT must be dynamically updated.

[0037] The single bi-directional auxiliary channel 224 provides a conduit to for various support functions useful for link set up and supporting main link operations as well as to carry auxiliary application data such as USB traffic. For example, with the auxiliary channel 224, a display device can inform the source device of events such as sync loss, dropped packets and the results of training sessions (described below). For example, if a particular training session fails, the transmitter 102 adjusts the main link rate based upon pre-selected or determined results of the failed training session. In this way, the closed loop created by combining an adjustable, high speed main link with a relatively slow and very reliable auxiliary channel allows for robust operation over a variety of link conditions. It should be noted that in some cases (an example of which is shown in Fig. 5B), a logical bi-directional auxiliary channel 520 can be established using a portion 522 of the bandwidth of the main link 222 to transfer data from the source device 202 to the sink device 204 and a uni-directional back channel 524 from the sink device 204 to the source device 202. In some applications, use of this logical bi-directional auxiliary channel may be more desirable than using a half-duplex bi-directional channel described in Fig. 5A.

[0038] Prior to starting the transmission of actual packet data streams the transmitter 102 establishes a stable link through a link training session that is analogous in concept to the link setup of the modem. During link training, the main link transmitter 102 sends a pre-defined training pattern so that the receiver 104 can determine whether it can achieve a solid bit/character lock. In the described embodiment, training related handshaking between the transmitter 102 and the receiver 104 is carried on the auxiliary channel. An example of a link training pattern is shown in Fig. 11 in accordance with an embodiment of the invention. As illustrated, during the training session, a phase 1 represents the shortest run length while phase 2 is the longest that are used by the receiver to optimize an equalizer. In phase 3, both bit lock and character lock are achieved as long as the link quality is reasonable. Typically, the training period is about 10 ms, in which time, approximately 107 bits of data are sent. If the receiver 104 does not achieve solid lock, it informs the transmitter 102 via the auxiliary channel 224 and the transmitter 102 reduces the link rate and repeats the training session.

[0039] In addition to providing a training session conduit, the auxiliary channel 224 can be also used to carry main link packet stream descriptions thereby greatly reducing the overhead of packet transmissions on the main link 222. Furthermore, the auxiliary channel 224 can be configured to carry Extended Display Identification Data (EDID) information replacing the Display Data Channel (DDC) found on all monitors (EDID is a VESA standard data format that contains basic information about a monitor and its capabilities, including vendor information, maximum image size, color characteristics, factory pre-set timings, frequency range limits, and character strings for the monitor name and serial number. The information is stored in the display and is used to communicate with the system through the DDC which sits between the monitor and the PC graphics adapter. The system uses this information for configuration purposes, so the monitor and system can work together). In what is referred to as an extended protocol mode, the auxiliary channel can carry both asynchronous and isochronous packets as required to support additional data types such as keyboard, mouse and microphone.

[0040] Fig. 12 illustrates a logical layering 1200 of the system 200 in accordance with an embodiment of the invention. It should be noted that while the exact implementation may vary depending upon application, generally, a source (such as the video source 202) is formed of a source physical layer 1202 that includes transmitter hardware, a source link

layer 1204 that includes multiplexing hardware and state machine (or firmware), and a data stream source 1206 such as Audio/Visual/Graphics hardware and associated software. Similarly, a display device includes a physical layer 1208 (including various receiver hardware), a sink link layer 1210 that includes de-multiplexing hardware and state machine (or firmware) and a stream sink 1212 that includes display/timing controller hardware and optional firmware. A source application profile layer 1214 defines the format with which the source communicates with the link layer 1204 and similarly, a sink application profile layer 1216 defines the format with which the sink 1212 communicates with the sink link layer 1210.

[0041] The various layers will now be discussed in more detail.

SOURCE DEVICE PHYSICAL LAYER

[0042] In the described embodiment, the source device physical layer 1202 includes an electrical sub layer 1202-1 and a logical sub layer 1202-2. The electrical sub layer 1202-1 includes all circuitry for interface initialization/operation such as hot plug/unplug detection circuit, drivers/receivers/termination resistors, parallel-to-serial/serial-to-parallel conversions, and spread-spectrum-capable PLL's. The logical sub layer 1202-2 includes circuitry for, packetizing/de-packetizing, data scrambling/de-scrambling, pattern generation for link training, time-base recovery circuits, and data encoding/decoding such as 8B/10B (as specified in ANSI X3.230-1994, clause 11) that provides 256 link data characters and twelve control characters (an example of which is shown as Fig. 13) for the main link 222 and Manchester II for the auxiliary channel 224 (see Fig. 14).

[0043] It should be noted that the 8B/10B encoding algorithm is described, for example, in U.S. Patent Number 4,486,739, which is hereby incorporated by reference. As known by those of skill in the art, the 8B/10B code is a block code that encodes 8-bit data blocks into 10-bit code words for serial transmission. In addition, the 8B/10B transmission code converts a byte wide data stream of random 1s and 0s into a DC balanced stream of 1s and 0s with a maximum run length of 5. Such codes provide sufficient signal transitions to enable reliable clock recovery by a receiver, such as transceiver 110. Moreover, a DC balanced data stream proves to be advantageous for fiber optic and electromagnetic wire connections. The average number of 1s and 0s in the serial stream is maintained at equal or nearly equal levels. The 8B/10B transmission code constrains the disparity between the number of 1s and 0s to be -2, 0, or 2 across 6 and 4 bit block boundaries. The coding scheme also implements additional codes for signaling, called command codes.

[0044] It should be noted that in order to avoid the repetitive bit patterns exhibited by uncompressed display data (and hence, to reduce EMI), data transmitted over main link 222 is first scrambled before 8B/10B encoding. All data except training packets and special characters will be scrambled. The scrambling function is implemented with Linear Feedback Shift Registers (LFSRs). When data encryption is enabled, the initial value of an LFSR seed is dependent on an encryption key set. If it is data scrambling without encryption, the initial value will be fixed.

[0045] Since data stream attributes are transmitted over the auxiliary channel 224, the main link packet headers serve as stream identification numbers thereby greatly reducing overhead and maximizing link bandwidth. It should also be noted that neither the main link 222 nor the auxiliary link 224 has separate clock signal lines. In this way, the receivers on main link 222 and auxiliary link 224 sample the data and extract the clock from the incoming data stream. Fast phase locking for any phase lock loop (PLLs) circuit in the receiver electrical sub layer is important for since the auxiliary channel 224 is half-duplex bi-directional and the direction of the traffic changes frequently. Accordingly, the PLL on the auxiliary channel receiver phase locks in as few as 16 data periods thanks to the frequent and uniform signal transitions of Manchester II (MII) code.

[0046] At link set up time, the data rate of main link 222 is negotiated using the handshake over auxiliary channel 224. During this process, known sets of training packets are sent over the main link 222 at the highest link speed. Success or failure is communicated back to the transmitter 102 via the auxiliary channel 224. If the training fails, main link speed is reduced and training is repeated until successful. In this way, the source physical layer 1102 is made more resistant to cable problems and therefore more suitable for external host to monitor applications. However, unlike conventional display interfaces, the main channel link data rate is decoupled from the pixel clock rate. A link data rate is set so that link bandwidth exceeds the aggregate bandwidth of the transmitted streams.

SOURCE DEVICE LINK LAYER

[0047] The source link layer 1204 handles the link initialization and management. For example, upon receiving a hot plug detect event generated upon monitor power-up or connection of the monitor cable from the source physical layer 1202, the source device link layer 1204 evaluates the capabilities of the receiver via interchange over the auxiliary channel 224 to determine a maximum main link data rate as determined by a training session, the number of time-base recovery units on the receiver, available buffer size on both ends, availability of USB extensions and then notifies the stream source 1206 of an associated hot plug event. In addition, upon request from the stream source 1206, the

source link layer 1204 reads the display capability (EDID or equivalent). During a normal operation, the source link layer 1204 sends the stream attributes to the receiver 104 via the auxiliary channel 224, notifies the stream source 1204 whether the main link 222 has enough resource for handling the requested data streams, notifies the stream source 1204 of link failure events such as sync loss and buffer overflow, and sends MCCS commands submitted by the stream source 1204 to the receiver via the auxiliary channel 224. All communications between the source link layer 1204 and the stream source/sink use the formats defined in the application profile layer 1214.

APPLICATION PROFILE LAYER (SOURCE AND SINK)

[0048] In general, the Application Profile Layer defines formats with which a stream source (or sink) will interface with the associated link layer. The formats defined by the application profile layer are divided into the following categories, Application independent formats (Link Message for Link Status inquiry) and Application dependent formats (main link data mapping, time-base recovery equation for the receiver, and sink capability/stream attribute messages sub-packet formats, if applicable). The Application Profile Layer supports the following color formats 24-bit RGB, 16-bit RG2565, 18-bit RGB, 30-bit RGB, 256-color RGB (CLUT based), 16-bit, CbCr422, 20-bit YCbCr422, and 24-bit YCbCr444.

[0049] For example, the display device application profile layer (APL) 1214 is essentially an application-programming interface (API) describing the format for Stream Source/Sink communication over the main link 222 that includes a presentation format for data sent to or received from the interface 100. Since some aspects of the APL 1214 (such as the power management command format) are baseline monitor functions, they are common to all uses of the interface 100.

Whereas other non-baseline monitor functions, such as data mapping format and stream attribute format, are unique to an application or a type of isochronous stream that is to be transmitted. Regardless of the application, the stream source 1204 queries the source link layer 1214 to ascertain whether the main link 222 is capable of handling the pending data stream(s) prior to the start any packet stream transmission on the main link 222.

[0050] When it is determined that the main link 222 is capable of supporting the pending packet stream(s), the stream source 1206 sends stream attributes to the source link layer 1214 that is then transmitted to the receiver over the auxiliary channel 224. These attributes are the information used by the receiver to identify the packets of a particular stream, to recover the original data from the stream and to format it back to the stream's native data rate. The attributes of the data stream are application dependent.

[0051] In those cases where the desired bandwidth is not available on the main link 222, the stream source 1214 may take corrective action by, for example, reducing the image refresh rate or color depth.

DISPLAY DEVICE PHYSICAL LAYER

[0052] The display device physical layer 1216 isolates the display device link layer 1210 and the display device APL 1216 from the signaling technology used for link data transmission/reception. The main link 222 and the auxiliary channel 224 have their own physical layers, each consisting of a logical sub layer and an electrical sub layer that includes the connector specification. For example, the half-duplex, bi-directional auxiliary channel 224 has both a transmitter and a receiver at each end of the link as shown in Fig 15. An auxiliary link transmitter 1502 is provided with link characters by a logical sub layer 1208-1 that are then serialized and transmitted to a corresponding auxiliary link receiver 1504. The receiver 1504, in turn, receives serialized link character from the auxiliary link 224 and de-serializes the data at a link character clock rate. It should be noted that the major functions of the source logical sub layers include signal encoding, packetizing, data scrambling (for EMI reduction), and training pattern generation for the transmitter port. While for the receiver port, the major functions of the receiver logical sub layer includes signal decoding, de-packetizing, data de-scrambling, and time-base recovery.

AUXILIARY CHANNEL

[0053] The major functions of auxiliary channel logical sub layer include data encoding and decoding, framing/de-framing of data and there are two options in auxiliary channel protocol: standalone protocol (limited to link setup/management functions in a point-to-point topology) is a lightweight protocol that can be managed by the Link Layer state-machine or firmware and extended protocol that supports other data types such as USB traffic and topologies such as daisy-chained sink devices. It should be noted that the data encoding and decoding scheme is identical regardless of the protocol whereas framing of data differs between the two.

[0054] Still referring to Fig. 15, the auxiliary channel electrical sub layer contains the transmitter 1502 and the receiver 1504. The transmitter 1502 is provided with link characters by the logical sub layer, which it serializes and transmits out. The receiver 1504 receives serialized link character from the link layer and subsequently de-serializes it at link

character clock rate. The positive and negative signals of auxiliary channel 224 are terminated to ground via 50-ohm termination resistors at each end of the link as shown. In the described implementation, the drive current is programmable depending on the link condition and ranges from approximately 8mA to approximately 24mA resulting in a range of $V_{\text{differential_pp}}$ of approximately 400mV to approximately 1.2V. In electrical idle modes, neither the positive nor the negative signal is driven. When starting transmission from the electrical idle state, the SYNC pattern must be transmitted and the link reestablished. In the described embodiment, the SYNC pattern consists of toggling a auxiliary channel differential pair signals at clock rate 28 times followed by four 1's in Manchester II code. The auxiliary channel master in the source device detects hot-plug and hot-unplug events by periodically driving or measuring the positive and negative signals of auxiliary channel 224.

MAIN LINK

[0055] In the described embodiment, the main link 222 supports discrete, variable link rates that are integer multiples of the local crystal frequency (see Fig 3 for a representative set of link rates consonant with a local crystal frequency of 24-MHz). As shown in Fig. 16, the main link 222 (being an unidirectional channel) has only a transmitter 1602 at the source device and only a receiver 1604 at the display device.

[0056] As shown, the cable 1604 takes the form includes a set of twisted pair wires, one for each of the Red (R), Green(G), and Blue(B) video signals provides in a typical RGB color based video system (such as PAL based TV systems). As known by those of skill in the art, twisted pair cable is a type of cable that consists of two independently insulated wires twisted around one another. One wire carries the signal while the other wire is grounded and absorbs signal interference. It should be noted that in some other systems, the signals could also be component based signals (Pb, Pr, Y) used for NTSC video TV systems. Within the cable, each twisted pair is individually shielded. Two pins for +12V power and ground are provided. The characteristics impedance of each differential pair is 100 ohms +/- 20%. The entire cable is also shielded. This outer shield and individual shields are shorted to the connector shells on both ends. The connector shells are shorted to ground in a source device. A connector 1700 as shown in Fig. 17 has 13 pins in one row having a pinout that is identical both for the connector on the source device end and that on the display device end. The source device supplies the power.

[0057] The main link 222 is terminated on both ends and since the main link 222 is AC coupled, the termination voltage can be anywhere between 0V (ground) to +3.6V. In the described implementation, the drive current is programmable depending on the link condition and ranges from approximately 8mA to approximately 24mA resulting in a range of $V_{\text{differential_pp}}$ of approximately 400mV to approximately 1.2V. The minimum voltage swing is selected for each connection using a training pattern. An electrical idle state is provided for power management modes. In electrical idle, neither the positive nor the negative signals are driven. When starting a transmission from electrical idle state, the transmitter must conduct a training session in order reestablish the link with the receiver.

STATE DIAGRAMS

[0058] The invention will now be described in terms of state diagrams shown in Figs. 18 and 19 described below. Accordingly, Fig. 18 shows the source state diagram described below. At an off state 1802, the system is off such that the source is disabled. If the source is enabled, then the system transitions to a standby state 1804 suitable for power saving and receiver detection. In order to detect whether or not the receiver is present (i.e., hot plug/play), the auxiliary channel is periodically pulsed (such as for 1 us every 10ms) and a measure of a voltage drop across the termination resistors during the driving is measured. If it is determined that a receiver is present based upon the measured voltage drop, then the system transitions to a detected receiver state 1806 indicating that a receiver has been detected, i.e., a hot plug event has been detected. If, however, there is no receiver detected, then the receiver detection is continued until such time, if ever, a receiver is detected or a timeout has elapsed. It should be noted that in some cases the source device may choose to go to "OFF" state from which no further display detection is attempted.

[0059] If at the state 1806 a display hot unplug event is detected, then the system transitions back to the standby state 1804. Otherwise the source drives the auxiliary channel with a positive and negative signal to wake up receiver and the receiver's subsequent response, if any, is checked. If there is no response received, then the receiver has not woken up and source remains in the state 1806. If, however, a signal is received from the display, then the display has woken up and the source is ready read the receiver link capabilities (such as max link rate, buffer size, and number of time-base recovery units) and the system transitions to a main link initialization state 1808 and is ready to commence a training start notification phase.

[0060] At this point, a training session is started by sending a training pattern over the main link at a set link rate and checks an associated training status. The receiver sets a pass/fail bit for each of three phases and the transmitter will proceed to the next phase upon detection of pass only such that when a pass is detected, the main link is ready at that link rate. At this point, the interface transitions to a normal operation state 1510, otherwise, the link rate is reduced

and the training session is repeated. During the normal operation state 1810, the source continues to periodically monitor a link status index, which if fails, a hot unplug event is detected and the system transitions to the standby state 1804 and waits for a hot plug detection event. If, however, a sync loss is detected, then the system transitions to state 1808 for a main link re-initiation event.

5 **[0061]** Fig 19 shows the display state diagram 1900 described below. At a state 1902, no voltage is detected, the display goes to an OFF state. At a standby mode state 1904, both main link receiver and auxiliary channel slave are in electrical idle, a voltage drop across the termination resistors of auxiliary channel slave port are monitored for a predetermined voltage. If the voltage is detected, then the auxiliary channel slave port is turned on indicating a hot plug event and the system moves to a display state 1906, otherwise, the display remains in the standby state 1904.
10 At the state 1906 (main link initialization phase), if a display is detected, then the auxiliary slave port is fully turned on, and the transmitter responds to a receiver link capability read command and the display state transitions to 1908, otherwise, if there is no activity on the auxiliary channel for more than a predetermined period of time then the auxiliary channel slave port is put into the to standby state 1904.

15 **[0062]** During a training start notification phase, the display responds to the training initiation by the transmitter by adjusting the equalizer using training patterns, updating the result for each phase. If the training fails, then wait for another training session and if the training passes, then go to normal operation state 1910. If there is no activity on the auxiliary channel or on the main link (for training) for more than a predetermined (10ms, for example), the auxiliary channel slave port is set to the standby state 1904.

[0063] Figs. 20 - 24 show particular implementations of the cross platform display interface.

20 **[0064]** Fig. 20 shows a PC motherboard 2000 having an on-board graphics engine 2002 that incorporates a transmitter 2004 in accordance with the invention. It should be noted that the transmitter 2004 is a particular example of the transmitter 102 shown in Fig. 1. In the described embodiment, the transmitter 2004 is coupled to an connector 2006 (along the lines of the connector 1700) mounted on the motherboard 2000 which in turn is connected to a display device 2008 by way of a twisted pair cable 2010 couples a display device 2010.

25 **[0065]** As known in the art, PCI Express (developed by Intel Corporation of Santa Clara, CA) is a high-bandwidth, low pin count, serial, interconnect technology that also maintains software compatibility with existing PCI infrastructure. In this configuration, the PCI Express port is augmented to become compliant with the requirements of the cross platform interface which can directly drive a display device either using a motherboard mounted connector as shown.

30 **[0066]** In situations where it is not practical to mount the connector on the motherboard, the signals can be routed through the SDVO slot of the PCI Express motherboard and brought to the back of the PC using a passive card connector as shown in Fig. 21. As is the case with the current generation of add-in graphics cards, a add-in graphics card can supplant the onboard graphics engine as shown in Fig. 23.

35 **[0067]** In the case of notebook applications, the transmitter on the motherboard graphics engine would drive through internal cabling, an integrated receiver/TCON which would drive the panel directly. For the most cost effective implementation, the receiver/TCON would be mounted on the panel thereby reducing the number of interconnect wires to 8 or 10 as shown in Fig. 24

40 **[0068]** All of the above examples assume integrated transmitters. However, is it quite feasible to implement as a standalone transmitter integrating into PCI and PCI Express environments through the AGP or SDVO slots, respectively. A standalone transmitter will enable output streams without any change in graphics hardware or software.

FLOWCHART EMBODIMENTS

45 **[0069]** The methodology of the invention will now be described in terms of a number of flowcharts each describing a particular process for enabling the invention. Specifically, FIGS 25 - 29 describe a number of interrelated processes that when used singly or in any combination described aspects of the invention.

50 **[0070]** Fig. 25 shows a flowchart detailing a process 2500 for determining an operational mode of the interface 100 in accordance with an embodiment of the invention. In this process, the operational mode will only be set to a digital mode if the video source and the display device are both digital. Otherwise, the operational mode will be set to analog mode. It should be noted that "analog mode" in this context can include both conventional VGA mode as well as enhanced analog mode having differential analog video with embedded alignment signal and bi-directional sideband. This enhanced analog mode will be described below.

[0071] In step 2502, a video source is interrogated to determine whether the video source supports analog or digital data. If the video source supports only analog data, the operational mode of coupling device 100 will be set to analog (step 2508), then the process will end (step 2512).

55 **[0072]** If the video source can output digital data, the process continues to step 2506. The display device is then interrogated to determine whether the display device is configured to receive digital data. If the display device supports only analog data, the operational mode of coupling device will be set to analog (step 2508), then the process will end (step 2512). Otherwise, the operational mode of the coupling device is set to digital (step 2510). For example, a proc-

essor may control switches within the coupling device to set the mode to digital. In general, the coupling device is configured to operate in a fully digital mode only when both the video source and the video sink are operating in a corresponding digital mode.

5 [0073] Fig. 26 shows a flowchart detailing a process 2600 for providing a real time video image quality check in accordance with some aspects of the invention. In this example, all determinations of process 2600 are made by a processor coupled to the display interface.

[0074] In step 2600, a video signal is received from a video source. Next, a signal quality test pattern is provided by the video source associated with the received video signal (step 2602). In step 2604, a determination of a bit error rate is made, based upon the quality test pattern. Then, a determination is made of whether the bit error rate is greater than a threshold value (step 2606). If the bit error rate is determined to not be greater than the threshold value, then a determination is made (step 2614) of whether or not there are more video frames. If it is determined that there are more video frames, then the process returns to step 2600. Otherwise, the process ends.

10 [0075] However, if the bit error rate is determined to be greater than the threshold value in step 2606, a determination is made (step 2608) as to whether the bit rate is greater than a minimum bit rate. If the bit rate is greater than a minimum bit rate, then the bit rate is lowered (step 2610) and the process returns to step 2606. If the bit rate is not greater than the minimum bit rate, then the mode is changed to analog mode (step 2612) and the process ends.

[0076] Fig. 27 shows a flowchart for a link set up process 2700 in accordance with an embodiment of the invention. The process 2700 begins at 2702 by the receiving of a hot plug detection event notification. At 2704 a main link inquiry is made by way of an associated auxiliary channel to determine a maximum data rate, a number of time base recovery units included in a receiver, and available buffer size. Next, at 2706, the maximum link data rate is verified by way of a training session and at 2708, a data stream source is notified of the hot plug event. At 2710, the capabilities of the display (using EDID, for example) are determined by way of the auxiliary channel and the display responds to the inquires at 2712 which, in turn, results a collaboration of the main link training session at 2714.

20 [0077] Next, at 2716, the stream source sends stream attributes to the receiver by way of the auxiliary channel and at 2718, the stream sources are further notified whether the main link is capable of supporting the requested number of data streams at 2720. At 2722, the various data packets are formed by adding associated packet headers and the multiplexing of a number of source streams is scheduled at 2724. At 2726 a determination is made whether or not the link status is OK. When the link status is not OK, then the source(s) are notified of a link failure event at 2728, otherwise, the link data streams are reconstructed into the native streams based upon the various packet headers at 2730. At 2732, the reconstructed native data streams are then passed to the display device.

25 [0078] Fig. 28 shows a flowchart detailing a process 2800 for performing a training session in accordance with an embodiment of the invention. It should be noted that the training session process 2800 is one implementation of the operation 2506 described in Fig. 25. A training session is started at 2802 by sending a training pattern over the main link at a set link rate to the receiver. A typical link training pattern is shown in Fig. 11 in accordance with an embodiment of the invention. As illustrated, during the training session, a phase 1 represents the shortest run length while phase 2 is the longest. The receiver is to use these two phases to optimize the equalizer. In phase 3, both bit lock and character lock are achieved as long as the link quality is reasonable. At 2804, the receiver checks an associated training status and based upon the training status check, the receiver sets a pass/fail bit for each of three phases and the transmitter at 2806. At each phase, the receiver will proceed to the next phase upon detection of pass only and at 2810 and if the receiver does not detect a pass then the receiver reduces the link rate and repeats the training session. The main link is ready at that link rate at which a pass is detected at 2812.

30 [0079] Fig. 29 illustrates a computer system 2900 employed to implement the invention. Computer system 2900 is only an example of a graphics system in which the present invention can be implemented. Computer system 2900 includes central processing unit (CPU) 1510, random access memory (RAM) 2920, read only memory (ROM) 2925, one or more peripherals 2930, graphics controller 2960, primary storage devices 2940 and 2950, and digital display unit 2970. As is well known in the art, ROM acts to transfer data and instructions uni-directionally to the CPUs 2910, while RAM is used typically to transfer data and instructions in a bi-directional manner. CPUs 2910 may generally include any number of processors. Both primary storage devices 2940 and 2950 may include any suitable computer-readable media. A secondary storage medium 880, which is typically a mass memory device, is also coupled bi-directionally to CPUs 2910 and provides additional data storage capacity. The mass memory device 880 is a computer-readable medium that may be used to store programs including computer code, data, and the like. Typically, mass memory device 880 is a storage medium such as a hard disk or a tape which generally slower than primary storage devices 2940, 2950. Mass memory storage device 880 may take the form of a magnetic or paper tape reader or some other well-known device. It will be appreciated that the information retained within the mass memory device 880, may, in appropriate cases, be incorporated in standard fashion as part of RAM 2920 as virtual memory.

35 [0080] CPUs 2910 are also coupled to one or more input/output devices 890 that may include, but are not limited to, devices such as video monitors, track balls, mice, keyboards, microphones, touch-sensitive displays, transducer card readers, magnetic or paper tape readers, tablets, styluses, voice or handwriting recognizers, or other well-known

input devices such as, of course, other computers. Finally, CPUs 2910 optionally may be coupled to a computer or telecommunications network, e.g., an Internet network or an intranet network, using a network connection as shown generally at 2995. With such a network connection, it is contemplated that the CPUs 2910 might receive information from the network, or might output information to the network in the course of performing the above-described method steps. Such information, which is often represented as a sequence of instructions to be executed using CPUs 2910, may be received from and outputted to the network, for example, in the form of a computer data signal embodied in a carrier wave. The above-described devices and materials will be familiar to those of skill in the computer hardware and software arts.

[0081] Graphics controller 2960 generates analog image data and a corresponding reference signal, and provides both to digital display unit 2970. The analog image data can be generated, for example, based on pixel data received from CPU 2910 or from an external encode (not shown). In one embodiment, the analog image data is provided in RGB format and the reference signal includes the VSYNC and HSYNC signals well known in the art. However, it should be understood that the present invention can be implemented with analog image, data and/or reference signals in other formats. For example, analog image data can include video signal data also with a corresponding time reference signal.

[0082] Although only a few embodiments of the present invention have been described, it should be understood that the present invention may be embodied in many other specific forms without departing from the spirit or the scope of the present invention. The present examples are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims along with their full scope of equivalents.

[0083] While this invention has been described in terms of a preferred embodiment, there are alterations, permutations, and equivalents that fall within the scope of this invention. It should also be noted that there are many alternative ways of implementing both the process and apparatus of the present invention. It is therefore intended that the invention be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

Claims

1. In a system having a bi-directional auxiliary channel arranged to transfer information between a video source and a video display and vice versa and a unidirectional main link arranged to carry a number multimedia data packets from the video source to the video display, a method of establishing a stable main link, comprising:

prior to starting transmission of multimedia data packet streams from a video source to the video display over the main channel,

using a link training session carried out over the auxiliary channel to establish the stable main link.

2. A method as recited in claim 1, further comprising

sending a pre-defined training pattern by a main link transmitter;

determining whether or not the video display can achieve a solid bit/character lock based upon the training pattern, wherein substantially all link training related handshaking between the video source and the video display is carried on the auxiliary channel.

3. A method as recited in claim 2 wherein if the video display does not achieve the solid bit/character lock, the video display informs the video source via the auxiliary channel.

4. A method as recited in claim 3, further comprising:

reducing the link rate by the video source;

repeating the training session until the solid bit/character lock is achieved; and

sending a fault message based upon the failure to achieve the solid bit/character lock.

5. A method as recited in claim 1, wherein the training pattern includes a number of training phases wherein a phase 1 represents a shortest run length and wherein a phase 2 are used by the receiver to optimize an equalize and wherein in a phase 3, both a bit lock and a character lock are achieved as long as the link quality is acceptable.

6. A method as recited in claim 1, wherein the training session is about 10 ms in duration and wherein approximately 10^7 bits of data are transmitted.

