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(54) Title: DATA BUS INVERSION MEMORY CIRCUITRY, CONFIGURATION AND OPERATION

Perform Write DBI logic at Section

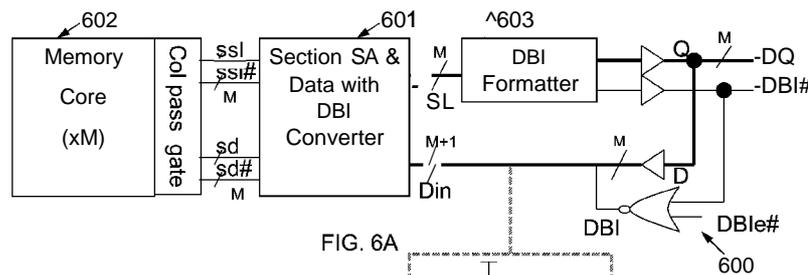
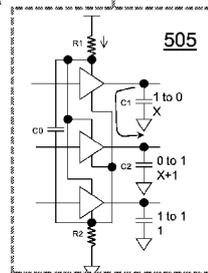


FIG. 6A



(57) Abstract: Systems, methods and fabrication processes relating to memory devices involving data bus inversion are disclosed. According to one illustrative implementation, a memory device may comprise a memory core, circuitry that receives a data bus inversion (DBI) bit associated with a data signal as input directly, without transmission through DBI logic associated with an input buffer, and circuitry that stores the DBI bit into the memory core, reads the DBI bit from the memory core, and provides the DBI bit as output. In further implementations, memory devices herein may store and process the DBI bit on an internal data bus as a regular data bit.



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/30899

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - G 11C 7/12 (2014.01) USPC - 365/189.07 According to International Patent Classification (IPC) or to both national classification and IPC</p>																	
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) IPC(8) Classification(s): IPC(8) Classification(s): G 11C 7/06, 7/10, 7/12 (2014.01) USPC Classification(s): 365/185.21 , 189.05, 189.07; CPC Classification(s): G 11C 7/06, 7/1006, 7/1084, 7/1051</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) MicroPatent (US-G, US-A, EP-A, EP-B, WO, JP-bib, DE-C.B, DE-A, DE-T, DE-U, GB-A, FR-A); ProQuest; IEEE; Google/Google Scholar, Espacenet; Keywords: dbi, inversion, conversion, address, compare, write, read, buffer, register, latch, bus, power, ground, circuit, logic, double data rate, clock</p>																	
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:15%;">Category*</th> <th style="width:65%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width:20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align:center">X ----- Y</td> <td>US 2009/0313521 A1, (HOLLIS), 17 December 2009; paragraphs [0020], [0032], [0036], [0042]</td> <td>1-2, 79, 101, 166 ----- 11-12, 21-22, 50-51, 58-59, 65, 71, 91, 96, 110, 119, 146, 153-154, 160, 170</td> </tr> <tr> <td style="text-align:center">X ----- Y</td> <td>US 2008/0019451 A1, (JANG, S. et al.), 24 January 2008; figure 1; paragraphs [0058], [0068].</td> <td>43, 139 ----- 11-12, 21-22, 110, 119</td> </tr> <tr> <td style="text-align:center">X ----- Y</td> <td>US 2012/0066570 A1, (BROWN, J. et al.), 15 March 2012; paragraphs [0035], [0054], [0074],</td> <td>32-33, 92, 95, 129, 171, 174 ----- 50-51, 58-59, 65, 71, 91, 96, 146, 153-154, 160, 170</td> </tr> <tr> <td style="text-align:center">Y</td> <td>US 2012/0243301 A1, (MAHESHWARI, D. et al.), 27 September 2012; paragraphs [0047], [0093], [0142],</td> <td>71</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X ----- Y	US 2009/0313521 A1, (HOLLIS), 17 December 2009; paragraphs [0020], [0032], [0036], [0042]	1-2, 79, 101, 166 ----- 11-12, 21-22, 50-51, 58-59, 65, 71, 91, 96, 110, 119, 146, 153-154, 160, 170	X ----- Y	US 2008/0019451 A1, (JANG, S. et al.), 24 January 2008; figure 1; paragraphs [0058], [0068].	43, 139 ----- 11-12, 21-22, 110, 119	X ----- Y	US 2012/0066570 A1, (BROWN, J. et al.), 15 March 2012; paragraphs [0035], [0054], [0074],	32-33, 92, 95, 129, 171, 174 ----- 50-51, 58-59, 65, 71, 91, 96, 146, 153-154, 160, 170	Y	US 2012/0243301 A1, (MAHESHWARI, D. et al.), 27 September 2012; paragraphs [0047], [0093], [0142],	71
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<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/></p>																	
<p>* Special categories of cited documents:</p> <table style="width:100%;"> <tr> <td style="width:50%;"> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="width:50%;"> <p>"T" later documents 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</p> <p>"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</p> <p>"Y" documents 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</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later documents 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</p> <p>"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</p> <p>"Y" documents 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</p> <p>"&" document member of the same patent family</p>													
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<p>Date of the actual completion of the international search</p> <p>19 August 2014 (19.08.2014)</p>		<p>Date of mailing of the international search report</p> <p align="center">29 OCT 2014</p>															
<p>Name and mailing address of the ISA/US</p> <p>Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201</p>		<p>Authorized officer :</p> <p align="center">Shane Thomas</p> <p>PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774</p>															

