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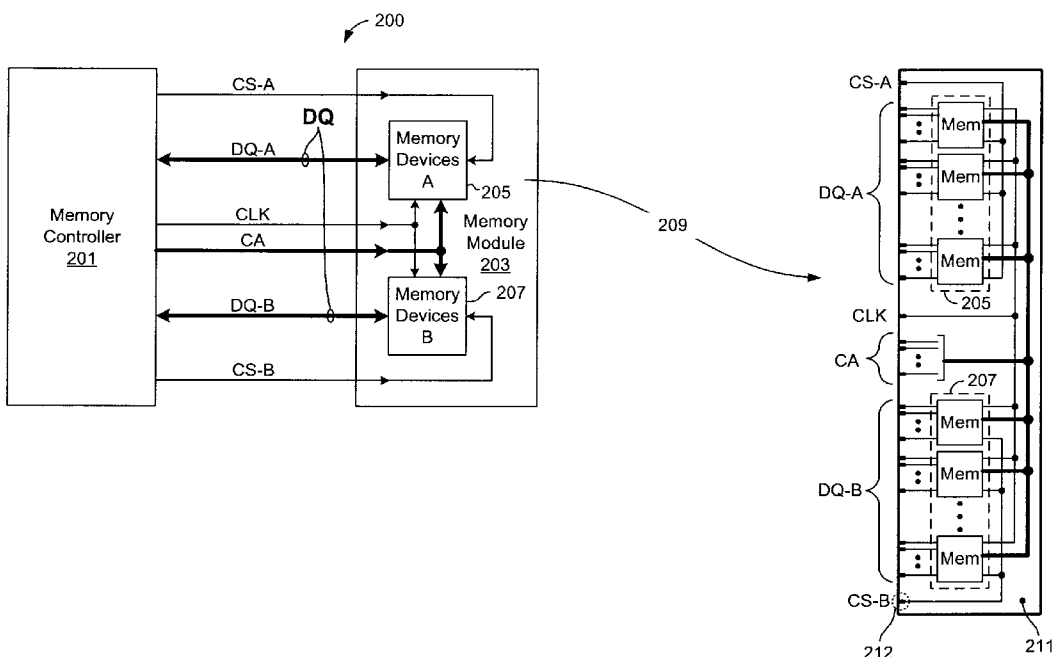
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(54) Title: MEMORY MODULE WITH REDUCED ACCESS GRANULARITY



(57) Abstract: A memory module having reduced access granularity. The memory module includes a substrate having signal lines thereon that form a control path and first and second data paths, and further includes first and second memory devices coupled in common to the control path and coupled respectively to the first and second data paths. The first and second memory devices include control circuitry to receive respective first and second memory access commands via the control path and to effect concurrent data transfer on the first and second data paths in response to the first and second memory access commands.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/067814

A. CLASSIFICATION OF SUBJECT MATTER
INV. G06F13/16 G11C7/10

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)
G06F G11C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 892 981 A (WIGGERS HANS A [US]) 6 April 1999 (1999-04-06) abstract column 4, line 42 - column 5, line 56 -----	1-4, 22, 34, 35 1-5, 7, 19-24, 34, 35
X Y	US 2006/004976 A1 (RADER SHEILA M [US]) 5 January 2006 (2006-01-05) column 1, line 59 - column 2, line 3; figure 1 column 3, line 26 - column 4, line 8; figure 4 -----	22, 34 1-5, 7, 19-24, 34, 35

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 document 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 another 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

10 December 2007

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INTERNATIONAL SEARCH REPORT

International application No.
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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:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers allsearchable claims.
2. As all searchable claims could be searched without effort justifying an 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.:

1-7, 19-25, 34, 35

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7,19-25,34,35

First and second memory devices coupled to a single control bus and to a first and second data bus, respectively, and transmit / receive circuitry within a control circuitry of the first and second memory devices to effect reading and writing data concurrently from and to said memory devices, respectively.

2. claims: 8-18,26-33

First and second memory devices coupled to a single control bus and to a first and second data bus, respectively, and signal exchange on the control path of said first and second memory devices, in particular its timing, the configuration of the chip select line(s) and the identification of access commands.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2007/067814
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Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
US 5892981	A	06-04-1999	DE 69709885 D1	28-02-2002
			DE 69709885 T2	27-06-2002
			EP 0931291 A1	28-07-1999
			JP 3860842 B2	20-12-2006
			JP 2001505684 T	24-04-2001
			WO 9815897 A1	16-04-1998
US 2006004976	A1	05-01-2006	US 2003088743 A1	08-05-2003