7. In a video system having a video source and a video display, a packet based video monitor trainer, comprising:
 - a bi-directional auxiliary channel arranged to transfer information between the video source and the video display device and vice versa;
 - 5 a unidirectional main link arranged to carry a number multimedia data packets from the multimedia source device to the multimedia sink device;
 - a main link receiver unit at the video display and a main link transmitter unit at the video source each coupled to the main link;
 - 10 an auxiliary channel slave unit coupled to the auxiliary channel wherein both the main link receiver unit and the auxiliary channel slave unit are each in an electrically idle state in a monitor standby mode and wherein when a hot plug event has been detected, then the system moves to a display state at which time the auxiliary channel slave unit is turned on and the main link transmitter unit responds to a receiver link capability read command; and
 - 15 a training pattern unit arranged to generate a training pattern used by the transmitter in a training phase to adjust an equalizer which is updated based upon a result for each training phase.
8. A trainer as recited in claim 7 wherein when the training fails, the another training session is commenced.
9. A trainer as recited in claim 8, wherein when the training session passes, then the display is normally operating.
- 20 10. A trainer as recited in claim 7, wherein when it is determined that there is no activity on the auxiliary channel for a predetermined period of time, then the auxiliary channel slave port is set to the standby state.
- 25 11. In a system having a bi-directional auxiliary channel arranged to transfer information between a video source and a video display and vice versa and a unidirectional main link arranged to carry a number multimedia data packets from the video source to the video display, computer program product for establishing a stable main link, comprising:
 - prior to starting transmission of multimedia data packet streams from a video source to the video display over the main channel,
 - 30 computer code for using a link training session carried out over the auxiliary channel to establish the stable main link.
12. Computer program product as recited in claim 11, further comprising
 - computer code for sending a pre-defined training pattern by a main link transmitter; and
 - 35 computer code for determining whether or not the video display can achieve a solid bit/character lock based upon the training pattern, wherein substantially all link training related handshaking between the video source and the video display is carried on the auxiliary channel.
13. Computer program product as recited in claim 12 wherein if the video display does not achieve the solid bit/character lock,
 - 40 computer code for informing the video source via the auxiliary channel.
14. Computer program product as recited in claim 13, further comprising:
 - 45 computer code for reducing the link rate by the video source;
 - computer code for repeating the training session until the solid bit/character lock is achieved; and
 - computer code for sending a fault message based upon the failure to achieve the solid bit/character lock.
15. Computer program product as recited in claim 11, wherein the training pattern includes a number of training phases wherein a phase 1 represents a shortest run length and wherein a phase 2 are used by the receiver to optimize an equalize and wherein in a phase 3, both a bit lock and a character lock are achieved as long as the link quality is acceptable.
- 50 16. Computer program product as recited in claim 11, wherein the training session is about 10 ms in duration and wherein approximately 10^7 bits of data are transmitted.
- 55

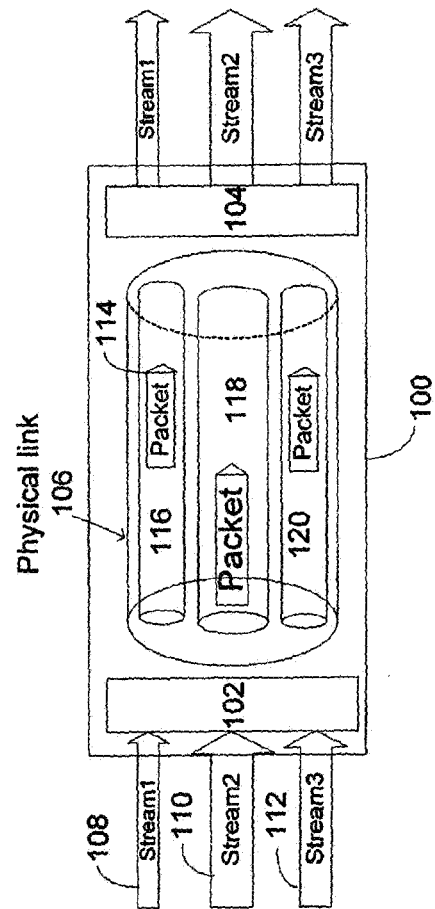


Fig. 1

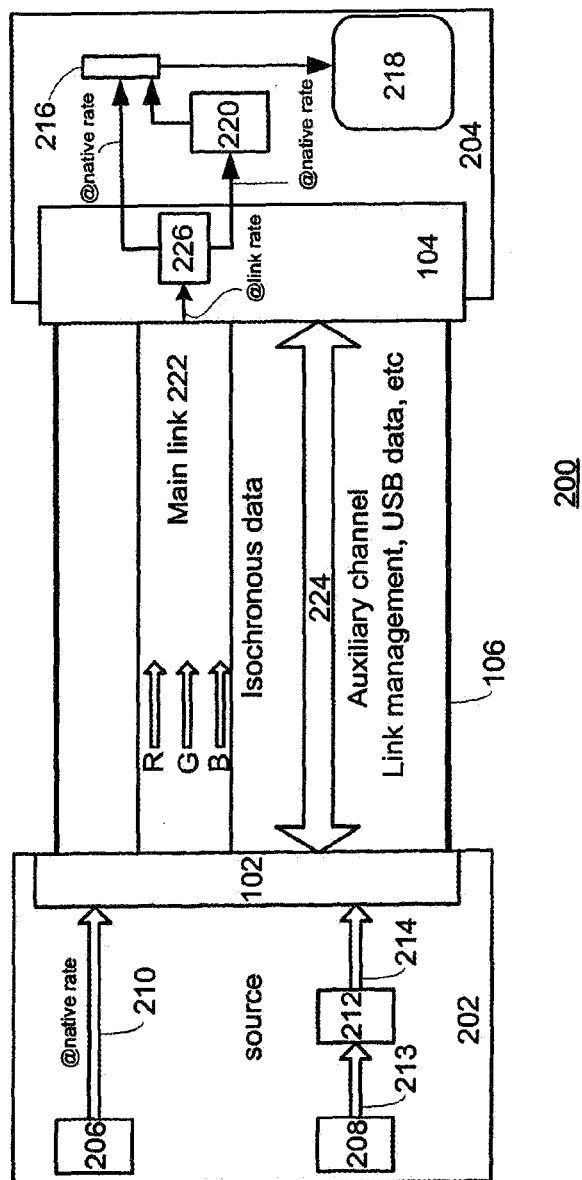


Fig. 2A

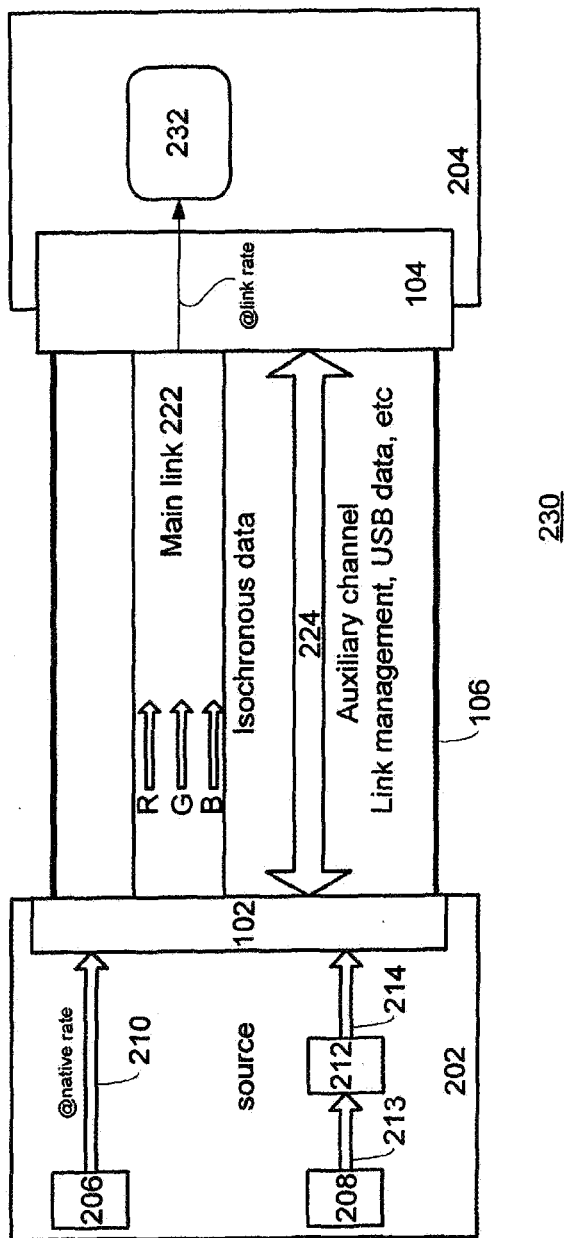


Fig. 2B

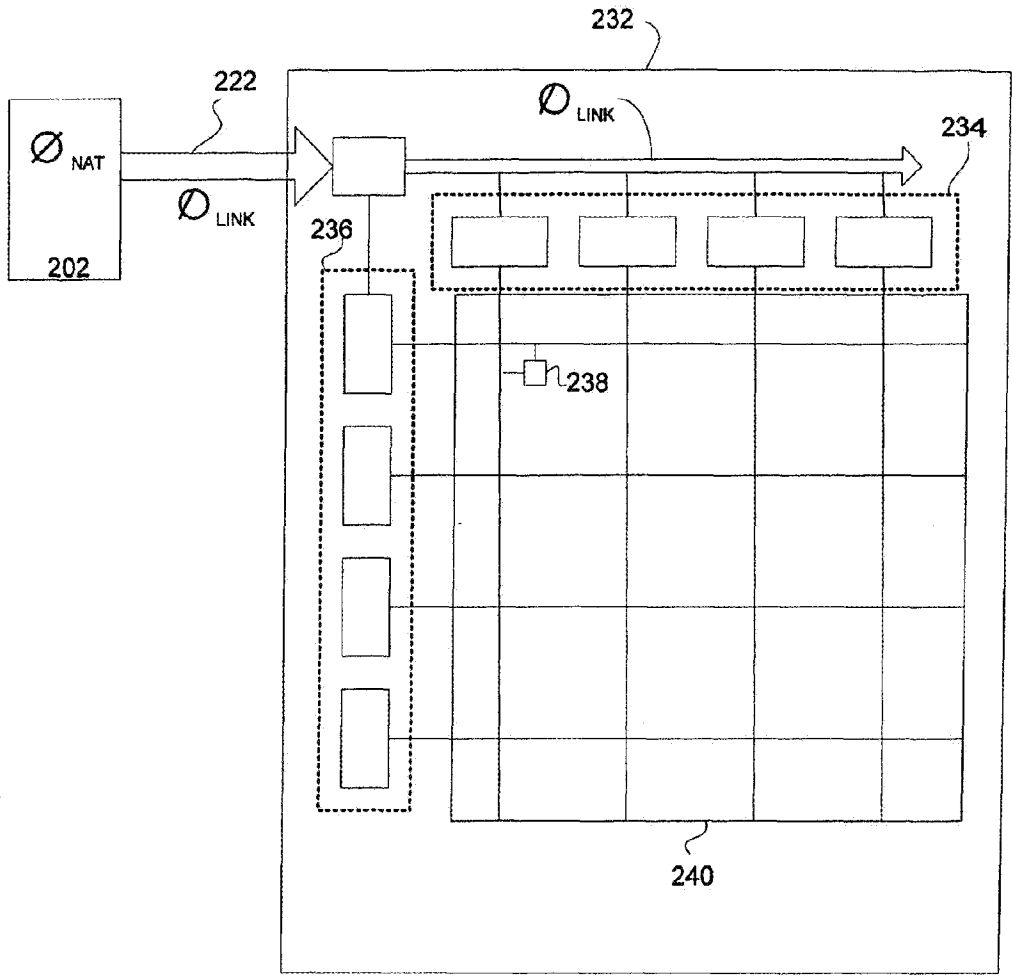


Fig. 2C

Main Link Data Rates

Nominal Baud Rate per channel (Gbits/second)	Actual Baud Rate per channel (Gbits/second)	Clock Multiplication Factor from 24-MHz crystal
1.0	0.960	x40
1.35	1.344	x56
1.7	1.728	x72
2.1	2.112	x88
2.5	2.496	x104

Fig. 3

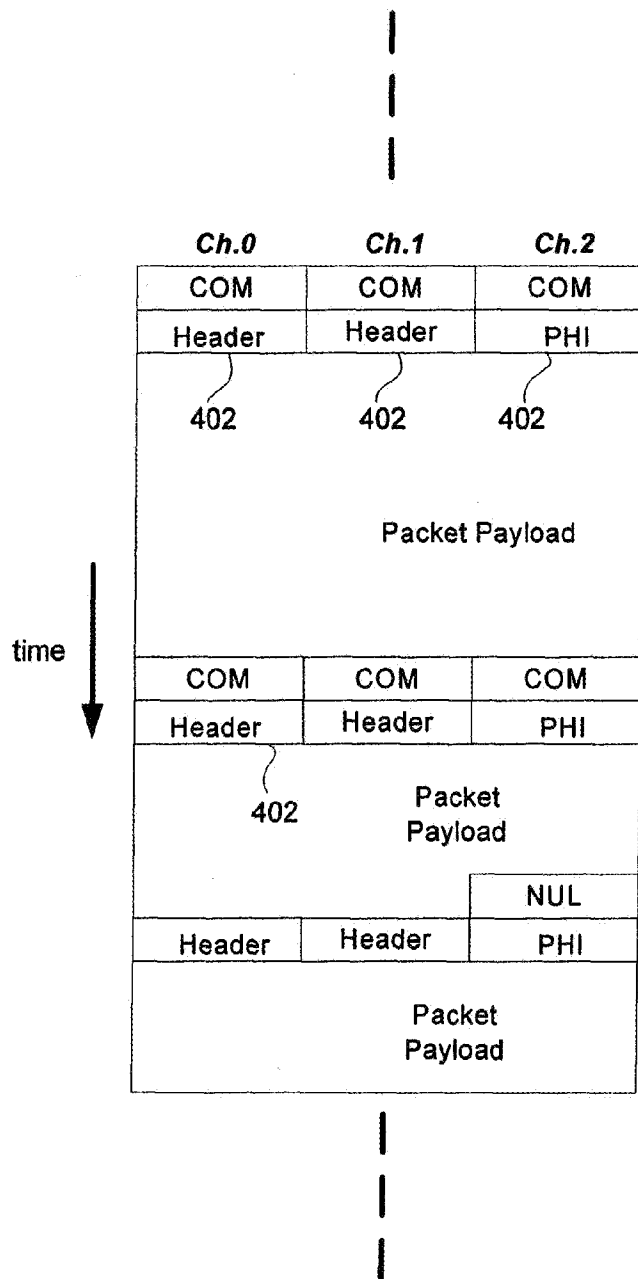


Fig. 4A

Main Link Packet Format

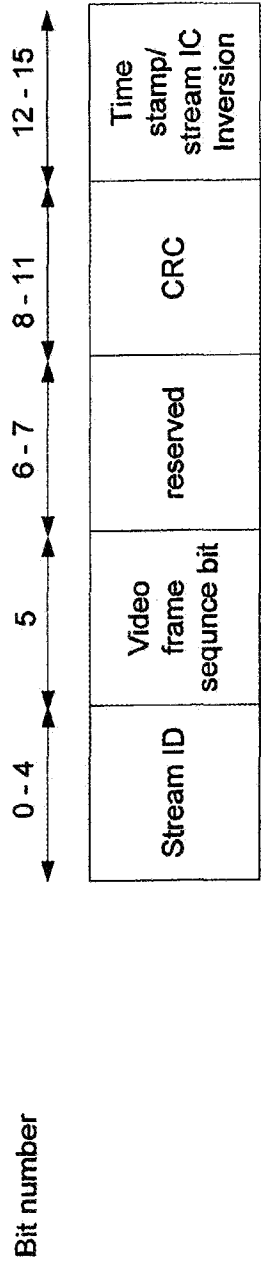
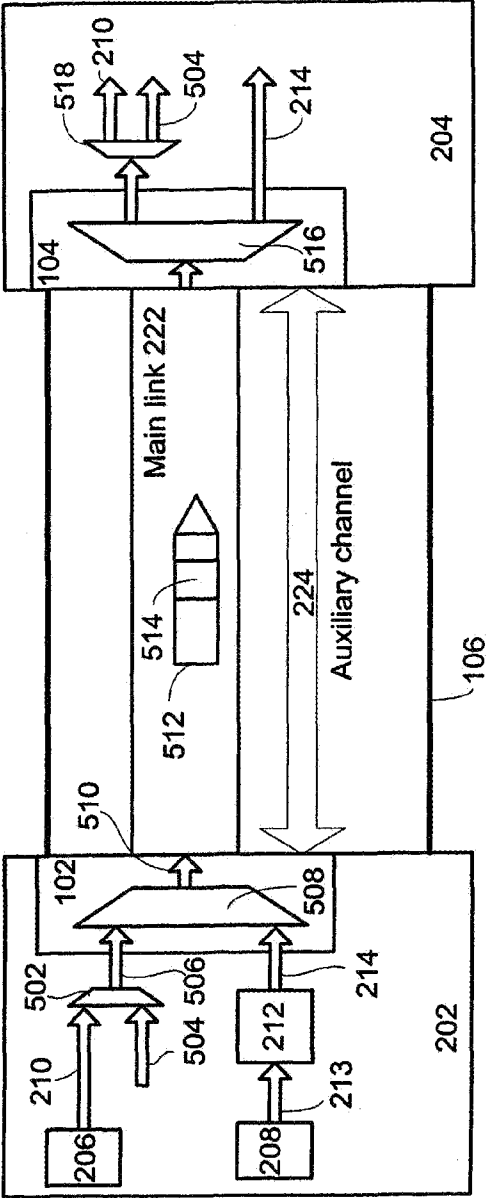


Fig. 4B



500

Fig. 5A

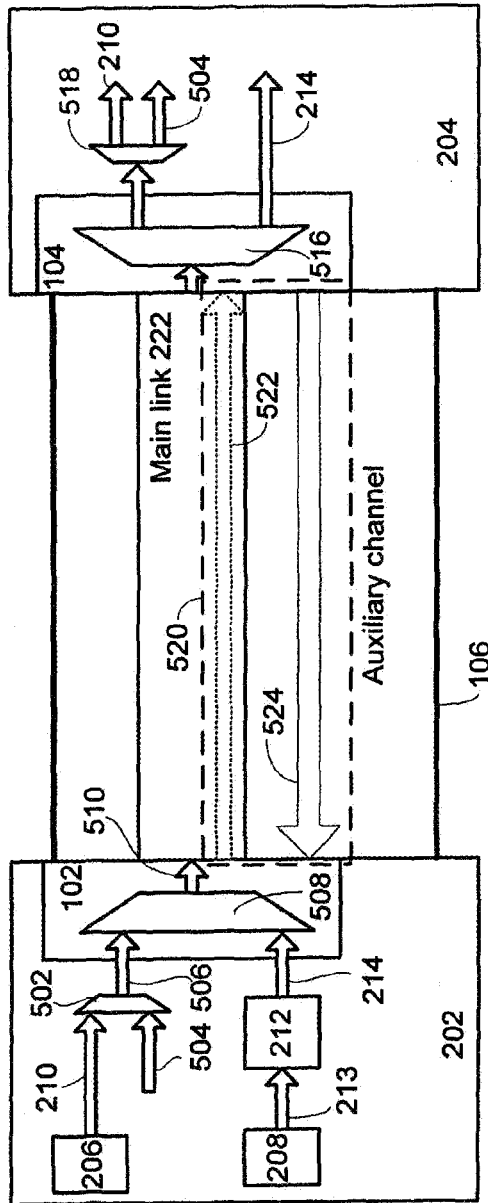


Fig. 5B

500

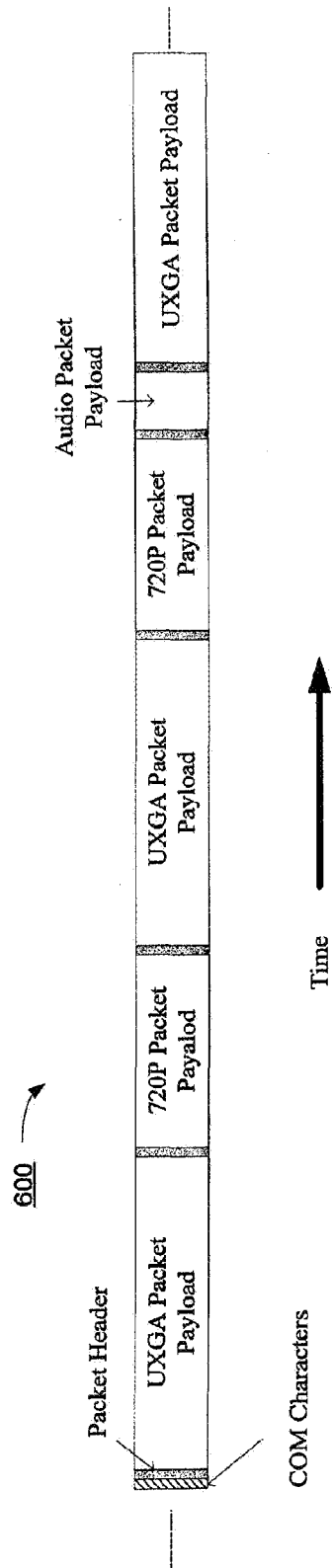


Fig. 6

High-level diagram of link traffic example with three streams

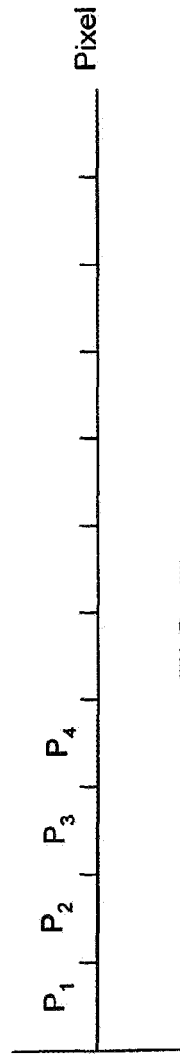
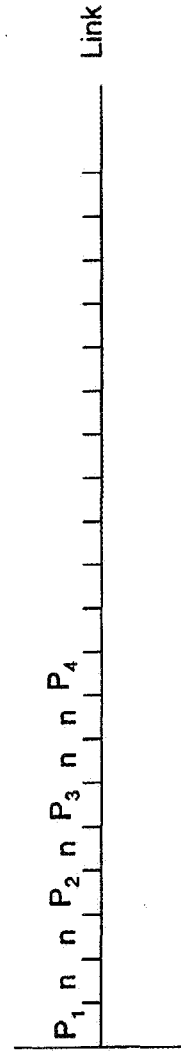


FIG. 7



$n = \text{null}$

FIG. 8

SID = 1	0	0	0	0	CRC	TSP19-16	PHI
Sub-packet Header	902	Sub-packet Header	902	SPS	904		
Sub-packet Payload							
SID = 1	1	0	0	0	CRC	TSP3-0	PHI
Packet Payload for SID 1							

Fig. 9A

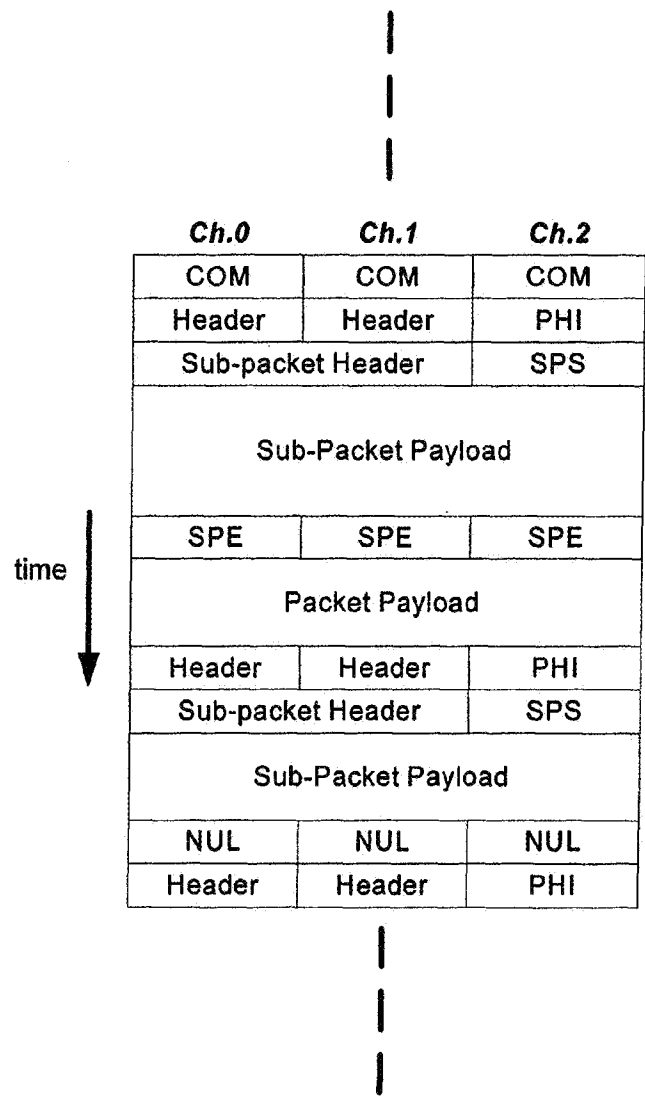


Fig. 9B

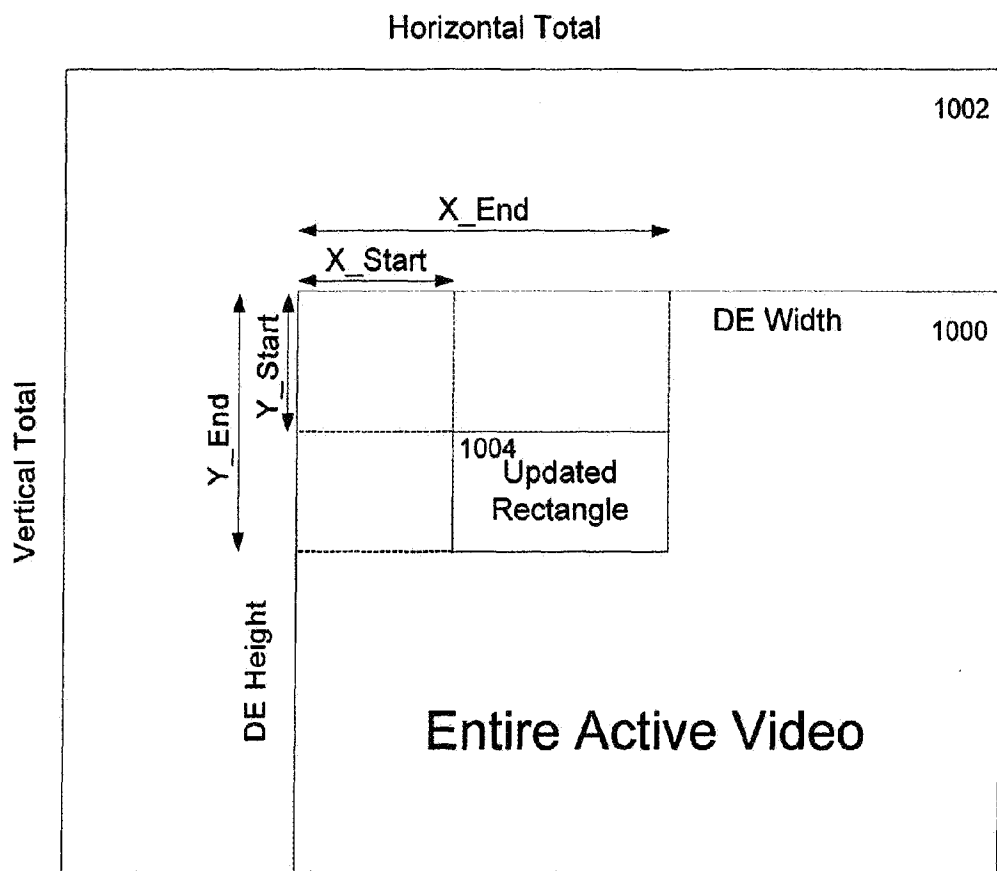


Fig. 10

Phase	Transmitted Link Characters	Binary pattern
1	D10.2	0101010101 0101010101 0101010101 0101010101 0101010101
2	K28.7	0011111000 0011111000 0011111000 0011111000 0011111000
3	K28.5, and three D10.2	0011111010 0101010101 0101010101 0101010101 1100000101

Main Link Training Pattern

Fig. 11

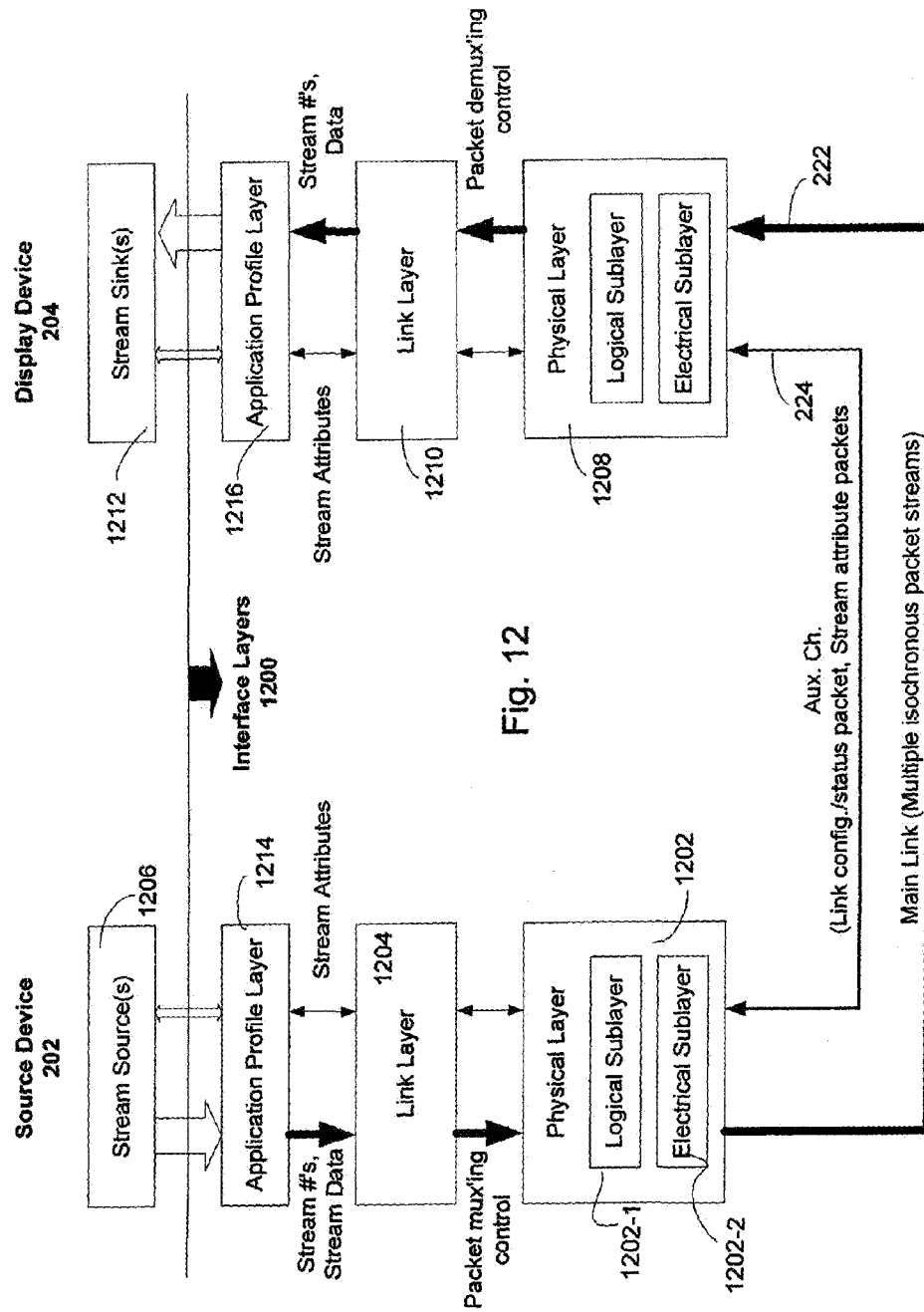


Fig. 12

8B/10B Special Characters Usage

Encoding	Name	Description
K28.5	Comma (COM)	Inserted between packets. Also used as part of Test Pattern
K28.7	TrainingPattern (TPN)	Sent during Training Pattern transmission for bit/byte clock lock.
K23.7	Null (NUL)	Sent within the packet period when there is no data to transmit.
K28.2	Sub-packet Start (SPS)	Indicate a start of sub-packet inserted in a packet
K29.7	Sub-packet End (SPE)	Indicate an end of sub-packet inserted in a main packet.
K28.0	PacketHeaderIndicator (PHI)	Sent along with 16 bits of header for header identification.
K28.1		Reserved
K28.3		Reserved
K28.4		Reserved
K28.6		Reserved
K25.7		Reserved
K27.7		Reserved