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 14/30899

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.: -"-See supplemental page-""-
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 1-2, 11-12, 21-22, 32-33, 43, 50-51, 58-59, 65, 71, 79, 91-92, 95-96, 101, 110, 119, 129, 139, 146, 153-154, 160, 166, 170-171, 174; Group II: Claims 61 and 156

-"-Please see Supplemental Page-"" -

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 additional fees, this Authority did not invite payment of additional fees.
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. ;
Claims 1-2, 11-12, 21-22, 32-33, 43, 50-51, 58-59, 65, 71, 79, 91-92, 95-96, 101, 110, 119, 129, 139, 146, 153-154, 160, 166, 170-171 and 174;

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/US 14/30899

---Continued from Box No. II - Observations where certain claims were found unsearchable---

Claims Nos.: 3-10, 13-20, 23-31, 34-42, 44-49, 52-57, 60, 62-64, 66-70, 72-78, 80-90, 93-94, 97-100, 102-109, 111-118, 120-128, 130-138, 140-145, 147-152, 155, 157-159, 161-165, 167-169, 172-173, and 175-178

---Continued from Box No. III - Observations where unity of invention is lacking---

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fee must be paid.

Group I: Claims 1-2, 11-12, 21-22, 32-33, 43, 50-51, 58-59, 65, 71, 79, 91-92, 95-96, 101, 110, 119, 129, 139, 146, 153-154, 160, 166, 170-171, and 174 are directed toward an SRAM memory device comprising: a memory core and formatting DBI formatted data to non-DBI formatted data

Group II: Claims 61 and 156 are directed toward a DBI formatted bus comprising a decoupling capacitor.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I include an SRAM memory device comprising: a memory core; a local DBI converter circuitry to convert DBI formatted data to non-DBI formatted data; sense circuitry coupled to a memory array; and an output buffer, which are not present in Group II.

The special technical features of Group II include a power supply bus shared by a data bus and DBI data bit; a ground bus shared by the data bus and the DBI data bit; and a decoupling capacitor provided between the power supply bus and the ground bus, which are not present in Group I.

The common technical feature shared by Groups I-II is a DBI formatted bus or a system/device including a DBI formatted bus, the DBI formatted bus comprising: a data configured such that no more than half the data bits are set to either high or low; and a DBI data bit indicating whether the data bus is to be inverted. However, this common feature is previously disclosed by US 2010/0214138 A1 (HOLLIS). Hollis discloses a DBI formatted bus or a system/device including a DBI formatted bus (a DBI bit on a DBI line; paragraph [0036]), the DBI formatted bus comprising: a data configured such that no more than half the data bits are set to either high or low (balancing bits D0-D7 if the bus contains an unbalanced logical values of '0's or '1's; paragraph [0037]); and a DBI data bit indicating whether the data bus is to be inverted (inverting bits on the bus while the DBI bit output is '1'; paragraph [0037]).

Since the common technical feature is previously disclosed by the Hollis reference, this common feature is not special and so Groups I-II lack unity.