Fig. 13

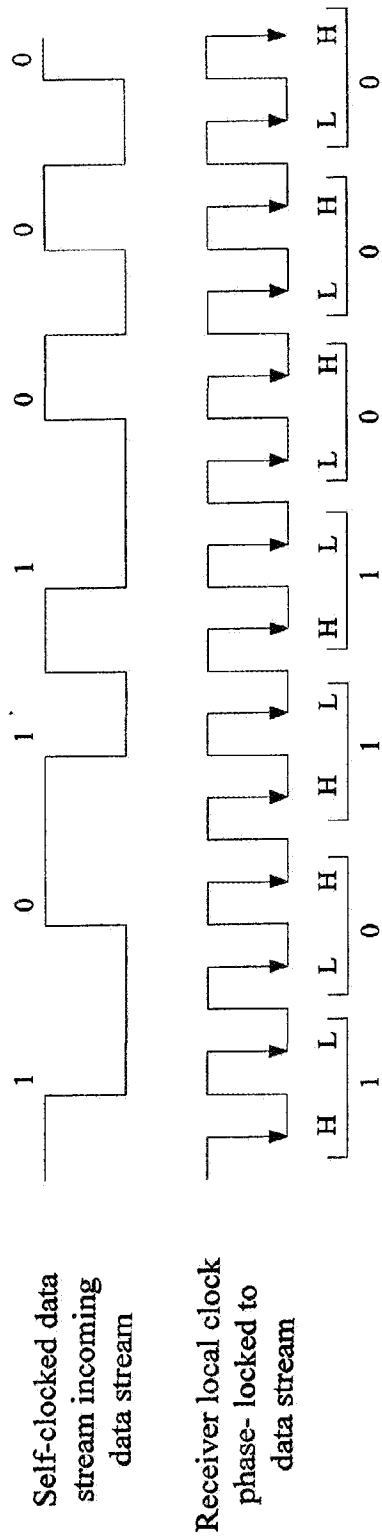


Fig. 14

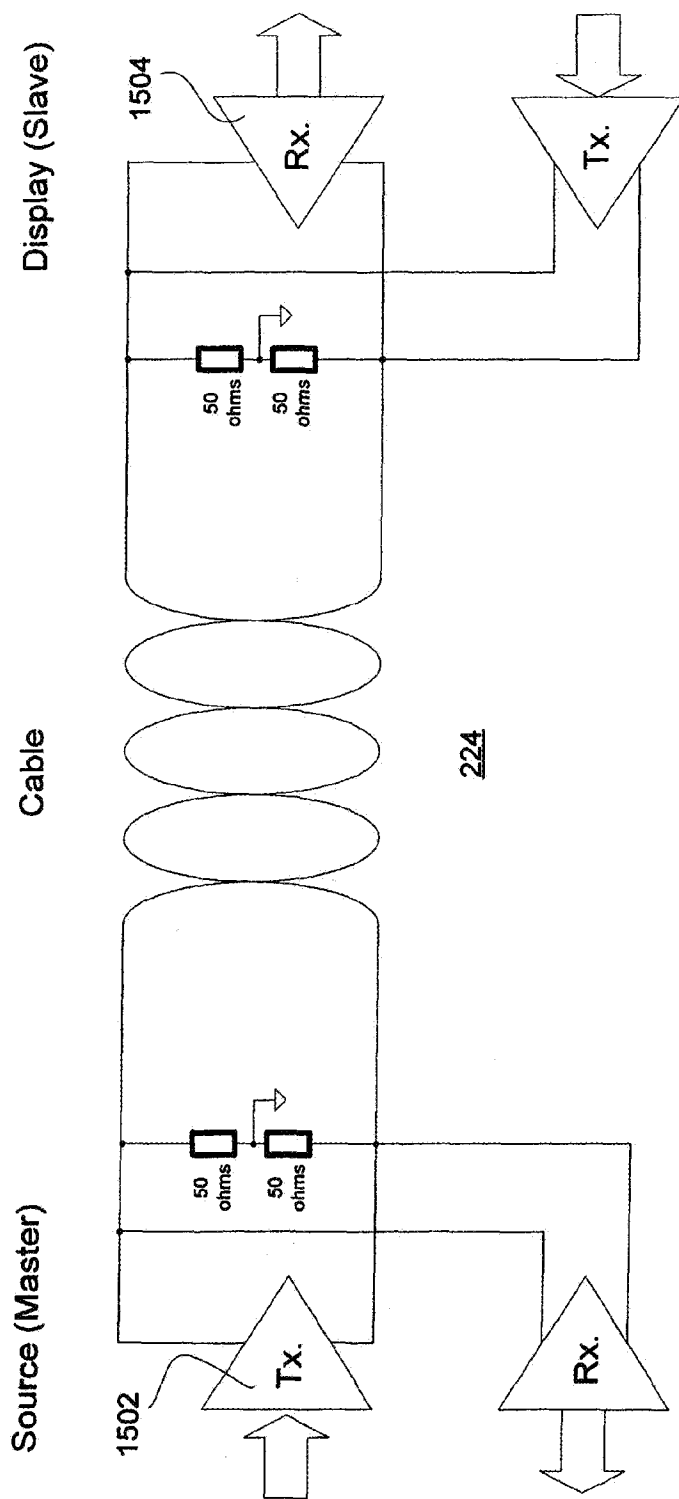


Fig. 15

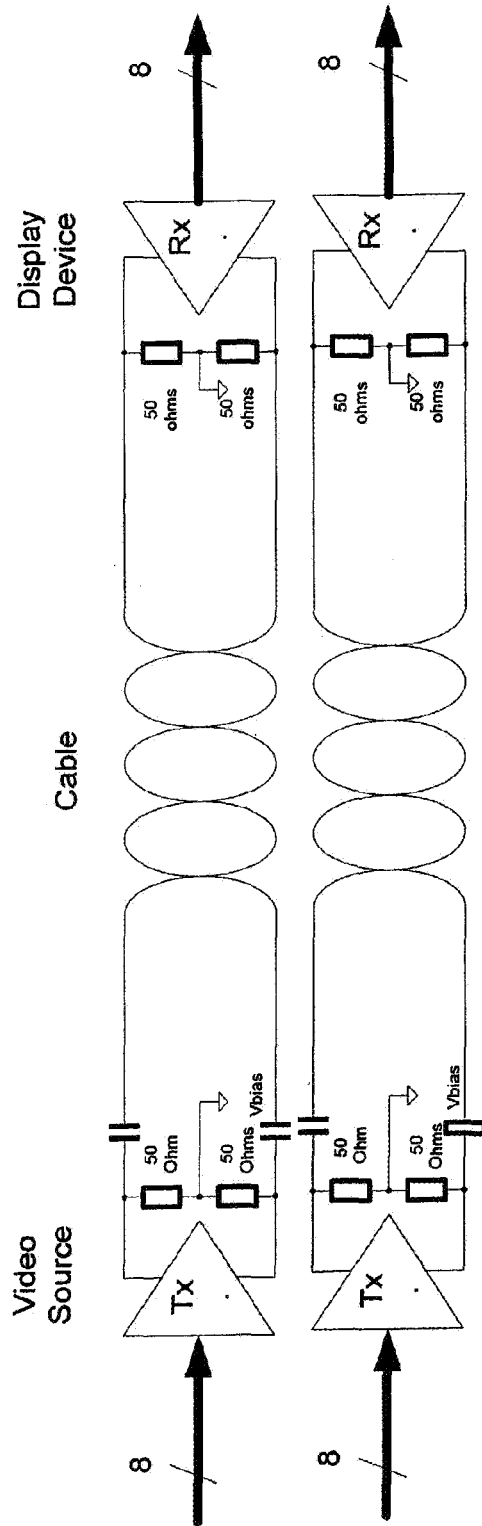


Fig. 16

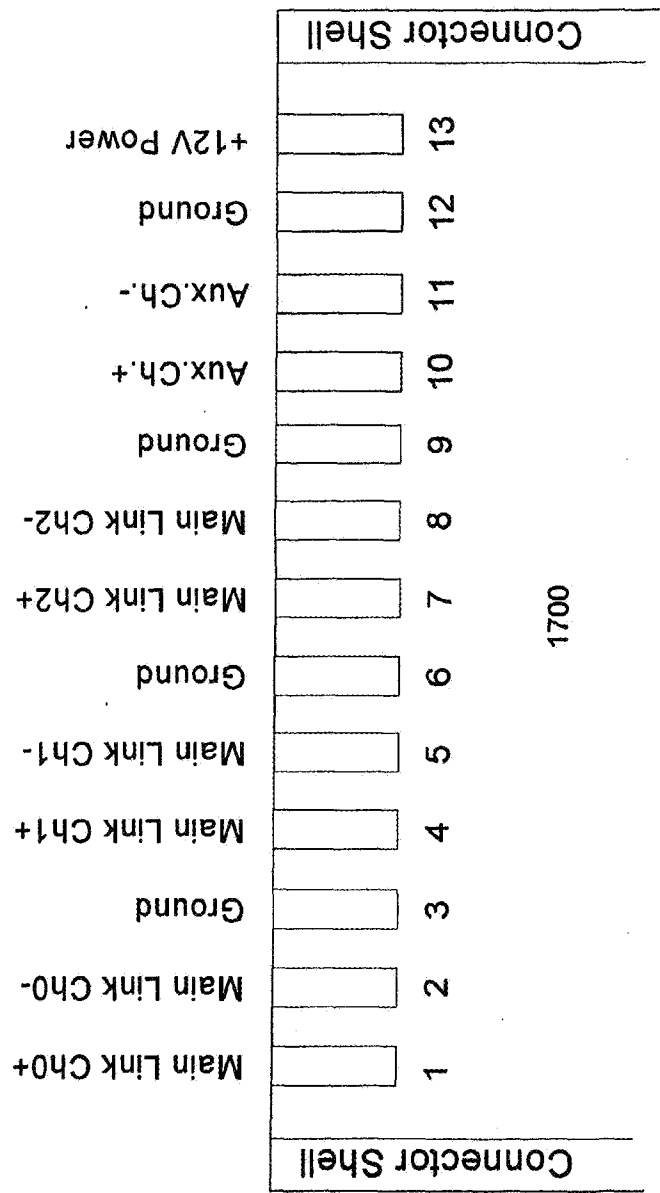


Fig. 17

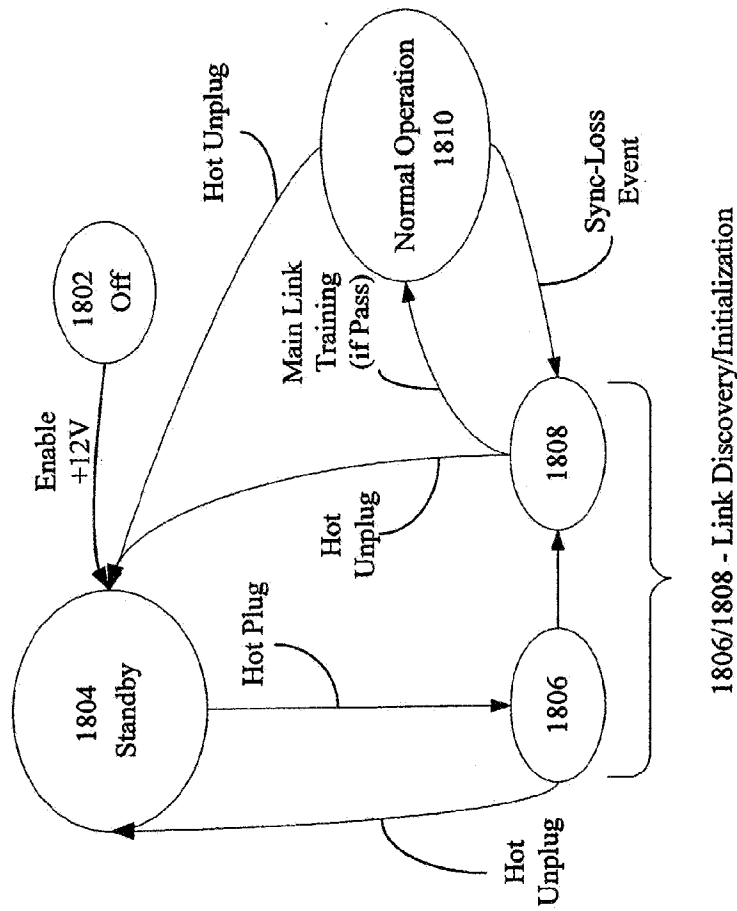


Fig. 18

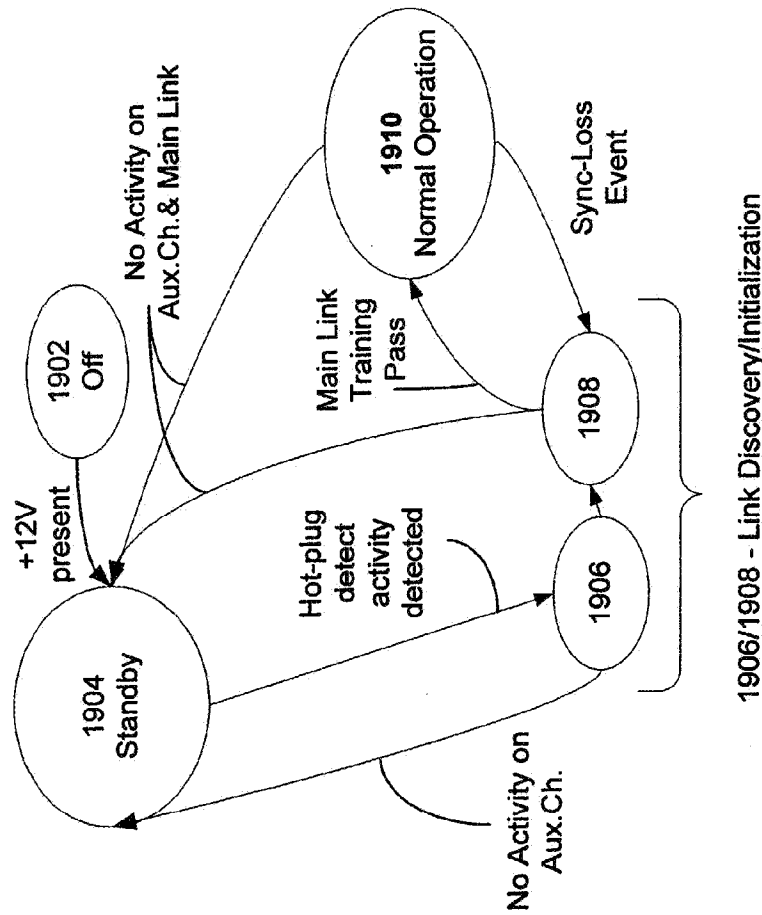
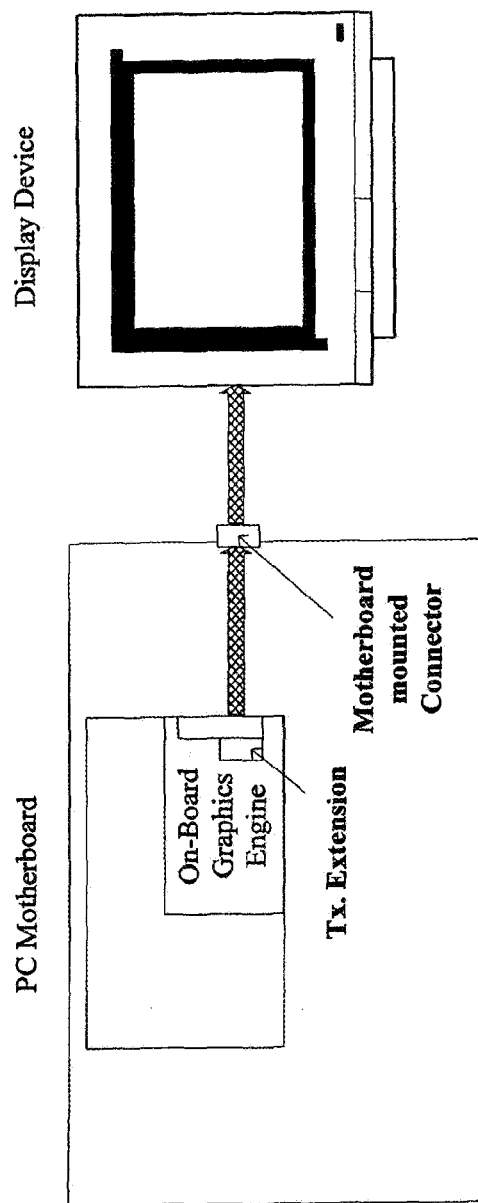
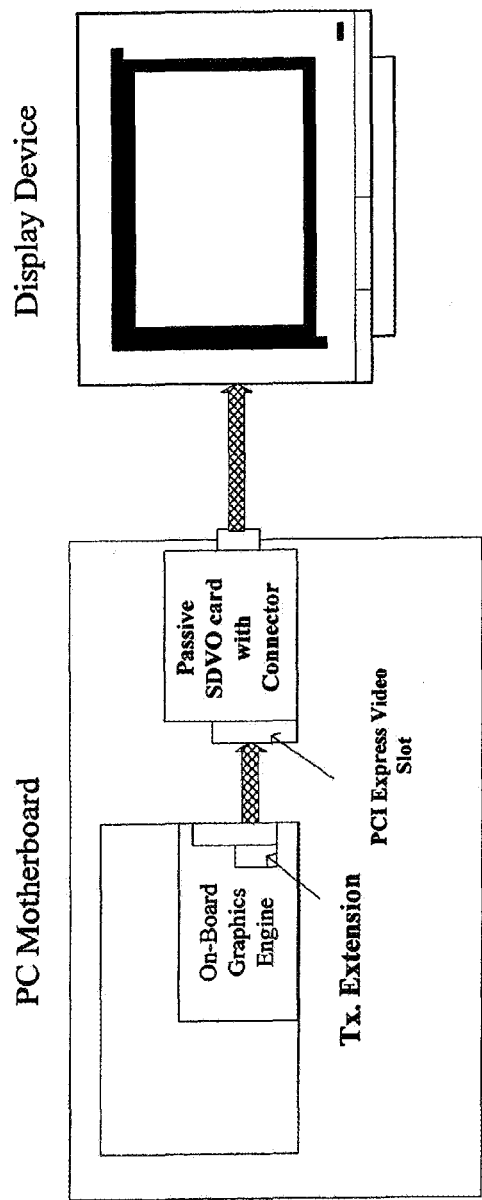


Fig. 19



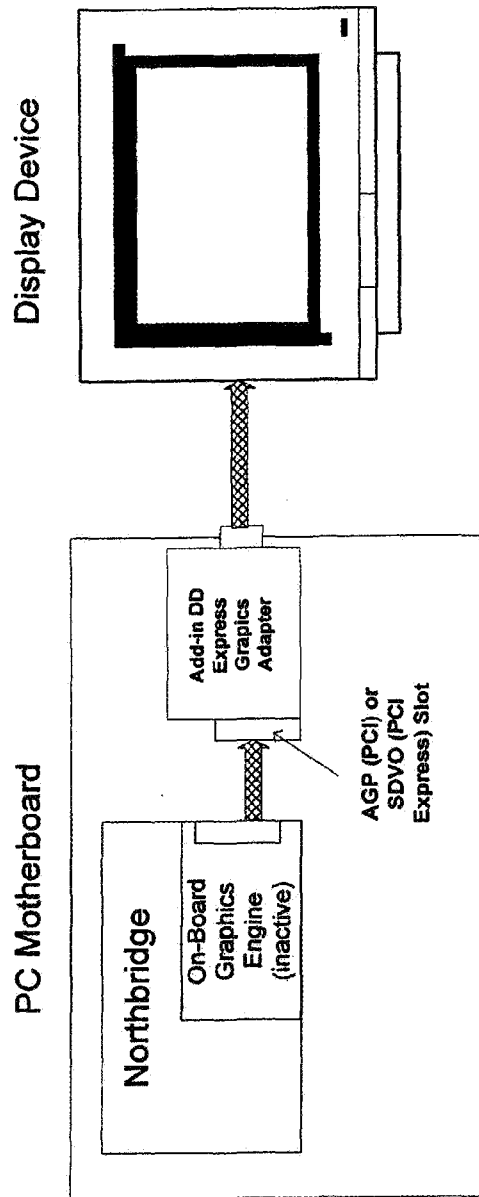
**PCI EXPRESS MOTHERBOARD WITH DEDICATED DD-
EXPRESS CONNECTOR**

Fig. 20



PCI Express motherboard with passive connector card.

Fig. 21



PCI Express motherboard with add-in DD-Express graphics card

Fig. 22

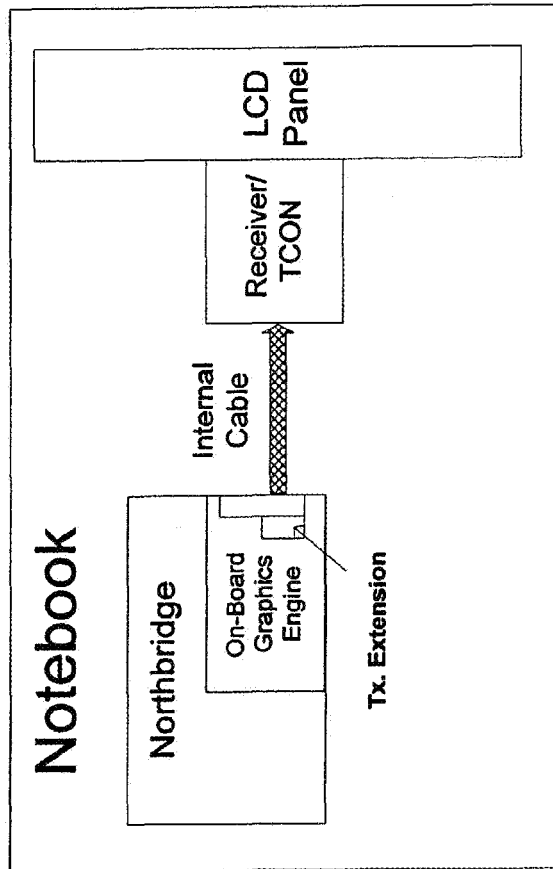
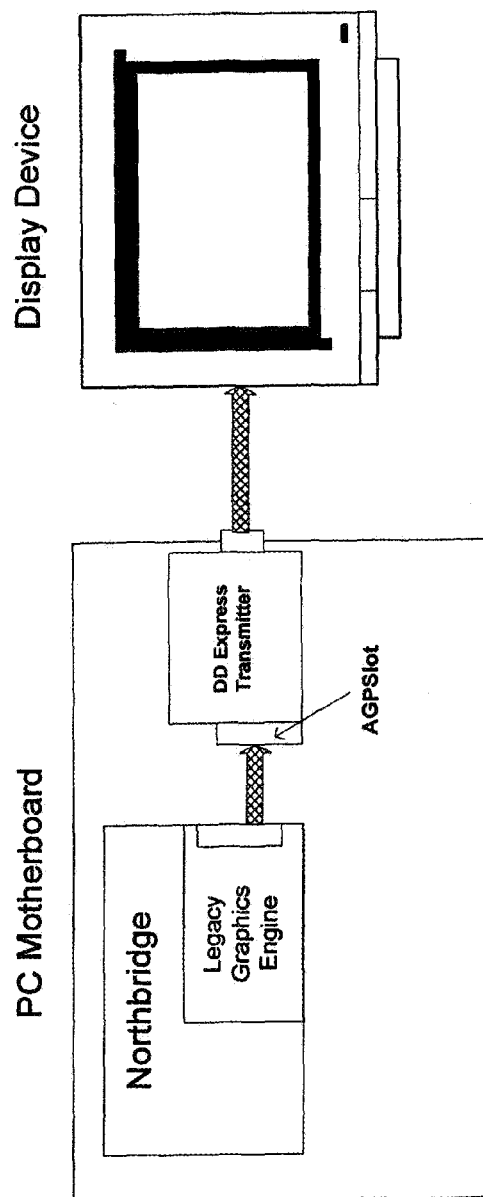


Fig. 23



Legacy graphics accelerator bus transmitter mounted on a legacy bus card slot converts digital raster data/timing signals into main link streams

Fig. 24

Fig. 25

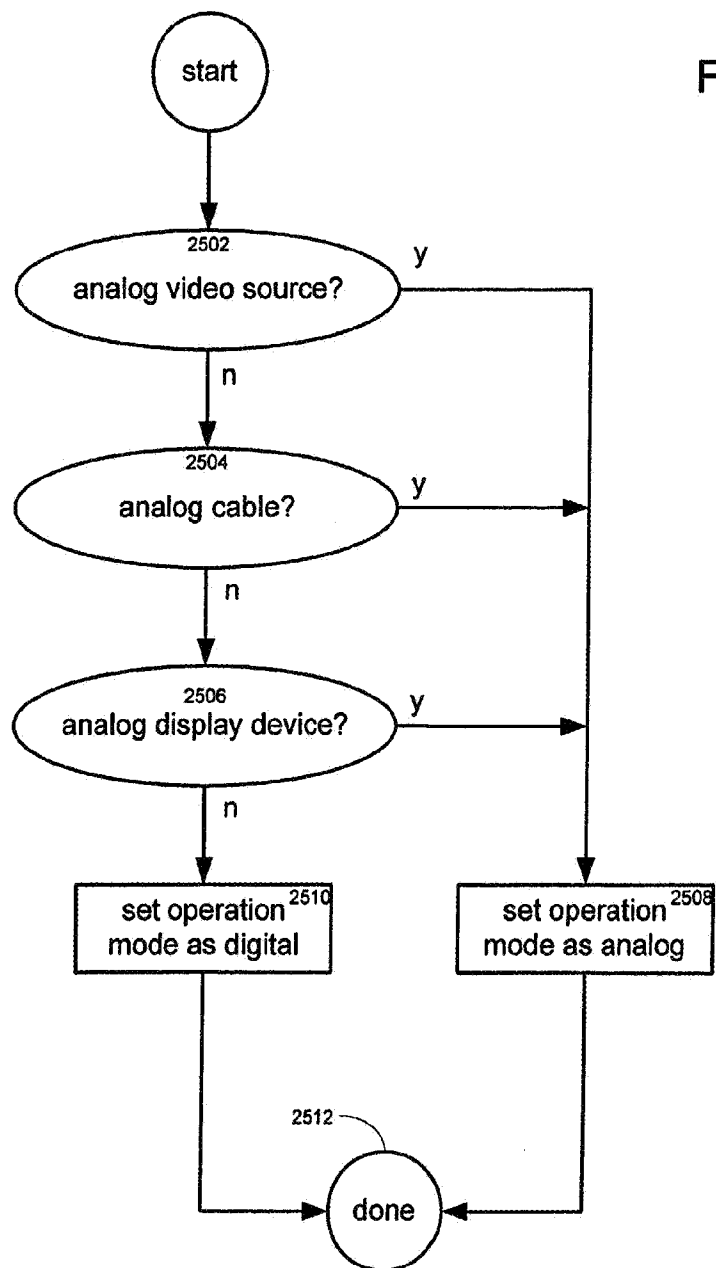
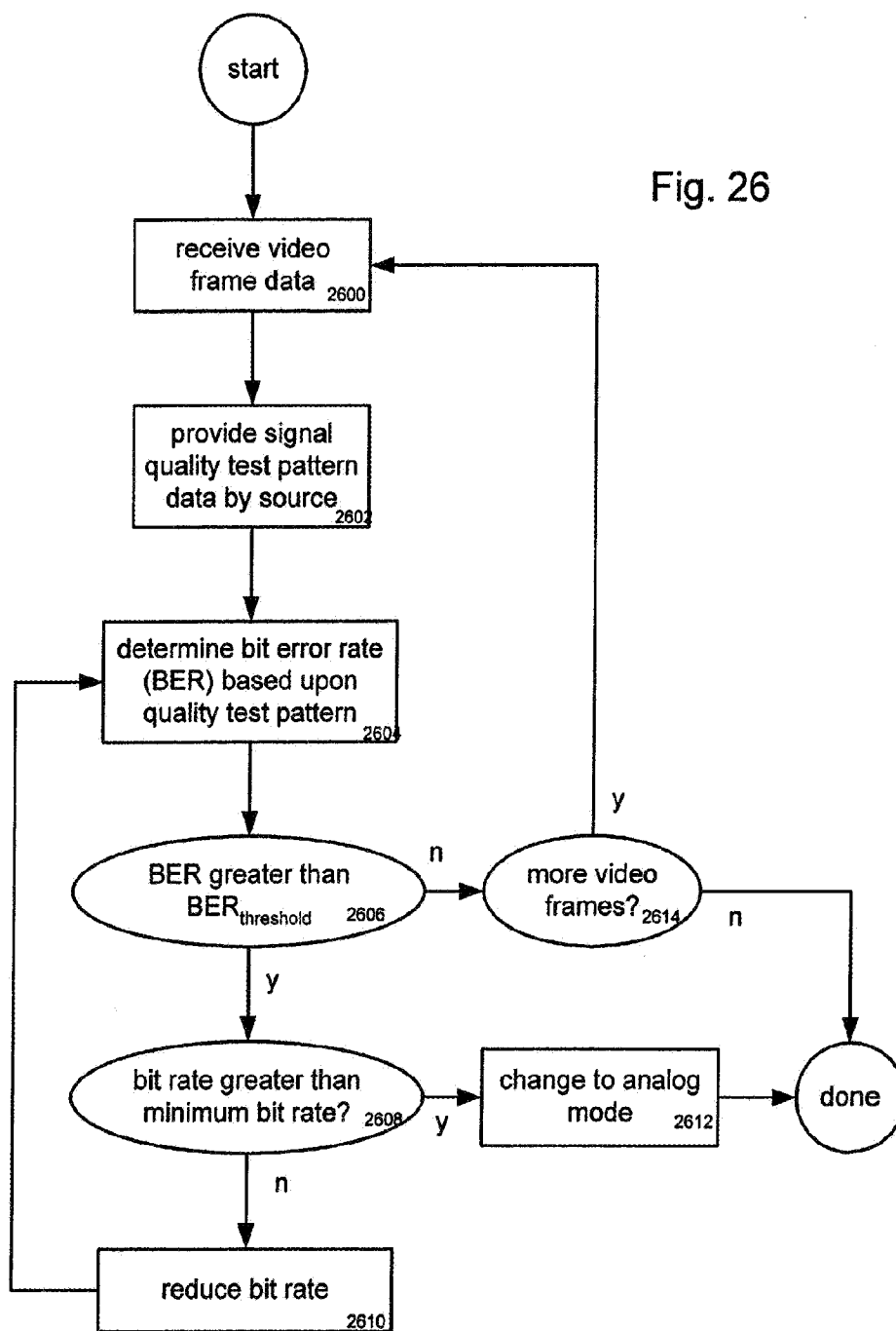


Fig. 26



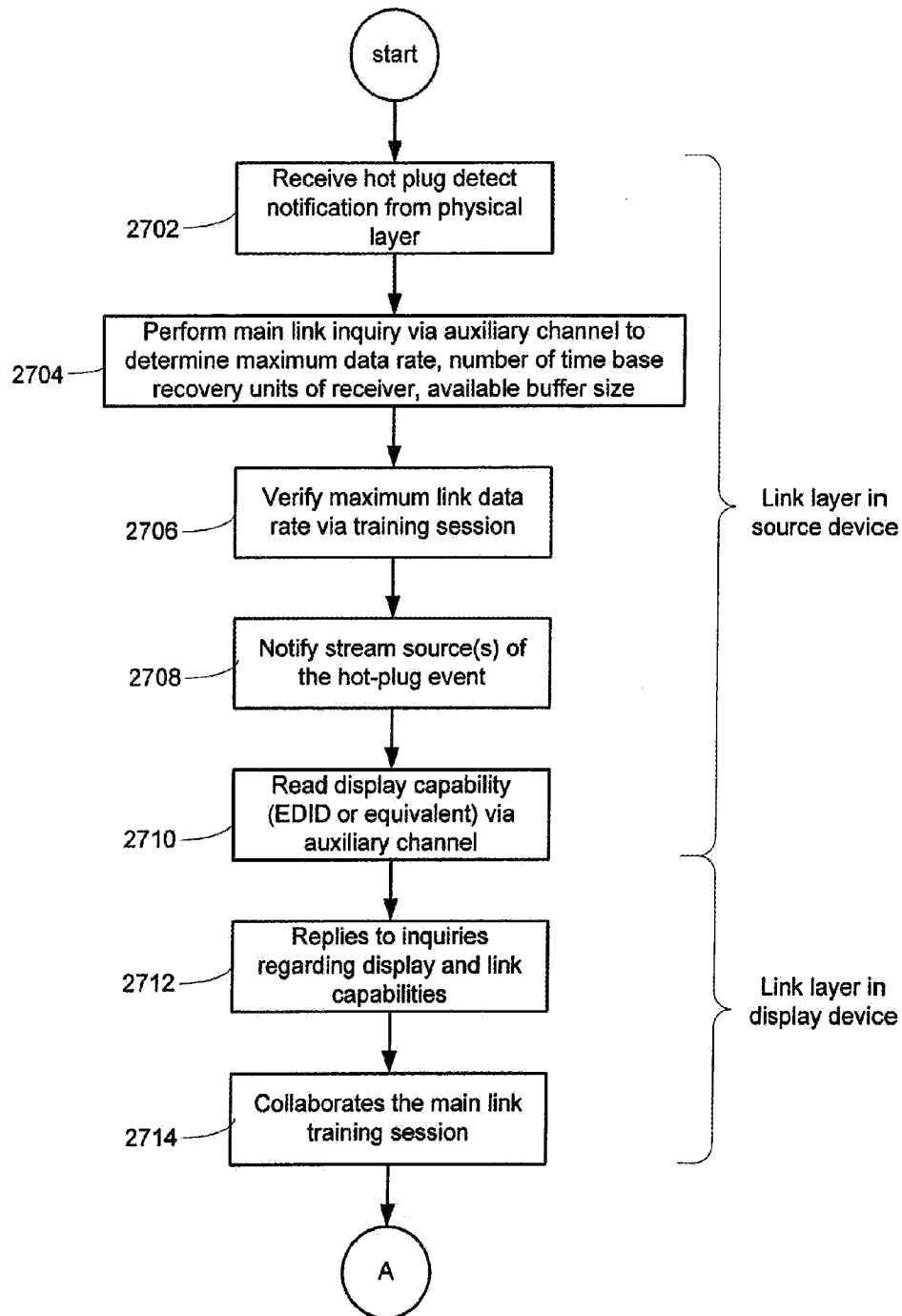


Fig. 27A

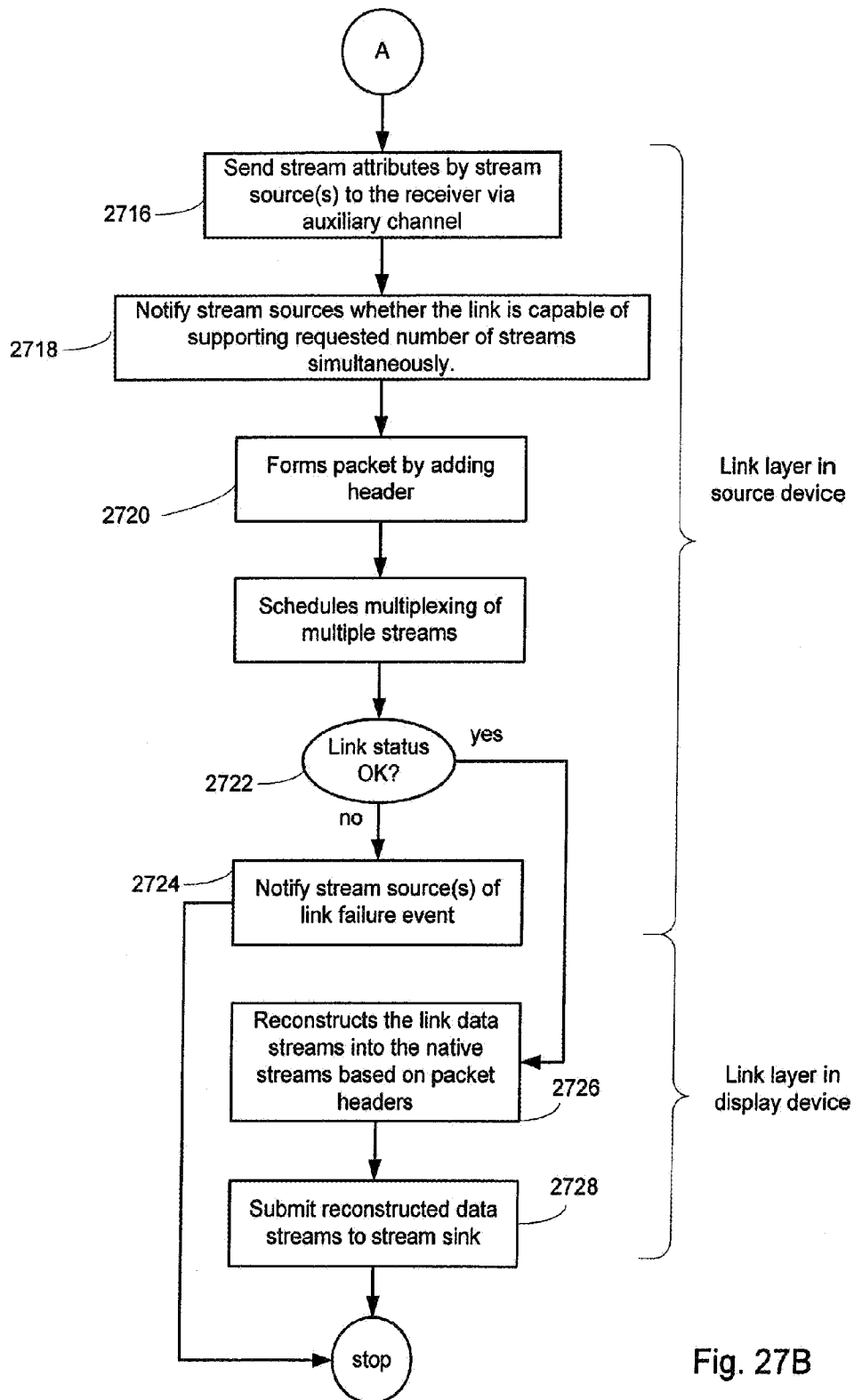


Fig. 27B

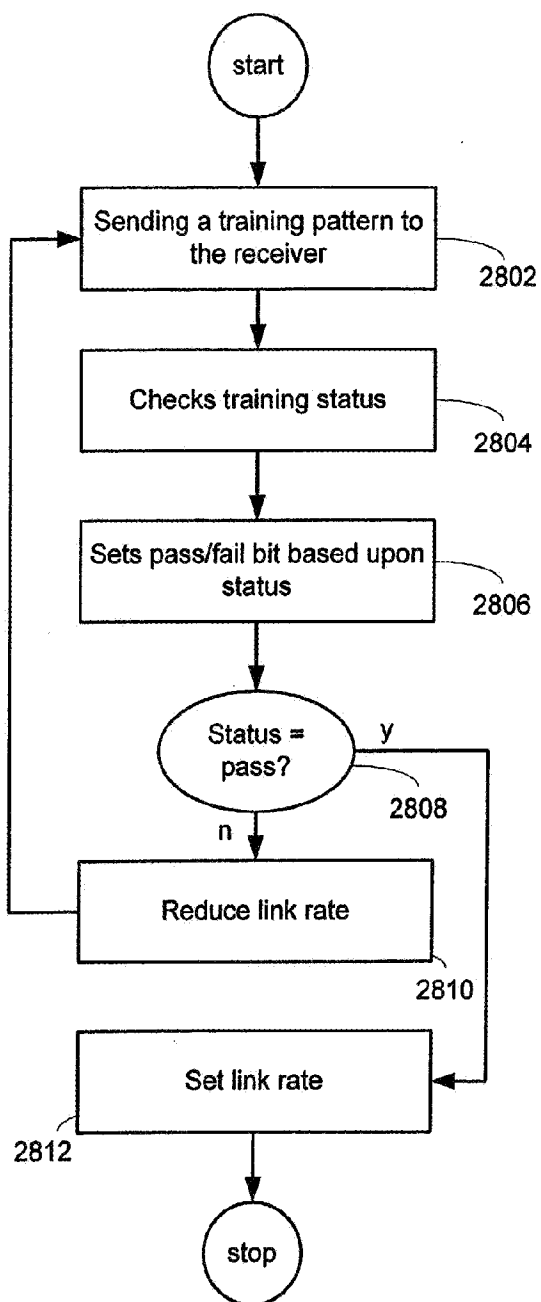


Fig. 28

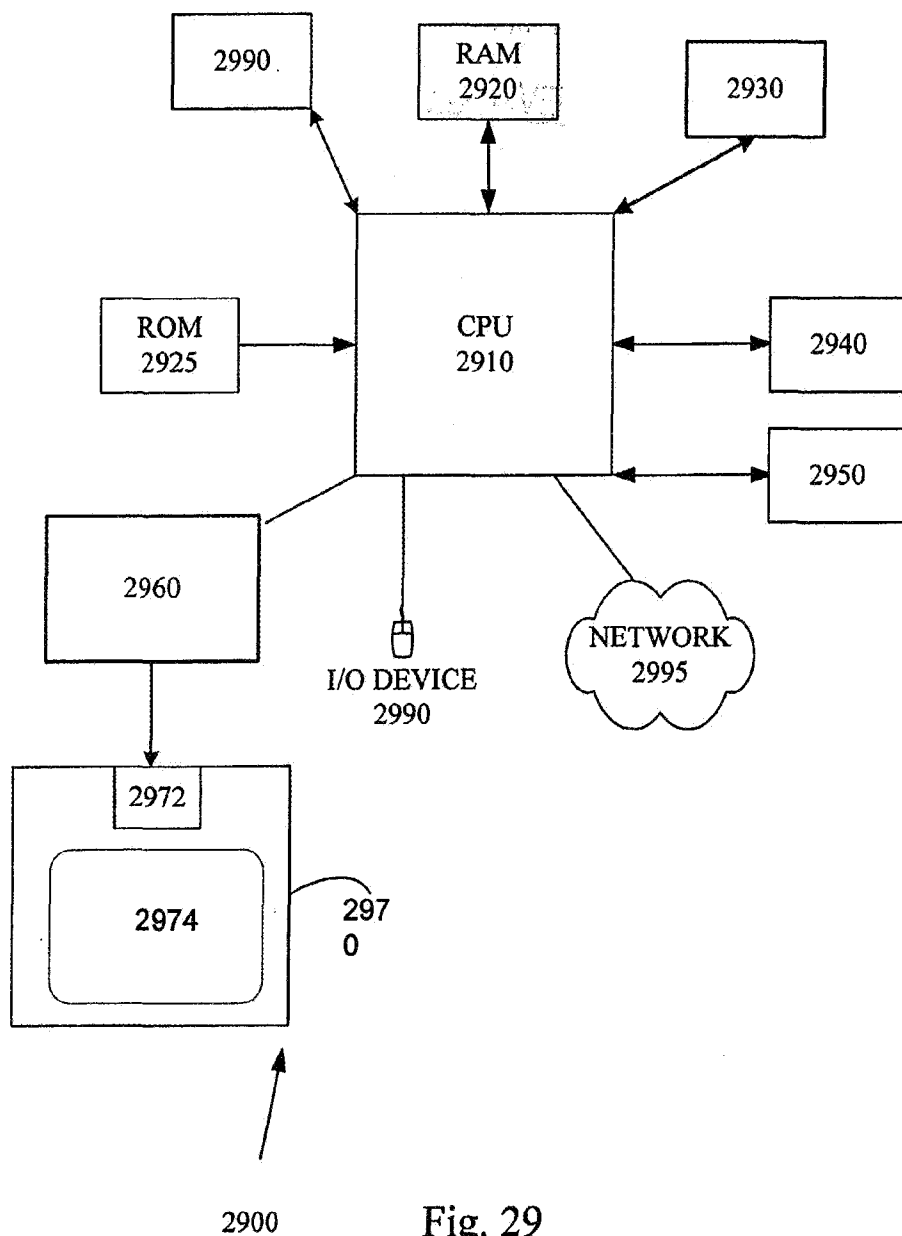


Fig. 29

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application No. 12/636,063

Filing Date December 11, 2009

First Inventor Dongyun Lee, et al.

Art Unit 2111

Examiner Name Khanh Dang

Attorney Docket No. 8029P150

Conf. No. 1550

DUTY OF DISCLOSURE STATEMENT

In accordance with the duty of disclosure, enclosed is a copy of an Information Disclosure Statement (IDS) Citation Form PTO/SB/08 or PTO-1449, together with copies of the documents cited on that form, except for copies not required to be submitted (e.g., copies of U.S. patents and U.S. published patent applications need not be enclosed). This IDS and IDS Citation Form are being submitted before the mailing of a first Office Action on the merits. It is respectfully requested that the cited references be considered and that the enclosed copy of PTO/SB/08 be initialed by the Examiner to indicate such consideration and a copy thereof returned to applicant(s).

The submission of this Information Disclosure Statement is not to be construed as a representation that a search has been made in the subject application and is not to be construed as an admission that the information cited in this statement is material to patentability.

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).

OR

☒ None

☐ The IDS Filing Fee in the amount of \$180.00 as set forth in 37 CFR 1.17(p) has been submitted herewith.

☒ It is requested that any requisite fees be debited from Deposit Account 02-2666.

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 signature.

Signature	/Mark C. Van Ness/	Date (MM-DD-YYYY)	10/23/2013
Name/Print	Mark C. Van Ness	Registration Number	39865

/Andrea Dolder/

Andrea Dolder

Date 10/23/2013

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.

Substitute for form 1449A/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>	Complete if Known	
	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Lee, Dongyun
	Group Art Unit	2111
	Examiner Name	Khanh Dang
Sheet 1 of 1		Attorney Docket No: 8029P150

US PATENT DOCUMENTS					
Examiner Initial *	Cite No ¹	USP Document Number	Publication or Issue Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	US-20020171741	11/21/2002	Tonkin, Steven W. et al.	
	A2	US-20040073697	04/15/2004	Nobuyuki, Saito et al.	
	A3	US-20050004708	01/06/2005	Goldenberg, Andrew et al.	
	A4	US-20070200859	08/30/2007	Banks et al.	
	A5	US-20070257923	11/08/2007	Whitby-Strevens Colin	
	A6	US-20080005433	01/03/2008	Diab et al.	
	A7	US-20080008470	01/10/2008	Lin, Chih-Chuan et al.	
	A8	US-20080301748	12/04/2008	Lida, Eyran et al.	
	A9	US-20080317181	12/25/2008	Suzuki et al.	
	A10	US-20090013366	01/08/2009	You et al.	
	A11	US-20090245345	10/01/2009	Lee, Dongyun et al.	
	A12	US-20090260043	10/15/2009	Tatsuta, Akihiro et al.	
	A13	US-20100283324	11/11/2010	Lee, Dongyun et al.	
	A14	US-7,295,578	11/13/2007	Lyle, James D. et al.	
	A15	US-7,639,765	12/29/2009	Suzuki, Akihiro et al.	
	A16	US-7,916,780	03/29/2011	Lee, Bong-Joon	
	A17	US-7,940,809	05/10/2011	Lee, Bong-Joon	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No ¹	Foreign Patent Document Country Code/Number/Kind Code (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ²
	A18	CN-101032113	09/05/2007	Makoto		
	A19	EP-0166441	01/02/1986	Hewlett-Packard Company		
	A20	EP-1473941	03/11/2004	Genesis Microchip, Inc.		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ²
	A21	"Electrical Transient Immunity for Power-Over-Ethernet," Application Report, SLVA233A, Texas Instruments, April 2006, Revised August 2006, 20 pages	
	A22	Digital Visual Interface DVI Revision 1.0, Digital Display Working Group, April 2, 1999, 76 pages	
	A23	DisplayPort Ver. 1.2 Overview, DisplayPort Developer Conference, Taipei, December 6, 2010, 33 pages	
	A24	High-Definition Multimedia Interface Specification Version 1.3, HDMI Licensing, LLC, June 22, 2006, 237 pages	

EXAMINER

DATE CONSIDERED

Based on PTO/SB/08/A(09-06) - Substitute Disclosure Statement Form (PTO-1449) as modified by BSTZ 03/26/07
 * EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional) ² Applicant is to place a check mark here if English language Translation is attached



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NOTICE OF ALLOWANCE AND FEE(S) DUE

65702 7590 07/23/2013
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BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER

DANG, KHANH

ART UNIT

PAPER NUMBER

2111

DATE MAILED: 07/23/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

12/636,063

12/11/2009

Dongyun Lee

8029P150

1550

TITLE OF INVENTION: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	10/23/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

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.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	8029P150	1550

TITLE OF INVENTION: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	10/23/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
DANG, KHANH	2111	307-042000

<p>1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).</p> <p>☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.</p> <p>☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.</p>	<p>2. For printing on the patent front page, list</p> <p>(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,</p> <p>(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.</p> <p>1 _____</p> <p>2 _____</p> <p>3 _____</p>
---	---

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

<p>4a. The following fee(s) are submitted:</p> <p>☐ Issue Fee</p> <p>☐ Publication Fee (No small entity discount permitted)</p> <p>☐ Advance Order - # of Copies _____</p>	<p>4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)</p> <p>☐ A check is enclosed.</p> <p>☐ Payment by credit card. Form PTO-2038 is attached.</p> <p>☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).</p>
---	--

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 form 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: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	8029P150	1550

65702 7590 07/23/2013
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EXAMINER

DANG, KHANH

ART UNIT	PAPER NUMBER
----------	--------------

2111

DATE MAILED: 07/23/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 557 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 557 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

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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. 12/636,063	Applicant(s) LEE ET AL.	
	Examiner KHANH DANG	Art Unit 2111	AIA (First Inventor to File) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 05/31/2013.
☐ 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 13-16, 18, 19 and 22-25. 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: _____.

Interim copies:

a) ☐ All b) ☐ Some c) ☐ None of the: Interim copies of the priority documents have been 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 _____.
---	---

/Khanh Dang/ Primary Examiner, Art Unit 2111	
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Search Notes 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
307	42	12/28/2012	KD
	54		
710	104		
	305		
	313		
	8		
	9		
	15-17		

SEARCH NOTES		
Search Notes	Date	Examiner
East Search Note	12/28/2012	KD
Search Updated	6/11/2013	KD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
710	15	6/11/2013	KD
307	54		

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<i>Index of Claims</i> 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant					☐ CPA					☐ T.D.					☐ R.1.47				
CLAIM		DATE																	
Final	Original	09/14/2012	12/31/2012	06/11/2013															
	1	÷	N	-															
	2	÷	N	-															
	3	÷	N	-															
	4	÷	N	-															
	5	÷	N	-															
	6	÷	N	-															
	7	÷	N	-															
	8	÷	N	-															
	9	÷	N	-															
	10	÷	N	-															
	11	÷	N	-															
	12	÷	N	-															
1	13	÷	✓	=															
2	14	÷	✓	=															
3	15	÷	✓	=															
4	16	÷	✓	=															
	17	÷	O	-															
5	18	÷	✓	=															
6	19	÷	✓	=															
	20	÷	N	-															
	21	÷	N	-															
7	22	÷	✓	=															
8	23	÷	✓	=															
9	24			=															
10	25			=															

Our Docket No: 8029P150

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Dongyun Lee, et al.

Application No: 12/636,063

Filed: December 11, 2009

Title: Power Delivery Over Digital
Interaction Interface For Video and
Audio (DiiVA)

Examiner: Khanh Dang

Art Unit: 2111

Conf. No.: 1550

AMENDMENT AND RESPONSE

Commissioner for Patents:

In response to the Office Action mailed February 1, 2013, applicants hereby submit the following amendment and remarks.

CERTIFICATE OF TRANSMISSION

This correspondence is being submitted electronically via EFS Web prior to 11:59pm on the date shown below.

Date: May 31, 2013

/Andrea Dolder/
Andrea Dolder

AMENDMENTS TO THE CLAIMS

Please cancel claims 1-13, 17, 20, and 21 without prejudice.

Please amend the claims as follows:

1-12. (Cancelled)

13. (Currently amended) A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising:

a voltage source configured to generate a voltage;

a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices;

a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and

a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current[.];

wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off, and whether or not the connected device needs a supply of power.

14. (Original) The power delivery circuit of claim 13, further comprising a controller that controls opening and closing of the power relay switch.

15. (Original) The power delivery circuit of claim 13, wherein the plurality of devices are connected to each other through a daisy chain, and wherein the power delivery circuit is included within each one of the devices in the daisy chain.

16. (Currently amended) The power delivery circuit of claim 13, wherein the information extracted by the load detector further comprises information regarding the identity of the connected device.

17. (Cancelled)

18. (Original) The power delivery circuit of claim 13, wherein the load detector is further configured to detect removal of one of the plurality of devices from the network.

19. (Original) The power delivery circuit of claim 13, wherein the load detector is further configured to detect connection of a new device to the network.

20-21. (Cancelled)

22. (Currently amended) A method of delivering power to one of a plurality of devices connected in a daisy chain, the method comprising:

detecting a load in [[the]] a first device of the plurality of devices including detecting a load current flowing through the load;

extracting information from the first device based on the detected load current; and

relaying power to the first device based on the extracted information~~[[.]]~~;

wherein the information extracted comprises information regarding whether the first device is powered on or powered off, and whether or not the first device needs a supply of power.

23. (Currently amended) The method of claim 22, wherein the information extracted from the device further comprises information regarding the identity of the first device[[,]], ~~and information regarding whether the device needs a supply of power.~~

Please add the following new claims:

24. (New) The method of claim 22, further comprising:
detecting removal of a device of the plurality of devices.

25. (New) The method of claim 22, further comprising:
detecting connection of a new device to the plurality of devices.

REMARKS

Claims 1-23 are currently pending, with claim 1-12, 20, and 21 being withdrawn.

Claims 13, 16, 22, and 23 have been amended. Claim 1-12, 17, 20, and 21 are cancelled.

New claims 24 and 25 have been added.

Therefore, claims 13-16, 18, 19, and 22-25 are now presented for examination.

Claim Rejections under 35 U.S.C. §103

Moon in view of Karam

The Office Action rejects claims 13-16, 18, 19, 22, and 23 under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 5,783,926 of Moon, et al. (hereinafter referred to as “*Moon*”) in view of U.S. Patent Application Publication No. 2006/0100799 of Karam (hereinafter referred to as “*Karam*”).

Claim 13 have been amended to incorporate the allowable subject matter of claim 17, the amended claim providing:

a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current;

wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off, and whether or not the connected device needs a supply of power.

In addition, independent claim 22 has been similarly amended, the claim as amended including the following:

detecting a load in a first device of the plurality of devices including
detecting a load current flowing through the load;

extracting information from the first device based on the detected load current; and

relaying power to the first device based on the extracted information;

wherein the information extracted comprises information regarding whether the first device is powered on or powered off, and whether or not the first device needs a supply of power.

It is submitted that independent claims 13 and 22 as amended are patentable over the combination of *Moon* and *Karam*.

The remaining rejected claims are dependent claims, and, while such claims have other differences with the cited combination of references, it is submitted that such claims are patentable as being dependent on the allowable base claims.

Allowable Subject Matter

The Applicant would like to thank the Examiner for Examiner's careful search, and the finding of allowable subject matter in claim 17 if claim 17 is rewritten in independent form including all limitations of the base claim and any intervening claims.

As indicated above, the subject matter of claim 17 has been incorporated into independent claim 13. Further, independent claim 23 has been amended similarly.

Claims 24 and 25 have been added, such claims being based upon the subject matter of currently pending claims 18 and 19.

Further, the previously withdrawn claims 13-19, 22, and 23 have been cancelled to place the pending claims into condition for allowance.

Conclusion

Applicants respectfully submit that the rejections have been overcome by the amendment and remarks, and that the claims as amended are now in condition for allowance. Accordingly,

applicants respectfully request the rejections be withdrawn and the claims as amended be allowed.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at 503-439-8778 if there remains any issue with allowance of the case.

Request for an Extension of Time

Applicants respectfully petition for a one-month extension of time to respond to the outstanding Office Action pursuant to 37 C.F.R. §1.136(a).

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: May 31, 2013

/Mark C. Van Ness/

Mark C. Van Ness

Reg. No. 39,865

1279 Oakmead Parkway
Sunnyvale, CA 94085-4040
(503) 531-7680

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Mark C. Van Ness/Andrea Dolder			
Attorney Docket Number:	8029P150			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with \$0 paid	1251	1	200	200

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				200

Electronic Acknowledgement Receipt

EFS ID:	15917296
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	65702
Filer:	Mark C. Van Ness/Andrea Dolder
Filer Authorized By:	Mark C. Van Ness
Attorney Docket Number:	8029P150
Receipt Date:	31-MAY-2013
Filing Date:	11-DEC-2009
Time Stamp:	13:56:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 200
RAM confirmation Number	218
Deposit Account	022666
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Extension of Time	8029P150ExtRequest.pdf	1740037	no	1
			f74253f7ea0eef00ec69332c39431da5823c77ab		

Warnings:

Information:

2		8029P150_Resp_to_OA.pdf	42448	yes	8
			c50056ce4c4f5bd73df55dbbc7bd117d9798618b		

Multipart Description/PDF files in .zip description

	Document Description	Start	End
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	4
	Applicant Arguments/Remarks Made in an Amendment	5	8

Warnings:

Information:

3	Fee Worksheet (SB06)	fee-info.pdf	30601	no	2
			bd0aa2e474ffdfcd660c964591adc122f152aad1		

Warnings:

Information:

Total Files Size (in bytes):			1813086
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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.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)		Docket Number (Optional) 8029P150
Application Number 12/636,063	Filed December 11, 2009	
For POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)		
Art Unit 2111	Examiner Khanh Dang	

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	<u>Fee</u>	<u>Small Entity Fee</u>	<u>Micro Entity Fee</u>	
☒ One month (37 CFR 1.17(a)(1))	\$200	\$100	\$50	\$ <u>200</u>
☐ Two months (37 CFR 1.17(a)(2))	\$600	\$300	\$150	\$ _____
☐ Three months (37 CFR 1.17(a)(3))	\$1,400	\$700	\$350	\$ _____
☐ Four months (37 CFR 1.17(a)(4))	\$2,200	\$1,100	\$550	\$ _____
☐ Five months (37 CFR 1.17(a)(5))	\$3,000	\$1,500	\$750	\$ _____

☐ 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.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to
Deposit Account Number 02-2666.

☒ Payment made via EFS-Web.

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.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration number 39,865.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Mark C. Van Ness/

May 31, 2013

Signature

Date

Mark C. Van Ness

503.439.8778

Typed or printed name

Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☒ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 12/636,063	Filing Date 12/11/2009	☐ To be Mailed
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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), (l), 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 \$ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$ =	
☐ 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	05/31/2013	CLAIMS REMAINING AFTER AMENDMENT	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 10	Minus	** 20	= 0	X \$40 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X \$210 =	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	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =
	☐ 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.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/VIOLA ROGERS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/636,063

12/11/2009

Dongyun Lee

8029P150

1550

65702

7590

02/01/2013

SILICON IMAGE/BSTZ

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP

1279 OAKMEAD PARKWAY

SUNNYVALE, CA 94085-4040

EXAMINER

DANG, KHANH

ART UNIT

PAPER NUMBER

2111

MAIL DATE

DELIVERY MODE

02/01/2013

PAPER

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.

Office Action Summary	Application No. 12/636,063	Applicant(s) LEE ET AL.	
	Examiner KHANH DANG	Art Unit 2111	

-- 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 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 18 December 2012.
- 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) 1-23 is/are pending in the application.
- 5a) Of the above claim(s) 1-12,20 and 21 is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 13-16,18,19,22 and 23 is/are rejected.
- 8) ☒ Claim(s) 17 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 ____ 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).
- a) ☐ All b) ☐ Some * c) ☐ None of:
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) | 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date ____. | 4) ☐ Other: ____. |

DETAILED ACTION

Election

Applicant's election of Species 2 (claims 13-19, 22, and 23 readable thereon) in the reply filed on 12/18/2012 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 103

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

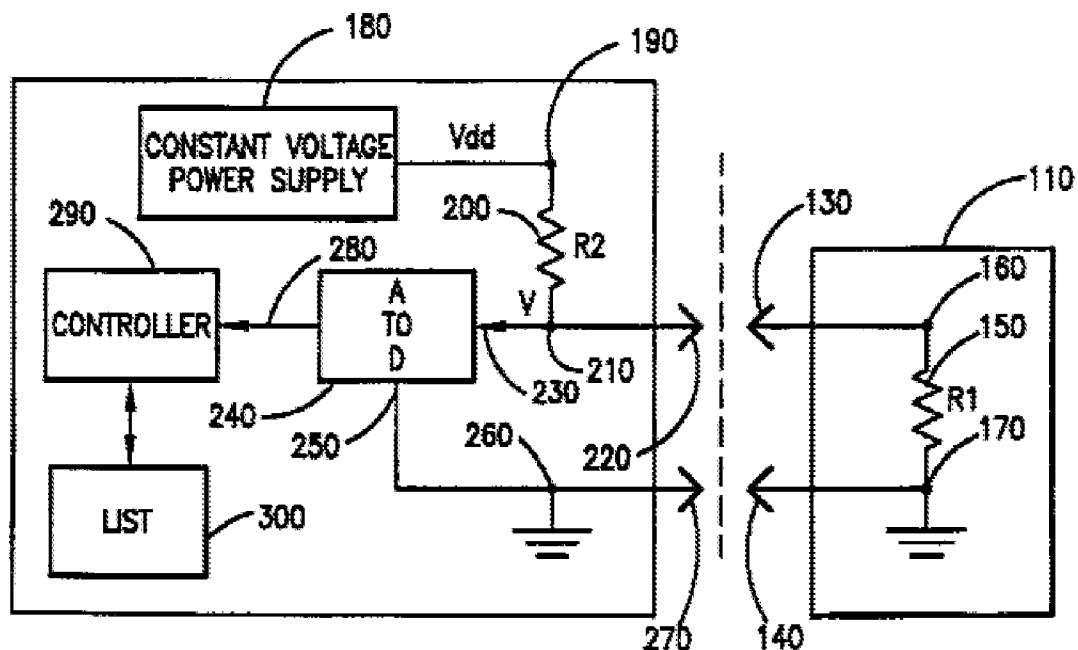
(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time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

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 13-16, 18, 19, 22, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moon et al. (Moon, 5783926) in view of Karam (2006/0100799).

With regard to claim 13, Moon discloses a power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising: a voltage source configured to generate a voltage; a signature resistor; and a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current (as shown in Fig. 2, which is reproduced below for ease of reference and convenience, Moon discloses a power delivery circuit comprising a voltage source 180, a signature resistor R1, and a load detector to detect a load of connected device 110 and to extract information about the connected device based on the load current. The load on resistor 150 (R1) is V which is a product of a current produced by $V_{dd}/R2$ and R1. See column 3, line 6 to column 4, line 55.



Moon does not disclose a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices 110.

Karam discloses a power delivery circuit and power device discovery and identification system comprising a switch for selectively connecting applying voltage across a signature resistor to identify power devices. See [0018] to [0025], Fig. 6 and description thereof.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide Moon with a voltage relay switch, as taught by Karam, for selectively applying voltage across a signature resistor of the power delivering circuit of Moon.

With regard to claim 14, it is clear from Karam that a controller is used to control opening and closing of the power relay switch.

With regard to claim 15, Karam also teaches connecting devices in daisy chain and providing power delivery circuit for each of the daisy-chained devices. See Fig. 6. Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to connect devices in daisy chain, as taught by Karam, for delivery power to and identifying a plurality of devices.

With regard to claim 16, it is clear from discussion above that the information extracted by the load detector comprises information regarding the identity of the connected device.

With regard to claim 18, it is clear from Moon in view of Karam that the load detector is further configured to detect removal of one of the plurality of devices 110 from the network.

With regard to claim 19, it is clear from Moon in view of LeMay that the load detector is further configured to detect connection of a new device 110 to the network.

With regard to claim 22, see discussion above.

With regard to claim 23, see discussion above. See also [0041] and [0042] of Karam.

Allowable Subject Matter

Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Dang whose telephone number is 571-272-3626. The examiner can normally be reached on Monday-Friday from 9:AM to 5:PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Vo, can be reached on 571-272-3642. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2111

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Khanh Dang/

Primary Examiner, Art Unit 2111

Notice of References Cited	Application/Control No. 12/636,063		Applicant(s)/Patent Under Reexamination LEE ET AL.	
	Examiner KHANH DANG		Art Unit 2111	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,783,926	07-1998	Moon et al.	320/106
*	B	US-2005/0132109	06-2005	Steger, Roland	710/104
*	C	US-8,122,159	02-2012	Monreal, Gerardo	710/9
*	D	US-5,983,288	11-1999	Visee, Maarten	710/16
*	E	US-5,428,752	06-1995	Goren et al.	710/300
*	F	US-4,575,714	03-1986	Rummel, Paul W.	340/468
*	G	US-7,856,561	12-2010	Stineman et al.	713/300
*	H	US-2006/0100799	05-2006	Karam, Roger A.	702/057
*	I	US-7,936,546	05-2011	Vorenkamp et al.	361/87
*	J	US-2008/0150718	06-2008	Apfel, Russell J.	340/568.2
*	K	US-2006/0164098	07-2006	Su, Kirk Tzukai	324/534
*	L	US-7,958,286	06-2011	Bresemann et al.	710/62
*	M	US-2004/0267974	12-2004	Dunstan, Robert A.	710/008

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Introduction to DiiVA, DiiVA Consortium, 2010.
	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.

Notice of References Cited	Application/Control No. 12/636,063		Applicant(s)/Patent Under Reexamination LEE ET AL.	
	Examiner KHANH DANG		Art Unit 2111	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2010/0100200	04-2010	Kim et al.	700/12
*	B	US-6,339,831	01-2002	Sugawara et al.	714/3
*	C	US-6,567,007	05-2003	Fritsche et al.	340/653
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Search Notes 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

SEARCHED			
Class	Subclass	Date	Examiner
307	42	12/28/2012	KD
	54		
710	104		
	305		
	313		
	8		
	9		
	15-17		

SEARCH NOTES			
Search Notes		Date	Examiner
East Search Note		12/28/2012	KD

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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BIB DATA SHEET

CONFIRMATION NO. 1550

SERIAL NUMBER 12/636,063	FILING or 371(c) DATE 12/11/2009 RULE	CLASS 307	GROUP ART UNIT 2111	ATTORNEY DOCKET NO. 8029P150		
APPLICANTS Dongyun Lee, Sunnyvale, CA; Edward Pak, Saratoga, CA; John Hahn, Los Altos, CA; Mayank Gupta, Sunnyvale, CA; ** CONTINUING DATA ***** This appln claims benefit of 61/201,727 12/11/2008 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED *** SMALL ENTITY ** 12/29/2009						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and /KHANH DANG/ Acknowledged Examiner's Signature		☐ Met after Allowance KD Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 7	TOTAL CLAIMS 23	INDEPENDENT CLAIMS 4
ADDRESS SILICON IMAGE/BSTZ BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP 1279 OAKMEAD PARKWAY SUNNYVALE, CA 94085-4040 UNITED STATES						
TITLE POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)						
FILING FEE RECEIVED 715	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit			

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	33075	((pod) (power adj4 diiva))	US-PGPUB; USPAT	OR	OFF	2012/12/26 10:38
L2	99	1 and (load adj current\$1)	US-PGPUB; USPAT	OR	OFF	2012/12/26 10:39
L3	27	1 and (load adj detect\$7)	US-PGPUB; USPAT	OR	OFF	2012/12/26 10:51
L4	5	((("7716386") or ("7539784") or ("20090282180") or ("20090172234") or ("7962661")).PN.	US-PGPUB; USPAT	OR	OFF	2012/12/26 11:17
L5	17	("4775931" "4951385" "5237257" "5420987" "5491830" "5530895" "5666557" "5698140" "5727169" "5727184" "6094053" "6339831" "6434632" "6442640" "6564278" "6615285" "7245501").PN. OR ("7962661").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:19
L6	13	("4816990" "5491830").PN. OR ("6564278").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:26
L7	28	("20020099878" "20030005274" "5257388" "5280202" "5418960" "5428752" "5600841" "5708819" "5796639" "5802074" "5809555" "5835931" "5854908" "5892973" "5948077" "5983288" "6000040" "6038629" "6052742" "6138182" "6188189" "6308240" "6340969" "6498759" "6559783" "6564278" "6606670").PN. OR ("6766401").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:31
L8	22	("5440244" "5532945" "5546590" "5606704" "5613130" "5634132" "5758171" "5768605" "5805473" "5862393").PN. OR ("6052742").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:34
L9	12	("4575714" "5159683" "5767500").PN. OR ("5983288").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:38
L10	34	("4467273").PN. OR ("4575714").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:40
L11	41	("4138599" "4524349" "4660141" "4889977" "5442512" "5505633" "5592361" "5642259" "5783926").PN. OR ("5948077").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:47

L12	28	("4593409" "4849682" "5164652" "5200686" "5206097" "5237257" "5298346" "5399446").PN. OR ("5783926").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 11:53
L13	10	("4301407" "5124661" "5247245" "5767500" "5781024" "5783926").PN. OR ("6567007").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 12:48
L14	25	("3922490" "3943348" "4041455").PN. OR ("4138599").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 12:52
L15	21	("4562535" "4589063" "4760553" "4825404" "5014193" "5109484" "5204669" "5274767" "5274771").PN. OR ("5428752").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 13:30
L16	28	("5148389" "5491830" "5530831" "5666557" "5865546" "5909596" "6044423").PN. OR ("6339831").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 13:54
L17	16048	((poe) (power adj4 ethernet))	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:00
L18	4729	((poe) (power adj4 ethernet)) and ((id) (identification))	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:05
L19	3746	((poe) (power adj4 ethernet)) and ((device\$1) adj2 (id) (identification))	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:05
L20	12	((poe) (power adj4 ethernet)) and ((device\$1) adj2 (id) (identification)) and resist\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:06
L21	516	((poe) (power adj4 ethernet)) and ((device\$1) adj2 (id) (identification)) and resist\$3 and voltage\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:06
L22	515	((poe) (power adj4 ethernet)) and ((device\$1) adj (id) (identification)) and resist\$3 and voltage\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:06
L23	0	((poe) (power adj4 ethernet)) and ((device\$1) adj (id) (identification)) and resist\$3 and voltage\$1 and diiva	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:07
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L26	53	((poe) (power adj2 ethernet)) and ((device\$1) adj (id) (identification)) and resist\$3 and voltage\$1 and sink\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:07
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L28	1	diiva and ((device\$1) adj (id) (identification)) and resist\$3 and voltage\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:12
L29	7	diiva and ((device\$1) adj (id) (identification))	US-PGPUB;	OR	OFF	2012/12/26 14:12

			USPAT			
L30	982315	diiva and (id) (identification)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:13
L31	12	diiva and (id identification)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:13
L32	1	diiva and (voltage\$1 current\$1 load\$1) adj detect\$7	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:15
L33	60	diiva	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:22
L34	601	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and (daisy chain)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:27
L35	76	34 and power and voltage\$1 and resistor\$1	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:27
L36	6384	(diiva hdmi) and (poll\$6 discover\$6 identif\$6)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:31
L37	0	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and cwitch\$5	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:32
L38	4096	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and switch\$5	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:32
L39	81	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and switch\$5 and (voltage\$1 current\$1 load\$1) adj (detect\$6)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:32
L40	20	(diiva hdmi) and (daisy chain) and switch\$5 and (voltage\$1 current\$1 load\$1) adj (detect\$6)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:42
L41	492	(diiva hdmi) and (daisy chain) and switch\$5 and (voltage\$1 current\$1 load\$1)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:44
L42	94	(diiva hdmi) and (daisy adj chain) and switch\$5 and (voltage\$1 current\$1 load\$1)	US-PGPUB; USPAT	OR	OFF	2012/12/26 14:45
L43	291434	(diiva hdmi) and (daisy adj chain) discovery	US-PGPUB; USPAT	OR	OFF	2012/12/26 15:09
L44	35	(diiva hdmi) and (daisy adj chain) and discovery	US-PGPUB; USPAT	OR	OFF	2012/12/26 15:09
L45	522	(diiva hdmi) and (serial series) and discovery	US-PGPUB; USPAT	OR	OFF	2012/12/26 15:10
L46	124	(diiva hdmi) and (serial series) and discovery and voltage\$1 and power	US-PGPUB; USPAT	OR	OFF	2012/12/26 15:10
L47	0	("2010/0100200").URPN.	USPAT	OR	OFF	2012/12/26 15:22
L48	18	("20020196611" "20060075152" "20090248924" "6593768" "6615301" "6718415" "6813654" "6907492"	US-PGPUB; USPAT;	OR	OFF	2012/12/26 15:26

		"7099981" "7146446" "7328297" "7363415" "7363416" "7376779" "7711865" "7711870" "7788428" "7805553").PN. OR ("8275914").URPN.	USOCR			
L49	4	"6789136"	US- PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 15:31
L50	1	("2004/0267974").URPN.	USPAT	OR	OFF	2012/12/26 15:32
L51	9	("20030023777" "4660141" "5313595" "5398265" "5428752" "5761697" "6092138" "6553437" "6564278").PN. OR ("7076571").URPN.	US- PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 15:33
L52	152	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and (daisy chain) and (set-top settop)	US- PGPUB; USPAT	OR	OFF	2012/12/26 15:42
L53	19	(diiva hdmi) and (poll\$6 discover\$6 identif\$6) and (daisy adj chain) and (set-top settop)	US- PGPUB; USPAT	OR	OFF	2012/12/26 15:42
L54	1	("20060064730").PN.	US- PGPUB; USPAT	OR	OFF	2012/12/26 16:04
L55	1	("8122159").PN.	US- PGPUB; USPAT	OR	OFF	2012/12/26 16:16
L56	10	("20010011892" "20050128100" "20050132109" "20060224776" "20070198139" "5361260" "5646609" "5675811" "6563419" "7191269").PN. OR ("8122159").URPN.	US- PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 16:16
L57	56	("5454081" "5577205").PN. OR ("5675811").URPN.	US- PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 16:23
L58	14	("4964141" "4984190" "5410542" "5444847" "5559502" "5675811" "5793993" "5819051" "5852406" "5878234" "6073186" "6182175").PN. OR ("6421752").URPN.	US- PGPUB; USPAT; USOCR	OR	OFF	2012/12/26 16:25

12/ 26/ 2012 4:31:08 PM

C:\Users\kdang\Documents\EAST\Workspaces\virtual.wsp

<i>Index of Claims</i> 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	09/14/2012	12/31/2012						
	1	÷	N						
	2	÷	N						
	3	÷	N						
	4	÷	N						
	5	÷	N						
	6	÷	N						
	7	÷	N						
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	11	÷	N						
	12	÷	N						
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	15	÷	✓						
	16	÷	✓						
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	18	÷	✓						
	19	÷	✓						
	20	÷	N						
	21	÷	N						
	22	÷	✓						
	23	÷	✓						



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	8029P150

65702
SILICON IMAGE/BSTZ
BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

CONFIRMATION NO. 1550
POA ACCEPTANCE LETTER



Date Mailed: 01/04/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 12/18/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/tkim/

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

Our Docket No: 8029P150

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Dongyun Lee, et al.

Application No: 12/636,063

Filed: December 11, 2009

Title: POWER DELIVERY OVER
DIGITAL INTERACTION
INTERFACE FOR VIDEO AND
AUDIO (DIIVA)

Examiner: (To be assigned)

Art Unit: 2111

Conf. No.: 1550

RESPONSE TO REQUIREMENT FOR ELECTION OF SPECIES

Commissioner for Patents:

In response to the Requirement for Election of Species dated October 18, 2012, Applicant hereby submits a response and amendment.

CERTIFICATE OF TRANSMISSION

This correspondence is being submitted electronically via EFS Web prior to 11:59pm on the date shown below.

Date: December 18, 2012 /Andrea Dolder/
Andrea Dolder

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Withdrawn) A system for delivering power over a network of devices connected through a serial link, the system comprising:

a first differential pair of wires and a second differential pair of wires, both differential pairs included in the serial link; and

a voltage source configured to generate a voltage for delivery to one or more of the devices over the first and second differential pairs of wires;

wherein the first differential pair of wires is double AC coupled by a first HPF (high pass filter) on one side and by a second HPF on an opposite side; and

wherein the second differential pair of wires is double AC coupled by a third HPF on one side and by a fourth HPF on an opposite side.

2. (Withdrawn) The system of claim 1, further comprising:

a first LPF (low pass filter) that connects a portion of the first differential pair of wires between the first HPF and the second HPF to the voltage source; and

a second LPF that connects the portion of the first differential pair of wires to a load.

3. (Withdrawn) The system of claim 2, further including a third LPF that connects a portion of the second differential pair between the third HPF and the fourth HPF to a first ground, and a fourth LPF that connects the portion of the second differential pair to a second ground.

4. (Withdrawn) The system of claim 1,
wherein the devices include a source device and a sink device, the source device configured to generate video data and to transmit the video data to the sink device through one or more video links, the source device and the sink device configured to exchange user data with each other through a bi-directional hybrid link; and
wherein the user data comprising one or more of: control data, Ethernet data, USB data, audio data, and bulk data.
5. (Withdrawn) The system of claim 4, further comprising a third differential pair of wires and a fourth differential pair of wires, both pairs included in the serial link;
wherein the first, second and third differential pair of wires are used for the video links and are configured to transmit therethrough the video data; and
wherein the fourth differential pair of wires are used for the bi-directional hybrid link and is configured to transmit therethrough the user data.
6. (Withdrawn) The system of claim 5, wherein the first, second, third and fourth differential pairs of wires are located within a single cable.
7. (Withdrawn) The system of claim 6, wherein the cable comprises one of: a CAT5 cable; a CAT6 cable; and a CAT7 cable.
8. (Withdrawn) The system of claim 5,
wherein the third differential pair of wires is double AC coupled by a HPF on one side and by another HPF on an opposite side; and
wherein the fourth differential pair of wires is double AC coupled by a HPF on one side and by another HPF on an opposite side.

9. (Withdrawn) The system of claim 1, wherein the devices include at least one of: an unpowered device; and a self-powered device.
10. (Withdrawn) The system of claim 3, further comprising:
at least one ferrite bead configured to provide biasing to the portion of the first differential pair of wires between the first HPF and the second HPF; and
at least one ferrite bead configured to provide biasing to the portion of the second differential pair of wires between the third HPF and the fourth HPF.
11. (Withdrawn) The system of claim 3, wherein the first ground and the second ground are different.
12. (Withdrawn) The system of claim 3, wherein the first ground and the second ground are identical.
13. (Original) A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising:
a voltage source configured to generate a voltage;
a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices;
a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and
a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current.

14. (Original) The power delivery circuit of claim 13, further comprising a controller that controls opening and closing of the power relay switch.
15. (Original) The power delivery circuit of claim 13, wherein the plurality of devices are connected to each other through a daisy chain, and wherein the power delivery circuit is included within each one of the devices in the daisy chain.
16. (Original) The power delivery circuit of claim 13, wherein the information extracted by the load detector comprises information regarding the identity of the connected device.
17. (Original) The power delivery circuit of claim 13, wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off; and whether or not the connected device needs a supply of power.
18. (Original) The power delivery circuit of claim 13, wherein the load detector is further configured to detect removal of one of the plurality of devices from the network.
19. (Original) The power delivery circuit of claim 13, wherein the load detector is further configured to detect connection of a new device to the network.
20. (Withdrawn) A system comprising:
 - a source device configured to generate and transmit digital video data;
 - a sink device configured to receive the digital video data from the source device through a video link, and to exchange user data with the source device through a bi-directional hybrid link;

at least one client device connected between the source device and the sink device;
wherein the source device, the client device, and the sink device are connected through a daisy chain; and

wherein the sink device, when powered on, is configured to supply power to the client device at a level sufficient to allow the client device to enter a mode in which user data can flow through the client device, and is further configured to supply power to the source device through the client device so as to permit the source device to be powered on.

21. (Withdrawn) The system of claim 20, wherein the user data comprising one or more of: control data, Ethernet data, USB data, audio data, and bulk data.

22. (Original) A method of delivering power to one of a plurality of devices connected in a daisy chain, the method comprising:

detecting a load in the device;

extracting information from the device based on the detected load; and

relaying power to the device based on the extracted information.

23. (Original) The method of claim 22, wherein the information extracted from the device comprises information regarding the identity of the device, and information regarding whether the device needs a supply of power.

REMARKS / ARGUMENTS

Claims 1-23 are currently pending.

No claims have been amended. Claim 1-12, 20, and 21 are hereby withdrawn. No claims have been cancelled. No claims have been added.

Therefore, claims 13-19, 22, and 23 are now presented for examination.

Election of Species

In response to the Requirement for Election of Species dated October 18, 2012, applicants hereby elect **Species 2 – Claims 13-19, 22, and 23** for examination at this time. Consideration of the elected species is now respectfully requested.

Conclusion

Applicants respectfully submit that the claims are in condition for allowance. Accordingly, Applicants respectfully request the claims now be allowed.

Invitation for a Telephone Interview

The Examiner is requested to call the undersigned at 503-439-8778 if there remains any issue with allowance of the case.

Extension of Time

Applicant hereby requests a one-month extension of time to respond to the Requirement for Election of Species, and requests that the fee for such extension be charged to our Deposit Account No. 02-2666.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: December 18, 2012

/Mark C. Van Ness/

Mark C. Van Ness

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Sunnyvale, CA 94085-4040
(503) 531-7680

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Mark C. Van Ness/Andrea Dolder			
Attorney Docket Number:	SYN-004			
Filed as Large Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with \$0 paid	1251	1	150	150

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				150

Electronic Acknowledgement Receipt

EFS ID:	14507164
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Mark C. Van Ness/Andrea Dolder
Filer Authorized By:	Mark C. Van Ness
Attorney Docket Number:	SYN-004
Receipt Date:	18-DEC-2012
Filing Date:	11-DEC-2009
Time Stamp:	20:39:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 150
RAM confirmation Number	8202
Deposit Account	022666
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73.	StatementF.pdf	1418627	no	1
			2ed8d818df6b37de91c6235f1b9ed230cd144ab7		

Warnings:

Information:

2	Assignee showing of ownership per 37 CFR 3.73.	SynerchipAssignment.pdf	1846928	no	7
			afedf4cf35815f7ed0c79dd852b1722ffa3db638		

Warnings:

Information:

3	Power of Attorney	POAF.pdf	1513028	no	1
			136fe8b463b795ff29ff52c33c67f4cfc24a225		

Warnings:

Information:

4	Miscellaneous Incoming Letter	NotificationLossSmallEntityF.pdf	21326	no	1
			6d60932ee522af30d2278e9017c8af976fdd587f		

Warnings:

Information:

5	Extension of Time	ExtReq.pdf	33196	no	1
			b7a739d73934f12f4a57f70eb76c17745dba9df9		

Warnings:

Information:

6		RespElectSpecies.pdf	40731	yes	8
			8b885821c9f8a7916bcb6bbef8be66edae0a1797		

Multipart Description/PDF files in .zip description

	Document Description	Start	End
	Response to Election / Restriction Filed	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	8

Warnings:

Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	30553	no	2
			e256d3c0ab0a0b68580ca6ce6f9615e76903a901		
Warnings:					
Information:					
			Total Files Size (in bytes):	4904389	
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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.

STATEMENT UNDER 37 CFR 3.73(b)Applicant/Patent Owner: Dongyun Lee et al.Application No./Patent No.: 12/636,063Filed/Issue Date: December 11, 2009Titled: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)

Silicon Image, Inc. _____, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy therefore is attached.

OR

- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Dongyun Lee et al. (inventors) To: Synerchip Co. Ltd.The document was recorded in the United States Patent and Trademark Office at
Reel 024321, Frame 0918, or for which a copy thereof is attached.2. From: Synerchip Co., Ltd. To: Silicon Image, Inc.The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

- ☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Date

Printed or Typed Name

Title

This collection of information is required by 37 CFR 3.73(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.

PATENT ASSIGNMENT AGREEMENT

This Patent Assignment Agreement (this "*Assignment*") is made and entered into as of October 5, 2012, by and between Synerchip Co., Ltd., a Mauritius corporation ("*Assignor*"), and Silicon Image, Inc., a Delaware corporation ("*Assignee*").

WHEREAS, Assignee and Assignor have entered into that certain Asset Purchase Agreement, dated as of October 5, 2012 (the "*Purchase Agreement*"), pursuant to which Assignor sells and agreed to sell and assign, and Assignee has agreed to buy and acquire the Purchased Assets, as defined in the Purchase Agreement; and

WHEREAS, pursuant to the Purchase Agreement, Assignor desires to assign and transfer to Assignee all of Assignor's rights, titles and interests in and to those patents, and in and to the registrations and applications therefor, if any, (collectively the "*Patents*") that are part of the Purchased Assets, as set forth and identified in Schedule I attached hereto,

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor and Assignee each hereby agree as follows:

1. Assignment. Assignor, on behalf of itself and its subsidiaries, does hereby sell, assign, and transfer to Assignee, for itself and its successors, transferees, and assignees, all worldwide rights, title, and interest in and to all of the following patents, patent applications, and patent rights:

(a) the Patents;

(b) any and all patents and patent applications claiming priority from the item(s) above or from which the items above claim priority;

(c) all divisional, continuation, continuation-in-part, substitute, request for continued examination, renewal, reexamination, reissue, and other related extensions and applications thereto (including any and all foreign counterpart patents and applications) which have been or may be filed in the United States or elsewhere in the world;

(d) all patents (including reissues and re-examinations), which may be granted on any of (a) – (c), above; and

(e) all rights of priority in any of (a) – (d), above, together with all rights to recover damages for past and present infringements and any other causes of action related to any of (a) – (d), above, including but not limited to infringement of Assignor's provisional rights therein.

Assignor agrees that Assignee may apply for and receive patents for subject matter disclosed in any of (a) – (d), above in Assignee's own name.

2. Further Assurances. Assignor agrees to do the following, when reasonably requested, and without further consideration, in order to carry out the intent of this Assignment, and further

to cause its subsidiaries and employees (and to use its reasonable best efforts to cause non-employee inventors) to do the same: (1) execute all oaths, assignments, powers of attorney, applications, and other papers necessary or desirable to fully secure to Assignee the right, title and interest herein conveyed; (2) communicate to Assignee all known facts relating to the subject matter of the above-identified patents and applications; and (3) generally do all lawful acts that Assignee shall reasonably consider desirable for securing, maintaining, and enforcing worldwide patent protection relating to the subject matter of the patents and patent applications and for vesting in Assignee the right, title, and interest herein conveyed. Assignor further agrees to provide any successor, assign, or legal representative of Assignee with the benefits and assistance provided to Assignee hereunder.

Assignor grants the attorney of record the power to insert on this Assignment any further identification that may be necessary or desirable in order to comply with the rules of the United States Patent and Trademark Office, or rules of other entities including but not limited to United States or foreign governments or patent offices, for recordation of this document.

Assignor represents that Assignor has the rights, titles, and interests to convey as set forth herein, and covenants with Assignee that Assignor has not made and will not hereafter make any assignment, grant, mortgage, license, or other agreement affecting the right, title, and interest herein conveyed.

3. Miscellaneous. Capitalized terms used without definitions in this Assignment shall have the same meanings ascribed to such capitalized terms in the Purchase Agreement. This Assignment shall be construed and interpreted in accordance with the Purchase Agreement. Nothing in this Assignment shall, or shall be deemed to, modify or otherwise affect any provisions of the Purchase Agreement or affect or modify any of the rights or obligations of the parties under the Purchase Agreement. In the event of any conflict between the provisions hereof and the provisions of the Purchase Agreement, the provisions of the Purchase Agreement shall govern and control.

This Assignment may not be supplemented, altered or modified in any manner except by a writing signed by all parties hereto. The failure of any party to enforce any terms or provisions of this Assignment shall not waive any of its rights under such terms or provisions. This Assignment shall bind and inure to the benefit of the respective parties and their assigns, transferees and successors.

The internal law, without regard for conflicts of laws principles, of the State of Delaware shall govern the validity of this Assignment, the construction of its terms, and the interpretation and enforcement of the rights and duties of the parties hereto.

This Assignment may be executed in one or more counterparts, and by the different parties hereto in separate counterparts, each of which when executed will be deemed to be an original but all of which taken together will constitute one and the same agreement.

[Signature Page Follows]

IN WITNESS WHEREOF, the parties hereto have caused this Assignment to be executed by their duly authorized representatives.

SYNERCHIP Co., LTD.

By: David D. Lee

Name: David D. Lee

Title: CEO

SILICON IMAGE, INC.

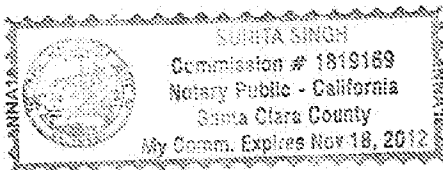
By: _____

Name: _____

Title: _____

[FORM OF NOTARIZATION]

This instrument was acknowledged before me on _____ (date) by _____ (name of person) as _____ (type of authority, e.g., officer, trustee, etc.) of _____ (name of party on behalf of whom instrument was executed).



Place Notary Seal Above

State of California County of Santa Clara ss.
On Oct 01, 2010 before me, Subita Singh,
Notary Public, personally appeared David Lee
who proved to me on the basis of satisfactory evidence to be the
person(s) whose name(s) is/are subscribed to the within instrument and
acknowledged to me that he/she/they executed the same in his/her/their
authorized capacity(ies), and that by his/her/their signature(s) on the
instrument the person(s), or the entity upon behalf of which the person(s)
acted, executed the instrument. I certify under PENALTY OF PERJURY
under the laws of the State of California that the foregoing paragraph is
true and correct. WITNESS my hand and official seal.

Signature of Notary Public Subita Singh

[SIGNATURE PAGE TO PATENT ASSIGNMENT AGREEMENT]

IN WITNESS WHEREOF, the parties hereto have caused this Assignment to be executed by their duly authorized representatives.

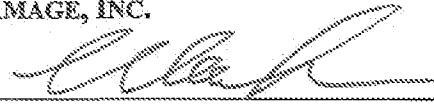
SYNERCHIP CO., LTD.

By: _____

Name: _____

Title: _____

SILICON IMAGE, INC.

By: 

Name: Camillo Marino

Title: CEO

[FORM OF NOTARIZATION]

This instrument was acknowledged before me on _____ (date) by
_____ (name of person) as _____ (type of authority, e.g.,
officer, trustee, etc.) of _____ (name of party on behalf of whom
instrument was executed).

Place Notary Seal Above

Signature of Notary Public

[SIGNATURE PAGE TO PATENT ASSIGNMENT AGREEMENT]

SCHEDULE I

ASSIGNED PATENTS

1. Title: Title: BI-DIRECTIONAL DIGITAL INTERFACE FOR VIDEO AND AUDIO (DiiVA)

Abstract of the Disclosure: Bi-directional home networking communication for video and audio. A communication system, comprising a first node, a second node, a serial communication link between the first node and the second node, configured to transmit digital video data from the first node to the second node over one or more video channels of the link. The communication system further including a hybrid link between the first node and the second node, wherein the first node and the second node are configured to transmit at least one stream of data to the other through a hybrid channel over the hybrid link. In the communication system, the bandwidth of the serial communication link is scaled according to a video pixel frequency. Further, the initial locking of the serial communication link is aided by clock information delivered over the hybrid link.

Date filed in US: 2008-03-27 w/application number No. 12/057,051

Date filed with PCT: 2009-03-24 w/application number PCT/US09/38077

Date filed in Taiwan: 2009-03-27 w/application number 98110096

Date filed in Japan: 2010-10-20 w/application number No. 2010-100060690

Filed in China: 2010-08-17 w/application number 200980100976.3

and Korea in October 27, 2010

2. Title: DIGITAL VIDEO INTERFACE WITH BI-DIRECTIONAL HALF-DUPLEX CLOCK CHANNEL USED AS AUXILIARY DATA CHANNEL

Abstract of the Disclosure: Using existing CE structure to also provide data in addition to video. A digital video interface system and method for communicating digital video data from a source device to a sink device is provided, where the clock channel is used to transmit data as well as clock signals in a bi-directional, half-duplex manner using time division multiplexing. The digital video interface system comprises one or more data channels configured to transmit digital video data from the source device to the sink device in time divisional multiplexing including a plurality of first time slots and second time slots, and a clock channel configured to transmit a clock signal from the source device to the sink device in the first time slots and configured to transmit additional data from the source device to the sink device or from the sink device to the source device in the second time slots.

Date filed in US: 2007-06-08 w/application number 11/760164 (Issued as Patent 7,940,809)

Date filed in Korea: 2008-04-08 w/application number 2008-32094 (Issued as Patent 10-965964)

Date filed in Taiwan: 2008-04-08 w/application number 97112652

Date filed in China: 2008-04-09 w/application number 200810091702.X. PATENT ISSUED JUNE 23, 2010. Authorized publication #CN101287088B

Date filed in Japan: 2008-04-09 w/application number No. 2008-101004

3. Title: ADAPTIVE EQUALIZER FOR USE WITH CLOCK AND DATA RECOVERY CIRCUIT OF SERIAL COMMUNICATION LINK

Abstract of the Disclosure: Intelligent use of data to determine quality of data transmission on hybrid channel. An adaptive equalizer system for use in a serial communication link uses timing information generated by a phase detector of a clock and data recovery circuit of the serial communication link and a frequency pattern of the recovered data to determine whether the data received over the serial communication link is over-equalized or under-equalized. The equalizer strength of the adaptive equalizer system is adjusted based on such determination.

Date filed in US: 2007-10-01 w/application number: 11/865621 (Patent issued as 7,916,780)

Date filed in Korea: 2008-04-08 w/application number 2008-32094

Date filed in Taiwan: 2008-04-08 w/application number: 97112651

Date filed in China: 2008-04-09 w/application number 200810091708.7

Date filed in Japan: 2008-04-09 w/application number No. 2008-101005

4. Title: PASSIVE EQUALIZER WITH NEGATIVE IMPEDANCE TO INCREASE GAIN

Date filed in Taiwan: 2008-05-29 w/application number: 97119835

Date filed in China: 2008-06-05 w/application number 200810109897.6

Date filed in Japan: 2008-10-03 w/application number 2008258225

Date filed in Korea: 2008-10-10 w/application number 10-2008-0099649 -- patent issued in Korea

Patent issued in US on 2010-06-15 w/patent no.: 7,737,802

5. Title: POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)

Abstract of the Disclosure: Transmission of power in addition to data, audio and video using DiiVA. An intelligent system for power delivery through double AC coupling, for an upstream device and a downstream device connected through a serial link.

Date filed with PCT: 2009-12-11 w/application number US09/67744

Date filed in US: 2009-12-11 w/application number: 12/636,063

Date filed in Taiwan: 2009-12-11 w/application number: 98142426

Date filed in China: 2010-08-17 w/application number: 200980105447.2

6. Title: MULTI-MEDIA USB DATA TRANSFER OVER DiiVA

Abstract of the Disclosure: A system for delivering USB data over a DiiVA network may include a USB host controller, at least one USB device, a first DiiVA device connected to the USB host controller through an upstream USB port, a second DiiVA device connected to the USB device through a downstream USB port; and a network configured to transfer data between the first DiiVA device and the second DiiVA device according to USB protocol through a DiiVA

bi-directional hybrid link in the network. The network is responsive to the USB host controller to deliver contents for the USB protocol through at least one line state information packet and at least one USB data packet transmitted through the hybrid link between the upstream USB port and the downstream USB port.

Date filed with PCT: 2011-1-12 w/application number PCT/US11/21031

Date filed in US: 2012-7-12 w/application number: 13/521,739

Date filed in Japan: 2012-7-12

Date filed in China: 2012-7-12

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POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS	Application Number	12/636,063
	Filing Date	December 11, 2009
	First Named Inventor	Dongyun Lee
	Title	POWER DELIVERY OVER . . .
	Art Unit	2111
	Examiner Name	Khanh Dang
	Attorney Docket Number	8029P150

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

65702

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number.

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.

Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature

Date

Name

Telephone

Title and Company

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Our Docket No: 8029P150

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Dongyun Lee et al.

Application No: 12/636,063

Filed: December 11, 2009

Title: POWER DELIVERY OVER
DIGITAL INTERACTION
INTERFACE FOR VIDEO AND
AUDIO (DIIVA)

Examiner: Khanh Dang

Art Unit: 2111

Conf. No.: 1550

**NOTIFICATION OF LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS
UNDER 37 CFR § 1.27(g)(2)**

Commissioner for Patents:

Applicants hereby submit notification, in accordance with the requirements of 37 CFR
§ 1.27(g)(2), that they no longer have status as a small entity.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Date: December 18, 2012 /Mark C. Van Ness/
Mark C. Van Ness
Reg. No. 39,865

1279 Oakmead Parkway
Sunnyvale, CA 94085-4040
(503) 531-7680

CERTIFICATE OF TRANSMISSION

This correspondence is being submitted electronically via EFS Web prior to 11:59pm on the date shown below.

Date: December 18, 2012 /Andrea Dolder/
Andrea Dolder

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)		Docket Number (Optional) 8029P150
Application Number 12/636,063	Filed December 11, 2009	
For POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DIIVA)		
Art Unit 2111	Examiner Khanh Dang	

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	<u>Fee</u>	<u>Small Entity Fee</u>	
☒ One month (37 CFR 1.17(a)(1))	\$150	\$75	\$ <u>150</u>
☐ Two months (37 CFR 1.17(a)(2))	\$570	\$285	\$ _____
☐ Three months (37 CFR 1.17(a)(3))	\$1,290	\$645	\$ _____
☐ Four months (37 CFR 1.17(a)(4))	\$2,010	\$1,005	\$ _____
☐ Five months (37 CFR 1.17(a)(5))	\$2,730	\$1,365	\$ _____

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

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to
Deposit Account Number 02-2666.

☐ Payment made via EFS-Web.

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.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).
- ☒ attorney or agent of record. Registration number 39,865.
- ☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Mark C. Van Ness/

December 18, 2012

Signature

Date

Mark C. Van Ness

503.531.7680

Typed or printed name

Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☒ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). 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 6 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: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/636,063		Filing Date 12/11/2009		☐ To be Mailed	
APPLICATION AS FILED – PART I										
(Column 1)			(Column 2)			SMALL ENTITY ☒ OR		OTHER THAN SMALL ENTITY		
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	OR	RATE (\$)	FEE (\$)			
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A				
☐ SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A			N/A				
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	minus 20 =	*	X \$	=	OR	X \$	=			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X \$	=		X \$	=			
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 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.										
APPLICATION AS AMENDED – PART II										
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	12/18/2012	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	* 23	Minus	** 23	=	0	OR	X \$	=	
	Independent (37 CFR 1.16(h))	* 4	Minus	*** 4	=	0	OR	X \$	=	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE		
(Column 1)			(Column 2)			SMALL ENTITY OR		OTHER THAN SMALL ENTITY		
AMENDMENT	Total (37 CFR 1.16(i))	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	OR	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	*	Minus	**	=		OR	X \$	=	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		OR	X \$	=	
☐ Application Size Fee (37 CFR 1.16(s))										
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))										
					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 number found in the appropriate box in column 1.										

Legal Instrument Examiner:
/NICOLE LOVE-HENSLEY/

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.**

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/636,063	12/11/2009	Dongyun Lee	SYN-004	1550

87708 7590 10/18/2012
Elizabeth Eunjoo Kim
Elizabeth Kim Patent Law Offices, LLC
43 Hackensack Road
Chestnut Hill, MA 02467-9998

EXAMINER

DANG, KHANH

ART UNIT	PAPER NUMBER
----------	--------------

2111

NOTIFICATION DATE	DELIVERY MODE
-------------------	---------------

10/18/2012

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):

ekim@ekimpatentlaw.com

Office Action Summary	Application No.	Applicant(s)	
	12/636,063	LEE ET AL.	
	Examiner	Art Unit	
	KHANH DANG	2111	

-- 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 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, 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 ____.
- 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) 1-23 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) ____ is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☒ Claim(s) 1-23 are subject to restriction and/or election requirement.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☐ The drawing(s) filed on ____ 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).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
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) | 4) ☐ Interview Summary (PTO-413) |
| 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) ☐ Information Disclosure Statement(s) (PTO/SB/08) | 5) ☐ Notice of Informal Patent Application |
| Paper No(s)/Mail Date ____. | 6) ☐ Other: ____. |

Art Unit: 2111

DETAILED ACTION***Election/Restrictions***

This application contains claims directed to the following patentably distinct species: species 1 (claims 1-12); species 2 (claims 13-19, 22, and 23); and species 3 (claims 20 and 21). The species are independent or distinct because the species as claimed do not overlap in scope, i.e., are mutually exclusive; the species as claimed are not obvious variants; and the species as claimed are either not capable of use together or can have a materially different design, mode of operation, function, or effect. In addition, these species are not obvious variants of each other based on the current record. In addition, these species are not obvious variants of each other based on the current record.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species, or a single grouping of patentably indistinct species, for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, no claim is generic.

There is a search and/or examination burden for the patentably distinct species as set forth above because at least the following reason(s) apply:

The species require a different field of search (e.g., searching different classes/subclasses or electronic resources, or employing different search queries); and/or the prior art applicable to one species would not likely be applicable to another species; and/or the species are likely to raise different non-prior art issues under 35

Art Unit: 2111

U.S.C. 101 and/or 35 U.S.C. 112, first paragraph. In addition, these species are not obvious variants of each other based on the current record.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species or a grouping of patentably indistinct species to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species or grouping of patentably indistinct species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species or grouping of patentably indistinct species.

Should applicant traverse on the ground that the species, or groupings of patentably indistinct species from which election is required, are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing them to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the

Art Unit: 2111

evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other species.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh Dang whose telephone number is 571-272-3626. The examiner can normally be reached on Monday-Friday from 9:AM to 5:PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Vo, can be reached on 571-272-3642. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 12/636,063

Page 5

Art Unit: 2111

/Khanh Dang/

Primary Examiner, Art Unit 2111

<i>Index of Claims</i> 	Application/Control No. 12636063	Applicant(s)/Patent Under Reexamination LEE ET AL.
	Examiner KHANH DANG	Art Unit 2111

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant		☐ CPA		☐ T.D.		☐ R.1.47			
CLAIM		DATE							
Final	Original	09/14/2012							
	1	÷							
	2	÷							
	3	÷							
	4	÷							
	5	÷							
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PLUS Search Results for S/N 12636063, Searched Wed Sep 28 15:05:48 EDT 2011

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

20100283324 88	6119183 45	3798003 33
5967853 45	6242911 45	4002500 33
4766402 45	6249475 45	4005521 33
5210523 45	20050052894 45	4050302 33
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5767698 45	20100142723 38	4136440 33
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4517553 33	4799544 33	
4521801 33	4800344 33	



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	SYN-004

CONFIRMATION NO. 1550

PUBLICATION NOTICE



OC000000044456328

87708

Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
Chestnut Hill, MA 02467-9998

Title:POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)

Publication No.US-2010-0283324-A1

Publication Date:11/11/2010

NOTICE OF PUBLICATION OF APPLICATION

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

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

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

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

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND
DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

November 9, 2010

RAUSCHENBACH PATENT LAW GROUP, LLP
43 HACKENSACK ROAD
CHESTNUT HILL, MA 02467-9998
US

Dear Sir/Madam,

Your refund request for 12636063 in the amount of \$310.00 has been denied.

Your request for refund has been denied, because the Office credited your American Express Credit Card in the amount of \$310.00 on July 28, 2010 for an due to a 3-month extension of time instead of a second-month extension of time.

Sincerely,


Cynthia Streater
OPAP
703-756-1137

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Dongyun Lee et al.
Serial No.: 12/636,063
Filed: December 11, 2009
Title: POWER DELIVERY OVER DIGITAL INTERACTIVE INTERFACT FOR VIDEO
AND AUDIO
Atty. Docket No.: SYN-004

Mail Stop 16 Director of the
USPTO P. O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR REFUND

Dear Sir:

Applicant respectfully requests a refund for overpaid fees.

Applicant filed a Response to Notice to File Missing Parts (mailed January 04 2010 by the USPTO) on May 02, 2010, with a Petition for Extension of Time for 3 months, and paid a 3-month fee of \$555. In actuality, an extension should have been for 2 months only (2-month fee is \$245). Accordingly, there currently is an overpayment to the U.S.P.T.O. of \$ 310.

Kindly consider a refund for this overpayment. The Commissioner is hereby authorized to charge any fees that may be due, or credit any overpayment of same to Deposit Account No. 50-4959.

Respectfully submitted,

/Elizabeth E. Kim/
Elizabeth E. Kim, Reg. No. 43,334
Rauschenbach Patent Law Group,
LLP
43 Hackensack Road
Chestnut Hill, MA 02467
Tel. (617) 2748641
Fax. (617) 274-8642

Date: October 13, 2010

Electronic Acknowledgement Receipt

EFS ID:	8616423
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	13-OCT-2010
Filing Date:	11-DEC-2009
Time Stamp:	13:46:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Refund Request	SYN-004_REQUEST_FOR_REFUND_10-13-10.pdf	95985 2105400b19a0847b051e5f0de3285f7cddbff65c	no	1

Warnings:

Information:

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

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
12/636,063	12/11/2009	2611	715	SYN-004	23	4

CONFIRMATION NO. 1550

UPDATED FILING RECEIPT



87708
Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
Chestnut Hill, MA 02467-9998

Date Mailed: 08/02/2010

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

Applicant(s)

Dongyun Lee, Sunnyvale, CA;
Edward Pak, Saratoga, CA;
John Hahn, Los Altos, CA;
Mayank Gupta, Sunnyvale, CA;

Assignment For Published Patent Application

SYNERCHIP CO., LTD., Hsinchu, TAIWAN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/201,727 12/11/2008

Foreign Applications

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

If Required, Foreign Filing License Granted: 12/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/636,063**

Projected Publication Date: 11/11/2010

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)

Preliminary Class

375

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 (1-866-999-4158).

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

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

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

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

NOT GRANTED

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

Electronic Patent Application Fee Transmittal

Application Number:

12636063

Filing Date:

11-Dec-2009

Adjustment date: 07/28/2010 NTEKLENI
05/03/2010 INTEFSW 00007538 12636063
01 FC:2253

07/28/2010 NTEKLENI 00000023 12636063
-555.00 DP

01 FC:2252

245.00 DP

Title of Invention:

POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)

Refund Ref:

07/28/2010

0030086671

Credit Card Refund Total: \$310.00

Am Exp.: XXXXXXXXXXXX3008

First Named Inventor/Applicant Name:

Dongyun Lee

Filer:

Elizabeth E. Kim.

Attorney Docket Number:

SYN-004

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with \$0 paid	2253	1	555	555

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Soon Yeong Heo, et al.
Serial No.: 12/065,662
Filed: July 25, 2008
Title: **SILVER ORGANO-SOL INK FOR FORMATTING ELECTRICALLY
CONDUCTIVE PATTERNS**
Atty. Docket No.: 081529-0013 (SHNJ-003)

CERTIFICATE OF ELECTRONIC SUBMISSION/FACSIMILE

I hereby certify that this correspondence is being electronically submitted, deposited with the U.S. Postal Service as first class mail in an envelope addressed to: Mail Stop Amendment, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450, or facsimile transmitted (571-273-8300) to the USPTO, on the date indicated below.

Date: September 22, 2008


Marilyn Warren

Mail Stop 16
Director of the USPTO
P. O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR REFUND

Dear Sir:

Applicant respectfully requests a refund for overpaid fees. Applicant filed its U.S. National Stage under 35 USC 371 as a large entity in the amount of \$1,030.00, but, in actuality, it should have filed under small entity status (\$515.00), leaving an overpayment to the U.S.P.T.O. of \$515. Kindly consider a refund for this overpayment. The Commissioner is hereby authorized to charge any fees that may be due, or credit any overpayment of same to Deposit Account No. 50-1133.

Respectfully submitted,

/Elizabeth E. Kim/
Elizabeth E. Kim, Reg. No. 43,334
McDermott Will & Emery LLP
28 State Street
Boston, MA 02109
Tel (617) 535-4411
Fax (617) 535-3800

Date: September 22, 2008

Electronic Acknowledgement Receipt

EFS ID:	8073547
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	22-JUL-2010
Filing Date:	11-DEC-2009
Time Stamp:	18:21:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	SYN-004_Refund_Request.pdf	47488 7fd762dfda2b81a4a5c32cd09853281df3c5cb65	no	1

Warnings:

Information:

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.

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Elizabeth E. Kim.			
Attorney Docket Number:	SYN-004			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with \$0 paid	2253	1	555	555

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				555

Electronic Acknowledgement Receipt

EFS ID:	7532021
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	02-MAY-2010
Filing Date:	11-DEC-2009
Time Stamp:	17:24:52
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$555
RAM confirmation Number	7538
Deposit Account	504959
Authorized User	KIM,ELIZABETH EUNJOO

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:
Charge any Additional Fees required under 37 C.F.R. Section 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	Fee Worksheet (PTO-875)	fee-info.pdf	30432 5be678ca6886acee46fff80cda5d88fb011dd2	no	2

Warnings:**Information:**

Total Files Size (in bytes):	30432
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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.

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.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2009 <i>(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)</i>		Docket Number (Optional) SYN-004																									
Application Number 12/636063		Filed December 11 2009																									
For POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)																											
Art Unit 2611		Examiner																									
<p>This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.</p> <p>The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"></th> <th style="width: 15%; text-align: center;"><u>Fee</u></th> <th style="width: 15%; text-align: center;"><u>Small Entity Fee</u></th> <th style="width: 30%;"></th> </tr> </thead> <tbody> <tr> <td>☐ One month (37 CFR 1.17(a)(1))</td> <td style="text-align: center;">\$130</td> <td style="text-align: center;">\$65</td> <td>\$ _____</td> </tr> <tr> <td>☐ Two months (37 CFR 1.17(a)(2))</td> <td style="text-align: center;">\$490</td> <td style="text-align: center;">\$245</td> <td>\$ _____</td> </tr> <tr> <td>☒ Three months (37 CFR 1.17(a)(3))</td> <td style="text-align: center;">\$1110</td> <td style="text-align: center;">\$555</td> <td>\$ <u>555</u></td> </tr> <tr> <td>☐ Four months (37 CFR 1.17(a)(4))</td> <td style="text-align: center;">\$1730</td> <td style="text-align: center;">\$865</td> <td>\$ _____</td> </tr> <tr> <td>☐ Five months (37 CFR 1.17(a)(5))</td> <td style="text-align: center;">\$2350</td> <td style="text-align: center;">\$1175</td> <td>\$ _____</td> </tr> </tbody> </table> <p>☒ Applicant claims small entity status. See 37 CFR 1.27.</p> <p>☐ A check in the amount of the fee is enclosed.</p> <p>☒ Payment by credit card. Form PTO-2038 is attached.</p> <p>☐ The Director has already been authorized to charge fees in this application to a Deposit Account.</p> <p>☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number <u>504959</u>.</p> <p>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.</p> <p>I am the ☐ applicant/inventor.</p> <p>☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).</p> <p>☒ attorney or agent of record. Registration Number <u>43334</u></p> <p>☐ attorney or agent under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 60%;"> <p><u>/Elizabeth Kim Reg. No. 43334/</u></p> <p style="text-align: center;">Signature</p> <p><u>Elizabeth Kim</u></p> <p style="text-align: center;">Typed or printed name</p> </div> <div style="width: 35%;"> <p><u>May 2 2010</u></p> <p style="text-align: center;">Date</p> <p><u>617-274-8641</u></p> <p style="text-align: center;">Telephone Number</p> </div> </div> <p>NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.</p> <p>☐ Total of _____ forms are submitted.</p>					<u>Fee</u>	<u>Small Entity Fee</u>		☐ One month (37 CFR 1.17(a)(1))	\$130	\$65	\$ _____	☐ Two months (37 CFR 1.17(a)(2))	\$490	\$245	\$ _____	☒ Three months (37 CFR 1.17(a)(3))	\$1110	\$555	\$ <u>555</u>	☐ Four months (37 CFR 1.17(a)(4))	\$1730	\$865	\$ _____	☐ Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$ _____
	<u>Fee</u>	<u>Small Entity Fee</u>																									
☐ One month (37 CFR 1.17(a)(1))	\$130	\$65	\$ _____																								
☐ Two months (37 CFR 1.17(a)(2))	\$490	\$245	\$ _____																								
☒ Three months (37 CFR 1.17(a)(3))	\$1110	\$555	\$ <u>555</u>																								
☐ Four months (37 CFR 1.17(a)(4))	\$1730	\$865	\$ _____																								
☐ Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$ _____																								

This collection of information is required by 37 CFR 1.136(a). 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 6 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.

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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Electronic Acknowledgement Receipt

EFS ID:	7532044
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	02-MAY-2010
Filing Date:	11-DEC-2009
Time Stamp:	18:25:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	SYN-004_Inventor_Declaration.pdf	232093 8c1a213761166ce355f3c553838b0218d9706022	no	4

Warnings:

Information:

2	Petition for review by the Office of Petitions.	SYN-004_Petition_for_Extension_of_Time_sb0022.pdf	331284 bfcc9ac1761601a4096c517d145f5e66efe35f84	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			563377		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket Number	SYN-004	
		First Named Inventor	Dongyun Lee	
		COMPLETE IF KNOWN		
		Application Number	12/636,063	
		Filing Date	Dec. 11, 2009	
☐ Declaration Submitted With Initial Filing	OR	☒ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)	Art Unit	2611
			Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 12/11/2009 as United States Application Number or PCT International Application Number 12/636,063 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

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

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

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

[Page 1 of 3]

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 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.

DECLARATION — Utility or Design Patent Application

Claim of Foreign Priority Benefits

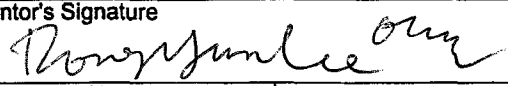
I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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.

DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐		The address associated with Customer Number: 87708		OR ☐		Correspondence address below	
Name							
Address							
City				State		Zip	
Country			Telephone			Email	
<p align="center">WARNING:</p> <p>Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: <i>Patent Application Files</i>. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: <i>Deposit Accounts and Electronic Funds Transfer Profiles</i>.</p> <p>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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.</p>							
NAME OF SOLE OR FIRST INVENTOR:				☐ A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Dongyun				Lee			
Inventor's Signature 					Date		
Residence: City		State		Country		Citizenship	
Sunnyvale		CA		US		KR	
Mailing Address							
1645 Lachine Drive							
City		State		Zip		Country	
Sunnyvale		CA		94087		US	
☒ Additional inventors or a legal representative are being named on the <u>1</u> supplemental sheet(s) PTO/SB/02A or 02LR attached hereto							

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet Page <u>1</u> of <u>1</u>
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Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Edward		Pak	
Inventor's Signature		Date <u>4/12/10</u>	
Saratoga Residence: City	CA State	US Country	US Citizenship
19834 Glen Brae Drive			
Mailing Address			
Saratoga City	CA State	Zip	US Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
John		Hahn	
Inventor's Signature		Date <u>4/15/2010</u>	
Los Altos Residence: City	CA State	US Country	US Citizenship
905 Loyola Drive			
Mailing Address			
Los Altos City	CA State	94024 Zip	US Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Mayank		Gupta	
Inventor's Signature		Date <u>4/12/10</u>	
Sunnyvale Residence: City	CA State	US Country	US Citizenship
480 Palmetto Drive			
Mailing Address			
Sunnyvale City	CA State	94086 Zip	US Country

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 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 (1-800-786-9199) and select option 2.

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.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2009 <i>(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)</i>		Docket Number (Optional) SYN-004																									
Application Number 12/636063		Filed December 11 2009																									
For POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)																											
Art Unit 2611		Examiner																									
<p>This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.</p> <p>The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;"></th> <th style="width: 15%; text-align: center;"><u>Fee</u></th> <th style="width: 15%; text-align: center;"><u>Small Entity Fee</u></th> <th style="width: 30%;"></th> </tr> </thead> <tbody> <tr> <td>☐ One month (37 CFR 1.17(a)(1))</td> <td style="text-align: center;">\$130</td> <td style="text-align: center;">\$65</td> <td>\$ _____</td> </tr> <tr> <td>☐ Two months (37 CFR 1.17(a)(2))</td> <td style="text-align: center;">\$490</td> <td style="text-align: center;">\$245</td> <td>\$ _____</td> </tr> <tr> <td>☒ Three months (37 CFR 1.17(a)(3))</td> <td style="text-align: center;">\$1110</td> <td style="text-align: center;">\$555</td> <td>\$ <u>555</u></td> </tr> <tr> <td>☐ Four months (37 CFR 1.17(a)(4))</td> <td style="text-align: center;">\$1730</td> <td style="text-align: center;">\$865</td> <td>\$ _____</td> </tr> <tr> <td>☐ Five months (37 CFR 1.17(a)(5))</td> <td style="text-align: center;">\$2350</td> <td style="text-align: center;">\$1175</td> <td>\$ _____</td> </tr> </tbody> </table> <p>☒ Applicant claims small entity status. See 37 CFR 1.27.</p> <p>☐ A check in the amount of the fee is enclosed.</p> <p>☒ Payment by credit card. Form PTO-2038 is attached.</p> <p>☐ The Director has already been authorized to charge fees in this application to a Deposit Account.</p> <p>☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number <u>504959</u>.</p> <p>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.</p> <p>I am the ☐ applicant/inventor.</p> <p>☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).</p> <p>☒ attorney or agent of record. Registration Number <u>43334</u></p> <p>☐ attorney or agent under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 60%;"> <p><u>/Elizabeth Kim Reg. No. 43334/</u></p> <p style="text-align: center;">Signature</p> <p><u>Elizabeth Kim</u></p> <p style="text-align: center;">Typed or printed name</p> </div> <div style="width: 35%;"> <p><u>May 2 2010</u></p> <p style="text-align: center;">Date</p> <p><u>617-274-8641</u></p> <p style="text-align: center;">Telephone Number</p> </div> </div> <p>NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.</p> <p>☐ Total of _____ forms are submitted.</p>					<u>Fee</u>	<u>Small Entity Fee</u>		☐ One month (37 CFR 1.17(a)(1))	\$130	\$65	\$ _____	☐ Two months (37 CFR 1.17(a)(2))	\$490	\$245	\$ _____	☒ Three months (37 CFR 1.17(a)(3))	\$1110	\$555	\$ <u>555</u>	☐ Four months (37 CFR 1.17(a)(4))	\$1730	\$865	\$ _____	☐ Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$ _____
	<u>Fee</u>	<u>Small Entity Fee</u>																									
☐ One month (37 CFR 1.17(a)(1))	\$130	\$65	\$ _____																								
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☐ Five months (37 CFR 1.17(a)(5))	\$2350	\$1175	\$ _____																								

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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.

Electronic Patent Application Fee Transmittal

Application Number:	12636063			
Filing Date:	11-Dec-2009			
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)			
First Named Inventor/Applicant Name:	Dongyun Lee			
Filer:	Elizabeth E. Kim.			
Attorney Docket Number:	SYN-004			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with \$0 paid	2253	1	555	555

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				555

Electronic Acknowledgement Receipt

EFS ID:	7532016
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	02-MAY-2010
Filing Date:	11-DEC-2009
Time Stamp:	17:15:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	SYN-004_Inventor_Declaration.pdf	232093 8c1a213761166ce355f3c553838b0218d9706022	no	4

Warnings:

Information:

2	Petition for review by the Office of Petitions.	SYN-004_Petition_for_Extension_of_Time_sb0022.pdf	331284 bfcc9ac1761601a4096c517d145f5e66efe35f84	no	2
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	30432 ba00b18a6c2fc4a98d25003d03fd09d9396ab7	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			593809		
<p>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)		Attorney Docket Number	SYN-004
		First Named Inventor	Dongyun Lee
		COMPLETE IF KNOWN	
		Application Number	12/636,063
		Filing Date	Dec. 11, 2009
		Art Unit	2611
☐ Declaration Submitted With Initial Filing OR ☒ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)		Examiner Name	

I hereby declare that: (1) Each inventor's residence, mailing address, and citizenship are as stated below next to their name; and (2) I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention titled:

POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)

(Title of the Invention)

the application of which

☐ is attached hereto

OR

☒ was filed on (MM/DD/YYYY) 12/11/2009 as United States Application Number or PCT International Application Number 12/636,063 and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified application, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

Authorization To Permit Access To Application by Participating Offices

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

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

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

[Page 1 of 3]

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 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.

DECLARATION — Utility or Design Patent Application**Claim of Foreign Priority Benefits**

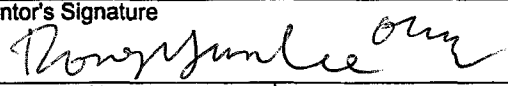
I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application number(s) are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

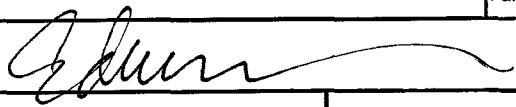
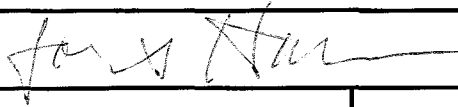
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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐		The address associated with Customer Number: 87708		OR ☐		Correspondence address below	
Name							
Address							
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Country			Telephone			Email	
<p align="center">WARNING:</p> <p>Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: <i>Patent Application Files</i>. Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: <i>Deposit Accounts and Electronic Funds Transfer Profiles</i>.</p> <p>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 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.</p>							
NAME OF SOLE OR FIRST INVENTOR:				☐ A petition has been filed for this unsigned inventor			
Given Name (first and middle [if any])				Family Name or Surname			
Dongyun				Lee			
Inventor's Signature 					Date		
Residence: City		State		Country		Citizenship	
Sunnyvale		CA		US		KR	
Mailing Address							
1645 Lachine Drive							
City		State		Zip		Country	
Sunnyvale		CA		94087		US	
☒ Additional inventors or a legal representative are being named on the <u>1</u> supplemental sheet(s) PTO/SB/02A or 02LR attached hereto							

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet Page <u>1</u> of <u>1</u>
--------------------	--

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Edward		Pak	
Inventor's Signature 		Date <u>4/12/10</u>	
Saratoga Residence: City	CA State	US Country	US Citizenship
19834 Glen Brae Drive			
Mailing Address			
Saratoga City	CA State	Zip	US Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
John		Hahn	
Inventor's Signature 		Date <u>4/15/2010</u>	
Los Altos Residence: City	CA State	US Country	US Citizenship
905 Loyola Drive			
Mailing Address			
Los Altos City	CA State	94024 Zip	US Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Mayank		Gupta	
Inventor's Signature 		Date <u>4/12/10</u>	
Sunnyvale Residence: City	CA State	US Country	US Citizenship
480 Palmetto Drive			
Mailing Address			
Sunnyvale City	CA State	94086 Zip	US Country

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
Chestnut Hill, MA 02467-9998



**Courtesy Reminder for
Application Serial No: 12/636,063**

Attorney Docket No: SYN-004
Customer Number: 87708
Date of Electronic Notification: 01/04/2010

This is a courtesy reminder that new correspondence is available for this application. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

ekim@rauschenbach.com
elizabethkim61@gmail.com

Please verify that these email addresses are correct.

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>. If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	SYN-004

CONFIRMATION NO. 1550

FORMALITIES LETTER



87708
Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
Chestnut Hill, MA 02467-9998

Date Mailed: 01/04/2010

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

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

- The oath or declaration is missing.

A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.

Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

Replies should be mailed to:

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

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

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/bnguyen/

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



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/636,063	12/11/2009	2611	715	SYN-004	23	4

CONFIRMATION NO. 1550

87708

Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
Chestnut Hill, MA 02467-9998

FILING RECEIPT



OC000000039397995

Date Mailed: 01/04/2010

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

Applicant(s)

Dongyun Lee, Sunnyvale, CA;
Edward Pak, Saratoga, CA;
John Hahn, Los Altos, CA;
Mayank Gupta, Sunnyvale, CA;

Assignment For Published Patent Application

SYNERCHIP CO., LTD., Hsinchu, TAIWAN

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/201,727 12/11/2008

Foreign Applications

If Required, Foreign Filing License Granted: 12/29/2009

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/636,063**

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

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)

Preliminary Class

375

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.

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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 (1-866-999-4158).

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NOT GRANTED

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CONFIRMATION NO. 1550

87708

Elizabeth Eunjoo Kim
Rauschenbach Patent Law Group, LLP
43 Hackensack Road
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NOT GRANTED

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/636,063	12/11/2009	Dongyun Lee	SYN-004

CONFIRMATION NO. 1550

FORMALITIES LETTER



87708
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Date Mailed: 01/04/2010

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FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SYN-004
		Application Number	
Title of Invention	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SYN-004
		Application Number	
Title of Invention	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)		

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Application Information:

Title of the Invention	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)		
Attorney Docket Number	SYN-004	Small Entity Status Claimed ☒	
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	7	Suggested Figure for Publication (if any)	1

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SYN-004
		Application Number	
Title of Invention	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)		

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☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
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Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	non provisional of	61201727	2008-12-11
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	SYN-004
		Application Number	
Title of Invention	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiVA)		

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Signature	/Elizabeth Kim, Reg. # 43334/			Date (YYYY-MM-DD)	2009-12-11
First Name	Elizabeth	Last Name	Kim	Registration Number	43334

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**POWER DELIVERY OVER
DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)**

[001] **CROSS-REFERENCE TO RELATED APPLICATIONS**

[002] The present application is based upon, and claims the benefit of priority under 35 U.S.C. § 119, to co-pending United States Provisional Patent Application No. 61/201,727 (the “’727 provisional application”), filed December 11, 2008 and entitled “Power Delivery Over Digital Interactive Interface For Video And Audio (DiiVA).” The content of the ‘727 provisional application is incorporated herein by reference in its entirety as though fully set forth.

[003] **BACKGROUND**

[004] DiiVA (Digital Interactive Interface For Video And Audio) is a bi-directional audio / video interface that allows uncompressed high-definition video, as well as multi-channel audio, high-bandwidth, and bi-directional data to be transferred over a single cable. DiiVA implements a bi-directional hybrid data channel capable of transporting user data, including but not limited to audio data, control data, Ethernet data, and bulk data. DiiVA allows users to connect, configure and control a plurality of consumer electronic devices (including without limitation DVD players, digital video recorders, set top boxes, personal computers, camcorders, cameras, and home stereo systems, just by way of example) from their digital TV or other DiiVA node.

[005] Methods and systems are needed for reliably delivering power over DiiVA.

[006] **SUMMARY**

[007] A system for delivering power over a network of devices connected through a serial link includes a first differential pair of wires and a second differential pair of wires. The first differential pair of wires is double AC coupled by a first HPF (high pass filter) on one side and by a second HPF on an opposite side. The second differential pair of wires is double AC coupled by a third HPF on one side and by a fourth HPF on an opposite side. A first LPF (low pass filter) connects a portion of the first differential pair of wires between the first HPF and the second HPF to a voltage source. A second LPF connects the portion of the first differential pair of wires to a

load. The system further includes a third differential pair of wires and a fourth differential pair of wires. All four differential pairs of wires are located within a single cable, such as a CAT6 cable. The first, second and third differential pair of wires are used for video links, and the fourth differential pair of wires are used for a bi-directional hybrid link.

[008] A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network includes a voltage source, and a power relay switch which can close to relay the voltage generated by the voltage source to the devices in the network. The circuit further includes a signature resistor for power source detection from one of the connected devices. A load detector is connected to the switch and reads a load current flowing therethrough in order to detect a load in a connected device and extract information about the connected device based on the load current.

[009] **BRIEF DESCRIPTION OF THE DRAWINGS**

[010] The drawings disclose illustrative embodiments. They do not set forth all embodiments. Other embodiments may be used in addition or instead. When the same numeral appears in different drawings, it is intended to refer to the same or like components or steps.

[011] Fig. 1 illustrates power delivery over DiiVA for an upstream device and a downstream device connected through a serial link, in accordance with one embodiment of the present disclosure.

[012] FIG. 2 illustrates the network topology for a power rail assigned to a DiiVA source device, in accordance with one embodiment of the present disclosure.

[013] FIG. 3 illustrates the network topology for a power rail assigned to a DiiVA sink device, in accordance with one embodiment of the present disclosure.

[014] FIG. 4 illustrates an exemplary POD (Power Over DiiVA) circuit, in accordance with one embodiment of the present disclosure.

[015] FIG. 5 provides a schematic overview of a DiiVA control protocol, in accordance with one

embodiment of the present disclosure.

[016] FIG. 6 illustrates a physical view and a link view of the connection between an active source device S4, POD clients S1-S3, and a POD server TV, in accordance with one embodiment of the present disclosure.

[017] FIG. 7 is a schematic diagram of one example of power delivery over DiiVA in a daisy chain configuration that includes one source device, one POD client, and one sink device.

[018] **DESCRIPTION**

[019] In the present disclosure, methods and systems are disclosed for delivering power over DiiVA. Illustrative embodiments are discussed. Other embodiments may be used in addition or instead.

[020] FIG. 1 illustrates power delivery over DiiVA between an upstream device and a downstream device connected through a serial link, in accordance with one embodiment of the present disclosure.

[021] In one embodiment, DiiVA implements serial link technology, i.e. sends information in bit stream format. The physical layer device performs parallel-to-serial conversion, then sends serial bits through a cable, which in one embodiment may be constructed using copper wire. A plurality of devices or nodes are connected through DiiVA in a daisy chain, in which the first device is connected through DiiVA to a second device, the second device is connected through DiiVA to a third device, and so on until the last device, with no loop-backs or webs.

[022] In one embodiment, DiiVA implements differential signaling, using two wires. When sending the bit “1,” plus voltage is put on one wire, and minus voltage is put on the other wire, and when sending the bit “0,” the polarity is flipped.

[023] In the embodiment illustrated in FIG. 1, an upstream device 105 is connected to a downstream device 106 through a serial link for which a single cable can be used. In one embodiment, the cable may be an Ethernet CAT6 cable. Other embodiments may use different

types of cables, including but not limited to the CAT5 cable and the CAT7 cable.

[024] In the illustrated embodiment, the cable includes four twisted pair wires, or differential pair wires. In the present application, a “differential pair wire” means two copper wires. In FIG. 1, the first pair is shown as VL0+ and VL0-, where VL stands for video link; the second pair is indicated as VL1+ and VL1-; the third pair is shown as VL2+ and VL2-; the fourth pair is shown as HL+ and HL-, where HL stands for hybrid link.

[025] As shown in FIG. 1, the first three differential pair wires (i.e. the first six copper wires, namely VL0+ and VL0-, VL1+ and VL1-, and VL2+ and VL2-) are used to transmit uncompressed video stream data, i.e. for the video links. Three differential pairs are assigned for video data, because the video links require a large bandwidth. The fourth differential pair wire, namely HL+ and HL-, is used for the hybrid link, through which all user data (including but not limited to Ethernet data, USB data, forward audio data, backward audio data, and control data) are transmitted.

[026] Because in the illustrated embodiment DiiVA transmits all data (including but not limited to all video data and user data) with only four twisted pair wires, DiiVA needs only eight connector pins. By using a single cheap and readily available commercial cable (CAT6, as one example), containing only four differential pair wires, to transmit data, cost effectiveness is significantly increased.

[027] While traditional 48 V power delivery uses a transformer for inductance coupling, high speed signals such as the multi-Gpbs signals supported by DiiVA cannot go through a transformer. In the embodiment illustrated in FIG. 1, double AC coupling is used to deliver power over DiiVA, instead of using inductance coupling to couple the incoming signal.

[028] In the illustrated embodiment, a first differential pair (VL0+, VL0-) of the serial link connection is doubly AC coupled using a first HPF (high pass filter) on one side and a second HPF on the other. Examples of HPFs are indicated with reference numeral 110. For clarity, not all the HPFs are labeled with reference numerals. A part of the first differential pair between the first and

the second HPFs are connected to a DC voltage source on one side through a first LPF (Low Pass Filter), and to a load on the other side through a second LPF.

[029] In the illustrated embodiment, a second differential pair of the serial link connection is doubly AC coupled with a third HPF on one side and a fourth HPF on the other. A part of the second differential pair between the third and the fourth HPFs are connected to a ground (shown in FIG. 1 as GND 1) on one side through the third LPF and to another ground (shown in FIG. 1 as GND 2) on the other side through the fourth LPF. The DC voltage source supplies a desired amount of current.

[030] The notation VD0, VD1, VD2, VD3 shown in FIG. 1 stands for voltage level, downstream port, for the corresponding differential pairs; the notation VU0, VU1, VU2, and VU3 shown in FIG. 1 stands for voltage level, upstream port, for the corresponding differential pairs.

[031] When both sides of a differential pair wire is doubly AC coupled, as illustrated in FIG. 1 and described above, the medium in-between is in a DC floating state. In the illustrated embodiment, ferrite beads, shown as rectangular elements in FIG. 1, may be used to perform biasing. In this way, DC components of the power may be delivered without undesirably affecting the main high speed signal. Some examples of the ferrite beads are indicated in FIG. 1 with reference numeral 120. For clarity, not all the ferrite beads are labeled with reference numerals.

[032] FIG. 2 illustrates the network topology for a power rail assigned to a DiiVA source device, in accordance with one embodiment of the present disclosure. FIG. 3 illustrates the network topology for a power rail assigned to a DiiVA sink device, in accordance with one embodiment of the present disclosure. FIGS. 2 and 3 illustrate the same topology, with only the direction reversed.

[033] The power rail shown as PR0 in FIG. 2 corresponds to the differential pairs denoted VL0 and VL1 in FIG. 1. The power rail shown as PR1 in FIG. 3 corresponds to the differential pairs denoted VL2 and HL in FIG. 1. In FIGS. 2 and 3, power is delivered through the upper differential pair in the power rails (PR0 and PR1, respectively) to a circuit 210, and the return or ground

current flows to ground through the lower differential pair in the power rails. In the embodiments illustrated in FIGS. 2 and 3, signature resistor 220 is used for detections.

[034] FIG. 4 is a schematic conceptual diagram of an exemplary POD (Power Over DiiVA) circuit, in accordance with one embodiment of the present disclosure. In one or more embodiments of the present disclosure, each device in the DiiVA network that supports POD contains such a POD circuit. In FIG. 4, both a POD circuit 401 for a downstream power channel (Tx (transmitter) to Rx (receiver)) and a POD circuit 402 for an upstream power channel (Rx to Tx) are illustrated. In one or more embodiments, both the downstream power channel and the upstream power channel may have a power delivery capacity of about 500 mA at about 5 V, over 2 pairs of signals. Other embodiments may have different power delivery capacities.

[035] In some embodiments (not illustrated), the downstream power channel and the upstream power channel may be aggregated to provide more power in the same direction.

[036] In the illustrative POD circuits shown in FIG. 4, the reference numerals 1, 2, 3, 4, 5, 6, 7, and 8 indicate copper wire numbering: “1,2” and “3,4” refer to the first two differential pairs of wires in the serial links connecting the devices in the DiiVA network, while “5,6” and “7,8” refer to the second two differential pairs of wires in the serial links. In the illustrated embodiment, one set of pairs (denoted “1,2” and “3,4”) are used to transmit power upstream, while the other set of pairs (denoted “5,6” and “7,8”) are used to transmit power downstream. In other embodiments, different arrangements of the wires may be used to transmit power upstream or downstream.

[037] In overview, the downstream POD circuit 401 includes: a voltage source 410 configured to generate a voltage (or equivalently, electric power); a power relay switch 420 configured to relay, when closed, the voltage generated by the voltage source 410 to one or more of the connected devices; a signature resistor 430 connected to the switch 420 and configured for power source detection from one or more of the connected devices; and a load detector 450 connected to the switch 420 and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current. A controller (not shown) controls the opening and closing of the power relay switch 420.

The upstream POD circuit 402 includes the same circuit components arranged in a symmetrically opposite configuration.

[038] The information extracted by the load detector 450 may include without limitation: information regarding the identity of the connected device; information regarding whether the connected device is powered on or powered off; and whether or not the connected device needs a supply of power. The load detector may also detect removal of one of the plurality of devices from the network, and/or connection of a new device to the network.

[039] When a load (typically one or more load resistors) is connected to the POD circuit 401 or 402, the POD load detector 450 detects current flow therethrough, to determine whether a device is connected, and if so, to obtain information about the connected device based on the load resistor value. For example, the POD load detector 450 may receive information from a connected device indicating that the device is self-powered, and thus does not need to be supplied with power. Alternatively, the POD load detector 450 may receive information from a connected device indicating that the device needs to be supplied with power.

[040] The POD circuit illustrated in FIG. 4 can perform a number of functions, including but not limited to: detecting power source from a neighboring device; detecting POD load in a neighboring device; detecting removal of a device and/or connection of a new device; detecting a hot plug; detecting a POD client device; detecting power-on or power-off state of a connected device; and relaying POD power, i.e. relaying POD current from one side to the other.

[041] FIG. 5 provides a schematic overview of a DiiVA control protocol, through which a source device 505 and a sink device (or display device) 506 can exchange command packets can be exchanged through a command sub-channel of a bi-directional hybrid link 534, in accordance with one embodiment of the present disclosure. As seen in FIG. 5, video data are transmitted in one direction only, i.e. downstream from a downstream port 510 in the source device 505 to an upstream port 515 in the sink device 506, through a video link 532.

[042] Data packets are exchanged between the source device 505 and the sink device 506 in both

directions through the bi-directional hybrid link 534. The hybrid link 534 thus allows high bandwidth bi-directional data to be transmitted between the source device 505 and the sink device 506 which are connected through a daisy chain. The hybrid link 534 carries data for a number of interfaces in a packetized manner, including without limitation: Forward Audio, Backward Audio, USB Data, Ethernet Data, and Command Channel.

[043] The video link 532 is a point to point interface. In some embodiments, the video link 532 carries uncompressed high definition video data, although it is not limited to carrying only uncompressed video data. The video data is carried over one or more lanes. In DiiVA, there may be 1, 2 or 3 lanes of data. The clock to operate the video link is embedded in the video data from the transmitter. While a uni-directional video link is shown in FIG. 5, other embodiments of the present disclosure may use bi-directional video links.

[044] FIG. 6 illustrates a physical layer view 610 and a link layer view 620, respectively, of one embodiment of an activation sequence in a daisy chain connection of devices including: an active source device S4, POD clients S1, S2, S3, and a POD server or sink device, which in the illustrate embodiment is a TV.

[045] The physical layer is responsible for physically transmitting and receiving the actual data over the medium. In one or more embodiments, the medium is industry standard Cat-6 cabling, although different types of medium can be used in other embodiments of the present disclosure. The data stream in the physical layer can be encoded in 8b-10b format.

[046] The link layer is responsible for prioritizing and packetizing all forms of data and sending it to the physical layer for transmission. The incoming data from the physical layer is de-packetized and forwarded to appropriate circuits for further processing.

[047] The devices in the daisy chain can operate in an active mode, a POD mode, or an off mode. In the active mode, the device is fully turned on, i.e. locally powered and fully functional. In this mode, all video and hybrid link data are processed on chip using local power.

[048] In the POD mode the video and hybrid link data is processed and serviced by the device. In this mode, the transmitter is able to communicate with the receiver in entirety through the POD mode device. In the off mode, the IC and all of the circuits are turned off. No communication takes place.

[049] In one embodiment, each device in the daisy chain supports a ping pong protocol, through which the device transmits back the data it received, and reverses the direction of the hybrid link, which is half-duplex. Every device connected through DiiVA supports this ping-pong protocol.

[050] In some embodiments, the hybrid link is a point to point half duplex interface, and is designed as a ping-pong or token passing interface. In a ping-pong interface, one device sends a message and then waits for a return message (or an acknowledgement or an idle packet), before sending another message. This operation can be summarized as follows: device A has the right to send and sends a packet; device B receives a packet; device B checks for correctness (no link errors); and device B acknowledges the packet.

[051] In one embodiment, power delivery over DiiVA is performed for a system that includes a source device, a sink device, and at least one client device connected between the source device and the sink device, all devices connected to each other through a daisy chain. The source device is configured to generate and transmit digital video data. The sink device is configured to receive the digital video data from the source device through a video link, and to exchange user data with the source device through a bi-directional hybrid link. In this embodiment, the sink device, when powered on, supplies power to the client device at a level sufficient to allow the client device to enter a mode in which user data can flow through the client device. The sink device supplies power to the source device through the client device so as to permit the source device to be powered on.

[052] FIG. 7 schematically illustrates an example of power delivery over DiiVA in a simple daisy chain configuration including one source device (in the example shown in FIG. 7, a DVD player), one POD client (in the example shown in FIG. 7, a set-up box), and one sink device (in the example shown in FIG. 7, a TV). In the illustrated embodiment, the TV first sends power to the

devices on the daisy chain. All source devices not locally powered (i.e. 'turned on') receive power from the TV over the DiiVA cable. The TV is POD server and the source devices not locally powered are POD clients. The client(s), in POD mode, operates the hybrid link in normal mode. All the devices discover each other through a hybrid link control protocol. The TV sends a command to the DVD player (source device) to turn itself on. The DVD player turns itself on, leaving the POD client mode, and sends video signals to the TV.

[053] In sum, methods and systems have been described for delivering power over DiiVA. The components, steps, features, objects, benefits and advantages that have been discussed are merely illustrative. None of them, nor the discussions relating to them, are intended to limit the scope of protection in any way. While certain embodiments have been described of systems and methods relating to power delivery over DiiVA, it is to be understood that the concepts implicit in these embodiments may be used in other embodiments as well. Numerous other embodiments are also contemplated, including embodiments that have fewer, additional, and/or different components, steps, features, objects, benefits and advantages. The components and steps may also be arranged and ordered differently. Nothing that has been stated or illustrated is intended to cause a dedication of any component, step, feature, object, benefit, advantage, or equivalent to the public.

[054] In the present disclosure, reference to an element in the singular is not intended to mean "one and only one" unless specifically so stated, but rather "one or more." All structural and functional equivalents to the elements of the various embodiments described throughout this disclosure, known or later come to be known to those of ordinary skill in the art, are expressly incorporated herein by reference.

What is claimed is:

1. A system for delivering power over a network of devices connected through a serial link, the system comprising:
 - a first differential pair of wires and a second differential pair of wires, both differential pairs included in the serial link; and
 - a voltage source configured to generate a voltage for delivery to one or more of the devices over the first and second differential pairs of wires;
 - wherein the first differential pair of wires is double AC coupled by a first HPF (high pass filter) on one side and by a second HPF on an opposite side; and
 - wherein the second differential pair of wires is double AC coupled by a third HPF on one side and by a fourth HPF on an opposite side.
2. The system of claim 1, further comprising:
 - a first LPF (low pass filter) that connects a portion of the first differential pair of wires between the first HPF and the second HPF to the voltage source; and
 - a second LPF that connects the portion of the first differential pair of wires to a load.
3. The system of claim 2, further including a third LPF that connects a portion of the second differential pair between the third HPF and the fourth HPF to a first ground, and a fourth LPF that connects the portion of the second differential pair to a second ground.
4. The system of claim 1,
 - wherein the devices include a source device and a sink device, the source device configured to generate video data and to transmit the video data to the sink device through one or more video links, the source device and the sink device configured to exchange user data with each other through a bi-directional hybrid link; and
 - wherein the user data comprising one or more of: control data, Ethernet data, USB data, audio data, and bulk data.
5. The system of claim 4, further comprising a third differential pair of wires and a fourth

differential pair of wires, both pairs included in the serial link;

wherein the first, second and third differential pair of wires are used for the video links and are configured to transmit therethrough the video data; and

wherein the fourth differential pair of wires are used for the bi-directional hybrid link and is configured to transmit therethrough the user data.

6. The system of claim 5, wherein the first, second, third and fourth differential pairs of wires are located within a single cable.

7. The system of claim 6, wherein the cable comprises one of: a CAT5 cable; a CAT6 cable; and a CAT7 cable.

8. The system of claim 5,
wherein the third differential pair of wires is double AC coupled by a HPF on one side and by another HPF on an opposite side; and
wherein the fourth differential pair of wires is double AC coupled by a HPF on one side and by another HPF on an opposite side.

9. The system of claim 1, wherein the devices include at least one of: an unpowered device; and a self-powered device.

10. The system of claim 3, further comprising:
at least one ferrite bead configured to provide biasing to the portion of the first differential pair of wires between the first HPF and the second HPF; and
at least one ferrite bead configured to provide biasing to the portion of the second differential pair of wires between the third HPF and the fourth HPF.

11. The system of claim 3, wherein the first ground and the second ground are different.

12. The system of claim 3, wherein the first ground and the second ground are identical.

13. A power delivery circuit configured to deliver power to one or more of a plurality of devices connected in a network, the power delivery circuit comprising:
- a voltage source configured to generate a voltage;
 - a power relay switch configured to relay, when closed, the voltage generated by the voltage source to one or more of the connected devices;
 - a signature resistor connected to the switch and configured to detect a power source from one or more of the connected devices; and
 - a load detector connected to the switch and configured to read a load current flowing therethrough so as to detect a load in one of the connected devices, and to extract information about the connected device based on the load current.
14. The power delivery circuit of claim 13, further comprising a controller that controls opening and closing of the power relay switch.
15. The power delivery circuit of claim 13, wherein the plurality of devices are connected to each other through a daisy chain, and wherein the power delivery circuit is included within each one of the devices in the daisy chain.
16. The power delivery circuit of claim 13, wherein the information extracted by the load detector comprises information regarding the identity of the connected device.
17. The power delivery circuit of claim 13, wherein the information extracted by the load detector comprises information regarding whether the connected device is powered on or powered off; and whether or not the connected device needs a supply of power.
18. The power delivery circuit of claim 13, wherein the load detector is further configured to detect removal of one of the plurality of devices from the network.
19. The power delivery circuit of claim 13, wherein the load detector is further configured to detect connection of a new device to the network.
20. A system comprising:

a source device configured to generate and transmit digital video data;

a sink device configured to receive the digital video data from the source device through a video link, and to exchange user data with the source device through a bi-directional hybrid link;

at least one client device connected between the source device and the sink device; wherein the source device, the client device, and the sink device are connected through a daisy chain; and

wherein the sink device, when powered on, is configured to supply power to the client device at a level sufficient to allow the client device to enter a mode in which user data can flow through the client device, and is further configured to supply power to the source device through the client device so as to permit the source device to be powered on.

21. The system of claim 20, wherein the user data comprising one or more of: control data, Ethernet data, USB data, audio data, and bulk data.

22. A method of delivering power to one of a plurality of devices connected in a daisy chain, the method comprising:

- detecting a load in the device;

- extracting information from the device based on the detected load; and

- relaying power to the device based on the extracted information.

23. The method of claim 22, wherein the information extracted from the device comprises information regarding the identity of the device, and information regarding whether the device needs a supply of power.

ABSTRACT

A system for delivering power over a network of devices connected through a serial link includes a first and second differential pairs of wires. Each differential pair of wires is double AC coupled by a HPF on one side and by another HPF on an opposite side. An LPF connects a portion of each differential pair of wires between the HPFs to a voltage source, and another LPF connects that portion of each differential pair to a load. The system further includes a third and fourth differential pairs of wires. All four differential pairs of wires are located within a single cable, such as a CAT6 cable. The first, second and third differential pair of wires are used for video links, and the fourth differential pair of wires are used for the bi-directional hybrid link. A power delivery circuit in each device includes a voltage source, a power relay switch, a signature resistor for detection, and a load detector.

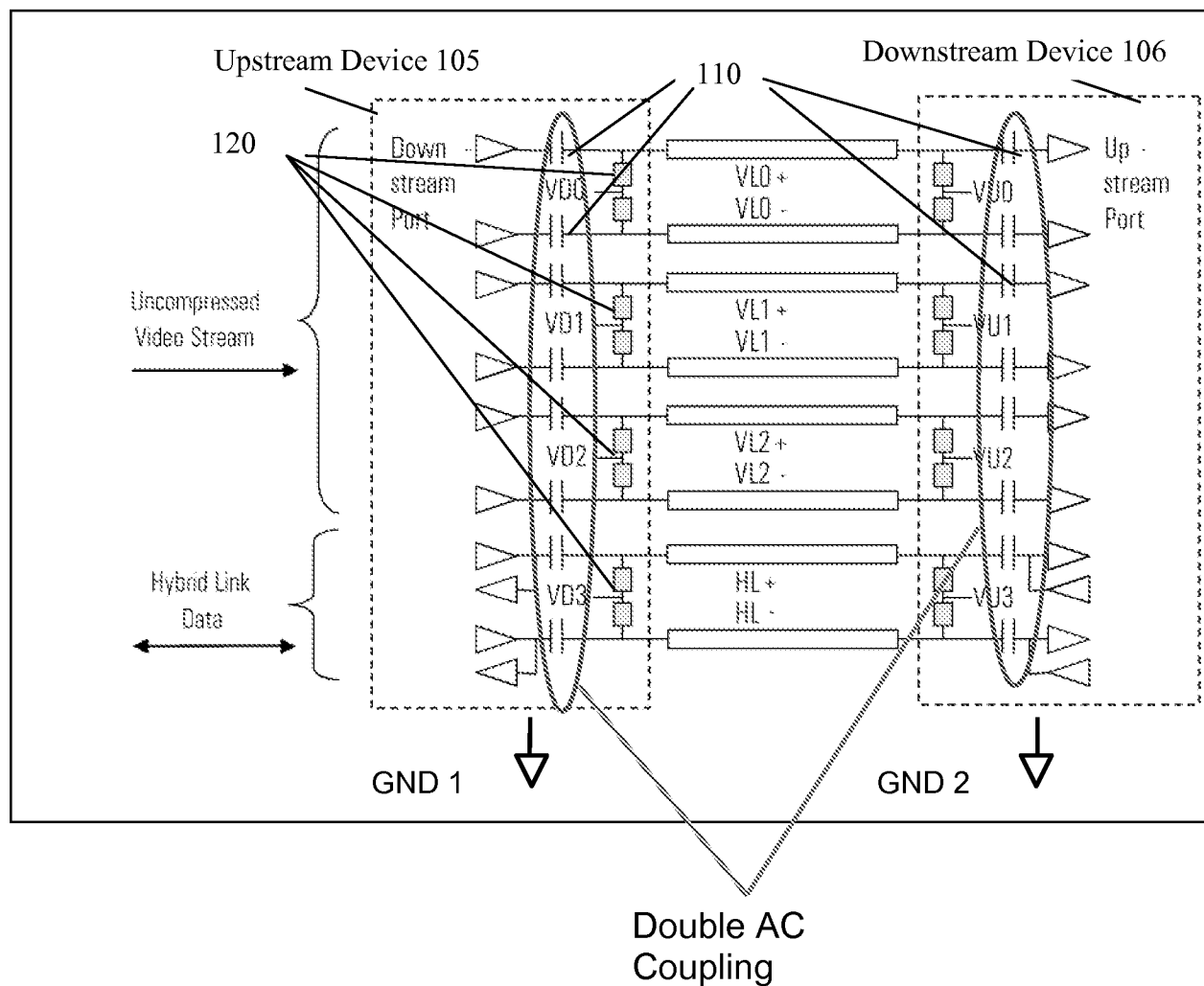


FIG. 1

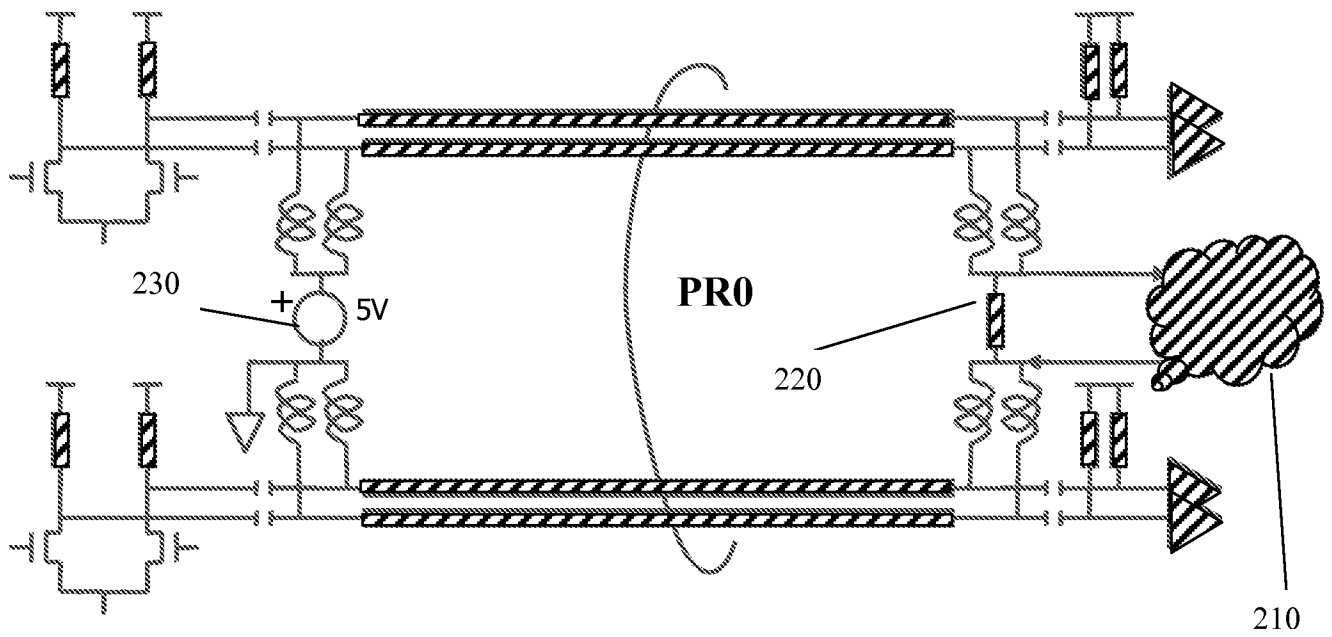


FIG. 2

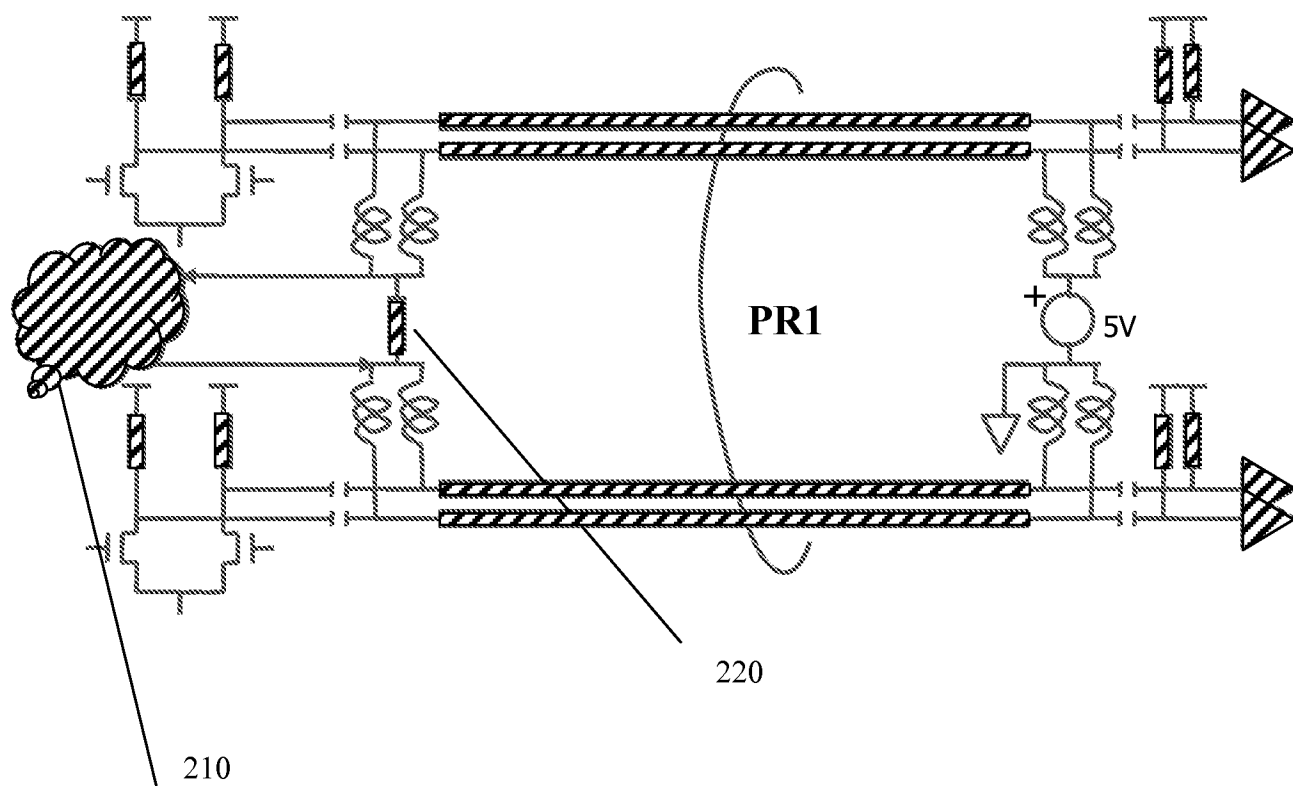


FIG. 3

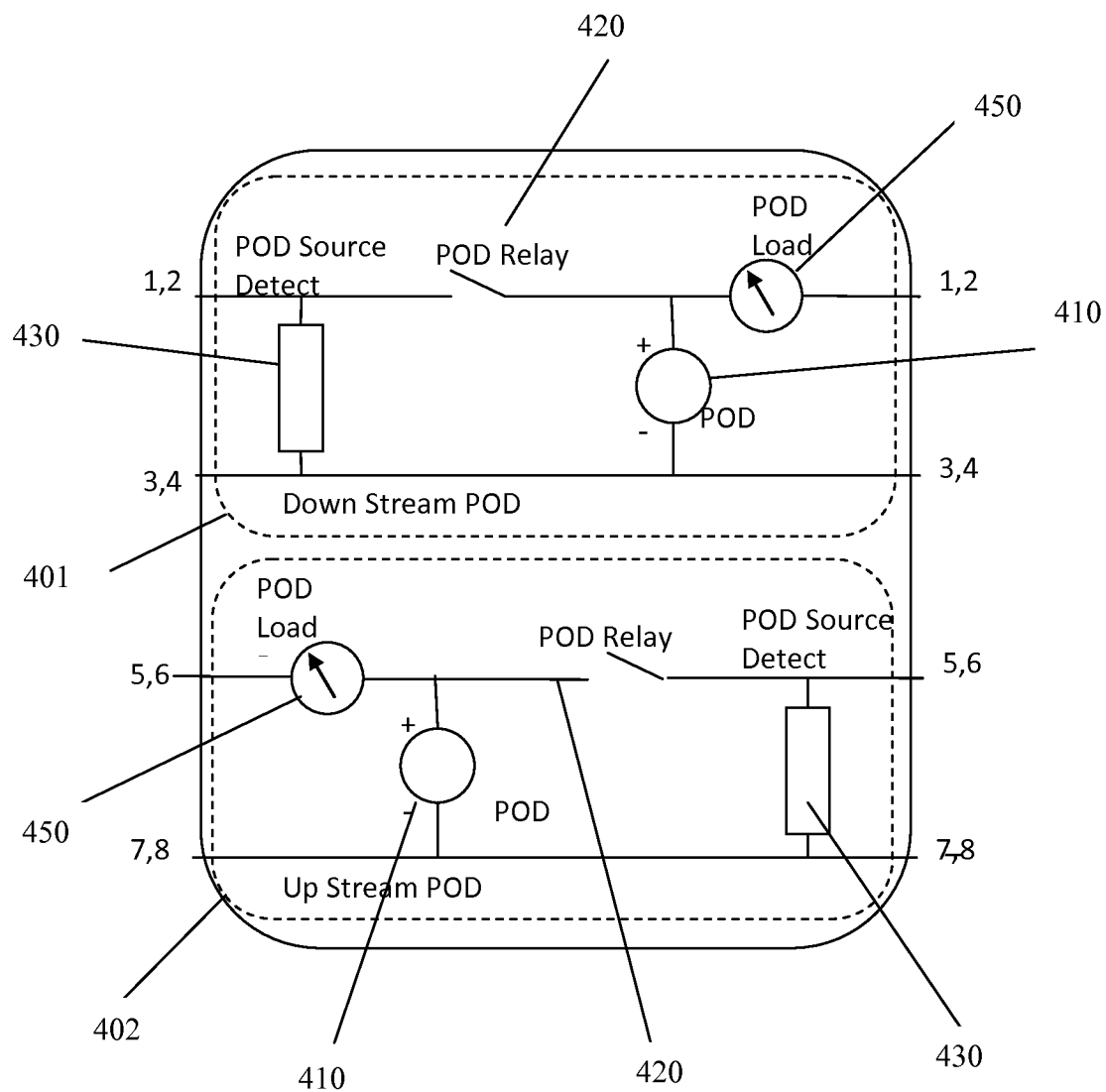


FIG. 4

Diva Control Protocol : Command Packets exchanged through the Hybrid Link Command Sub-Channel

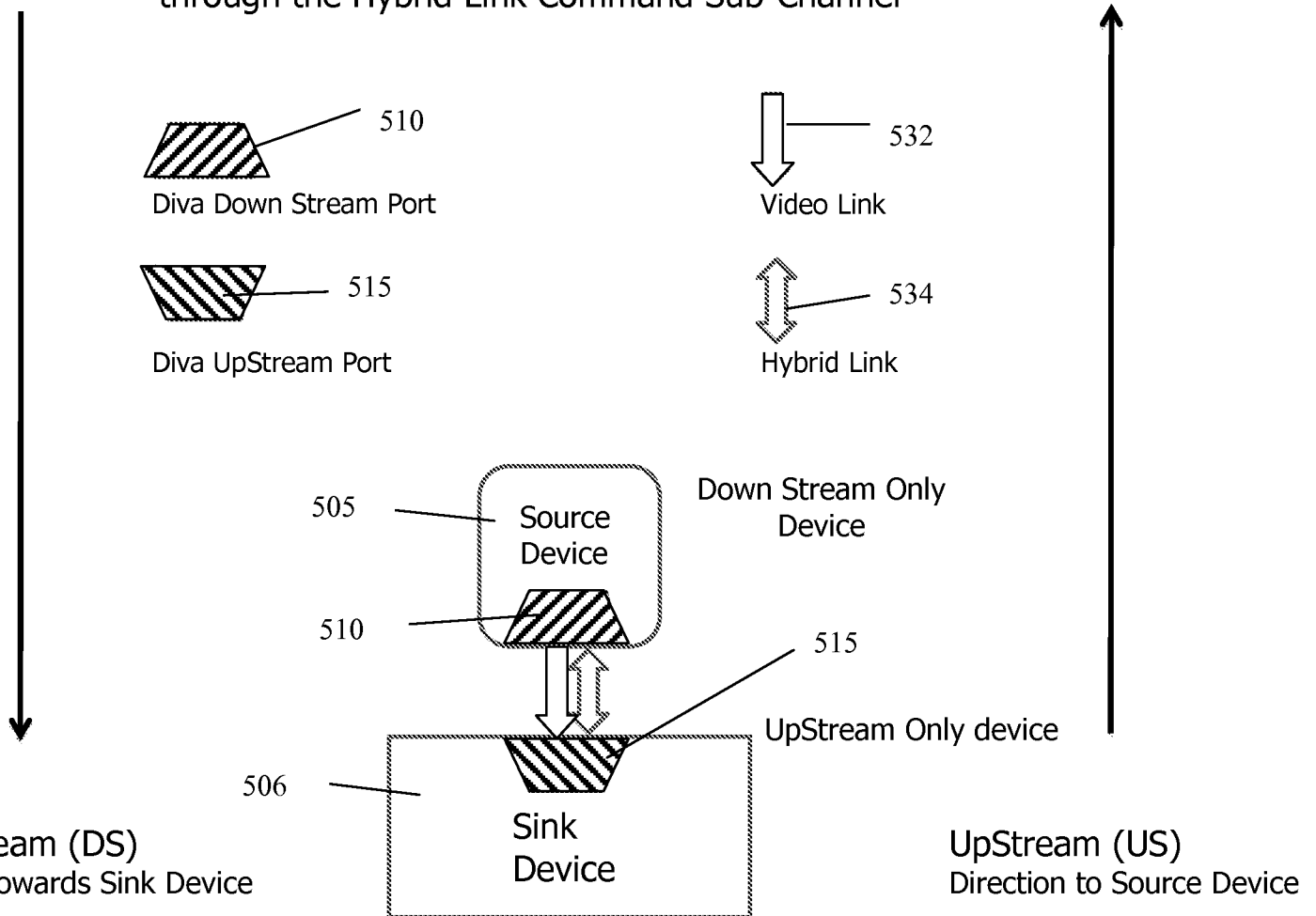


FIG. 5

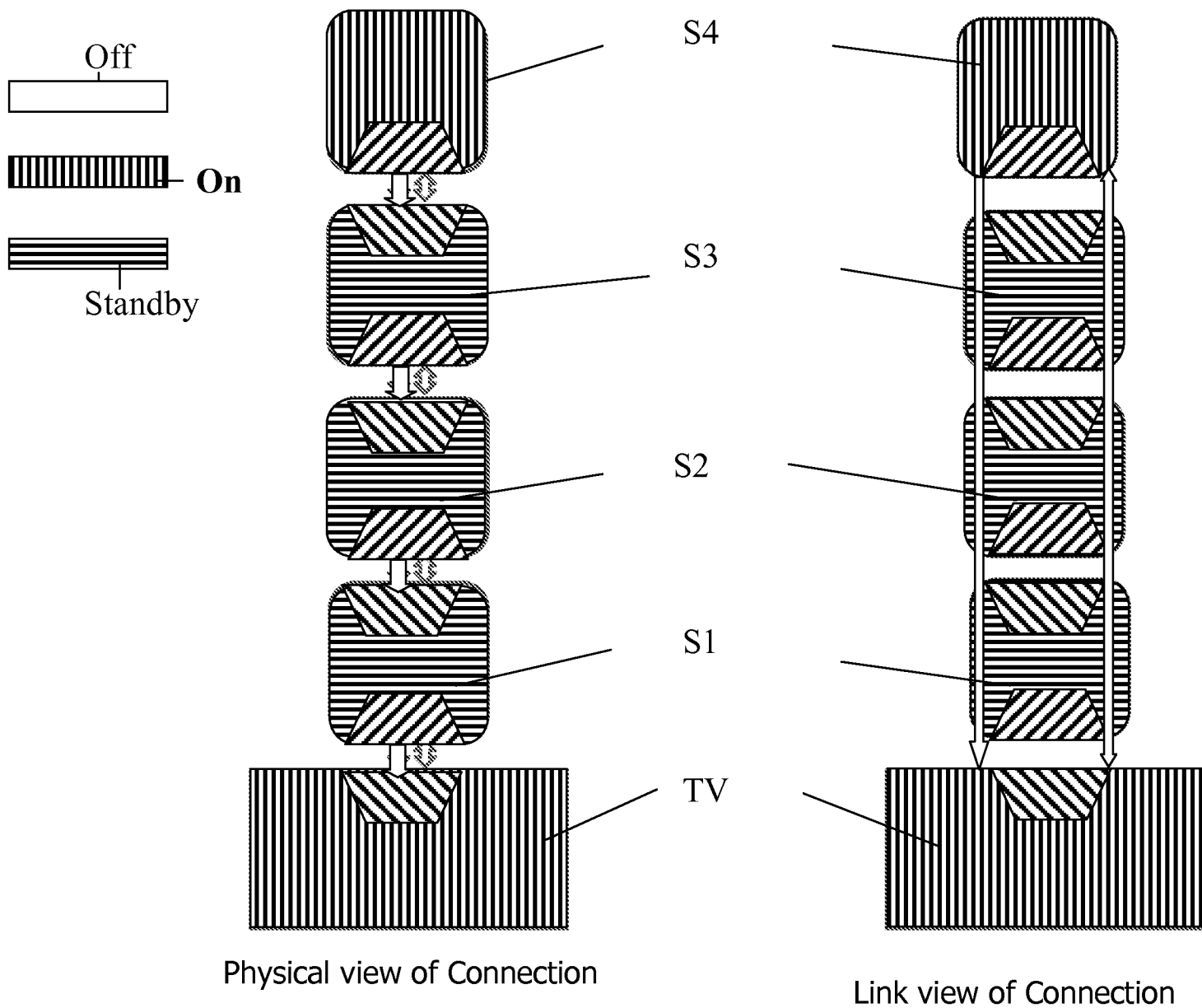


FIG. 6

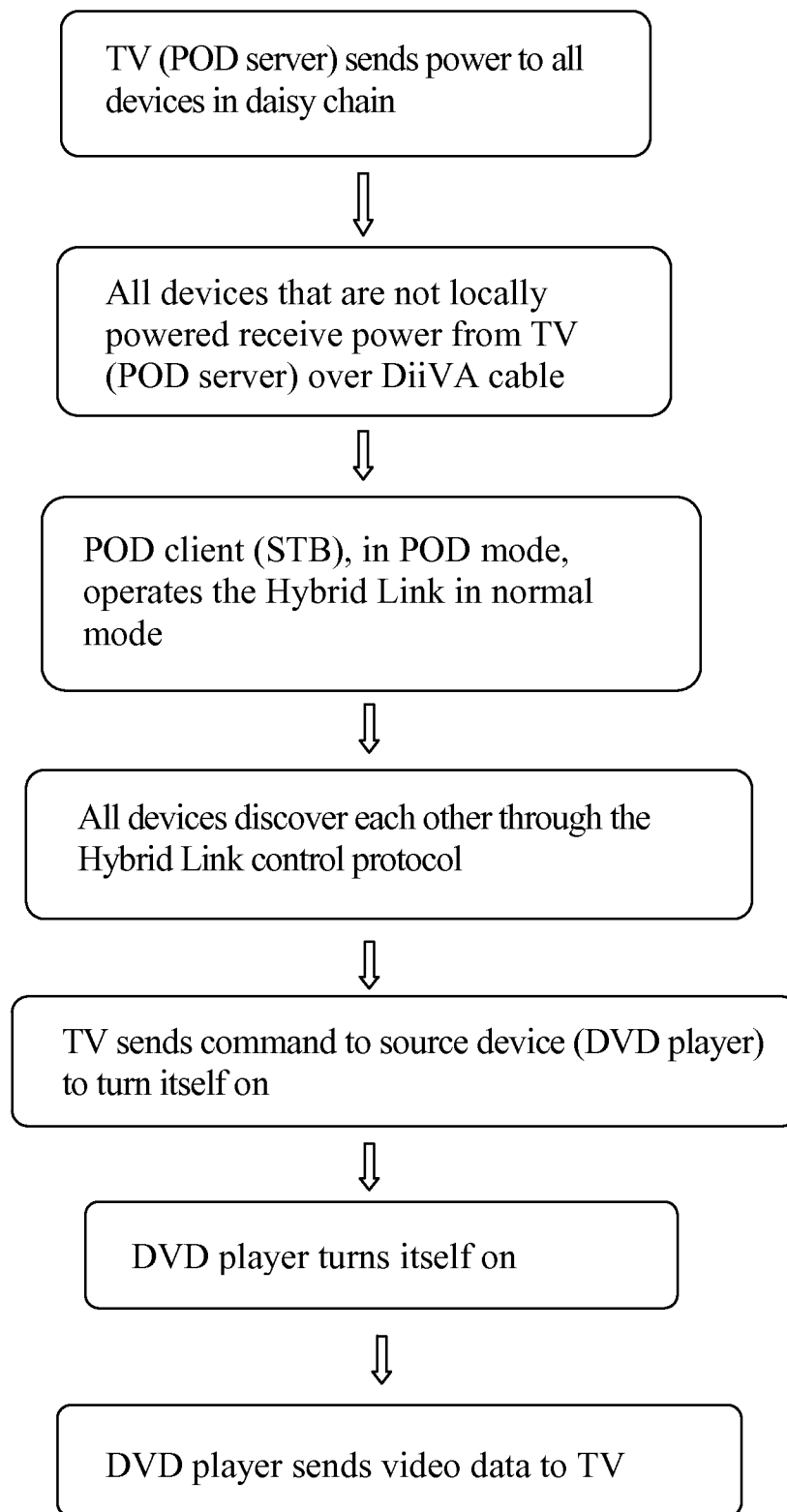


FIG. 7

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiIVA)		
First Named Inventor/Applicant Name:		Dongyun Lee		
Filer:		Elizabeth E. Kim.		
Attorney Docket Number:		SYN-004		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	82	82
Utility Search Fee	2111	1	270	270
Utility Examination Fee	2311	1	110	110
Pages:				
Claims:				
Claims in excess of 20	2202	3	26	78
Independent claims in excess of 3	2201	1	110	110
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Late filing fee for oath or declaration	2051	1	65	65
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				715

Electronic Acknowledgement Receipt

EFS ID:	6619666
Application Number:	12636063
International Application Number:	
Confirmation Number:	1550
Title of Invention:	POWER DELIVERY OVER DIGITAL INTERACTION INTERFACE FOR VIDEO AND AUDIO (DiiVA)
First Named Inventor/Applicant Name:	Dongyun Lee
Customer Number:	87708
Filer:	Elizabeth E. Kim.
Filer Authorized By:	
Attorney Docket Number:	SYN-004
Receipt Date:	11-DEC-2009
Filing Date:	
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Application Type:	Utility under 35 USC 111(a)

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Payment Type	Credit Card
Payment was successfully received in RAM	\$715
RAM confirmation Number	733
Deposit Account	504959
Authorized User	KIM,ELIZABETH EUNJOO

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	SYN-004_Application_Data_Sheet.pdf	965108 7cb99bf4b7107d857507142410d5855fe1ee35cc	no	5
Warnings:					
Information:					
2	Specification	SYN-004_Specification.pdf	142947 32e4f6dee12481e8dd7fa0376abef67d3865b722	no	15
Warnings:					
Information:					
3	Drawings-only black and white line drawings	SYN-004_Drawings.pdf	230468 702771e5ed6d65ff95cd0dcab953bf08de853d7cc	no	7
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	39712 199610dc129864e52deb3a2b6ce6c15cbb99affc	no	2
Warnings:					
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Total Files Size (in bytes):			1378235		
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Form Revision Date: February 8, 2006

Filing Date: 12/11/09

Approved for use through 7/31/2006. OMB 0651-0032

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 12/636,063			
APPLICATION AS FILED – PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA		RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)		
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	82	N/A			
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A		N/A	270	N/A			
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	110	N/A			
TOTAL CLAIMS (37 CFR 1.16(i))	23	minus 20 =		x\$26	78	x\$52			
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4	minus 3 =		x\$110	110	x\$220			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$260 (\$130 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR								
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				195		390			
				TOTAL	650	TOTAL			
* If the difference in column 1 is less than zero, enter "0" in column 2.									
APPLICATION AS AMENDED – PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	Minus	**	=	X =		X =		
	Independent (37 CFR 1.16(h))	Minus	***	=	X =		X =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A		
				TOTAL ADD'T FEE		TOTAL ADD'T FEE			
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY	
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)	ADDITIONAL FEE (\$)	
	Total (37 CFR 1.16(i))	Minus	**	=	X =		X =		
	Independent (37 CFR 1.16(h))	Minus	***	=	X =		X =		
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A		
				TOTAL ADD'T FEE		TOTAL ADD'T 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".

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