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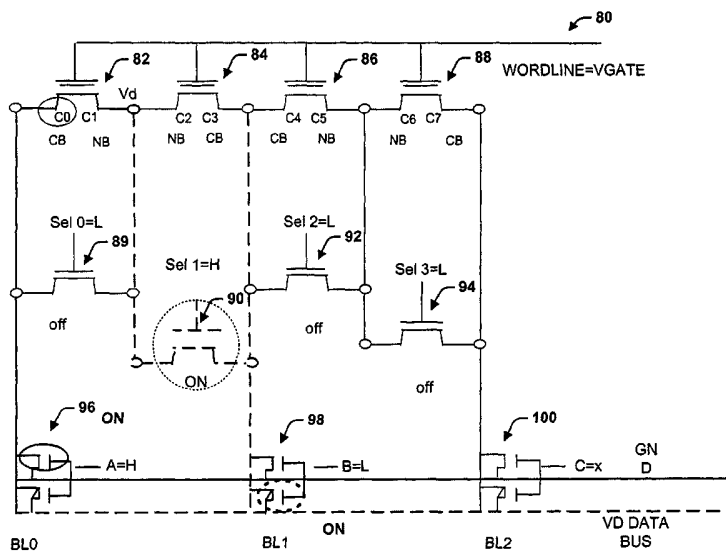
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- (74) Agent: RODDY, Richard, J.; Advanced Micro Devices, Inc., One AMD Place, Mail Stop 68, Sunnyvale, CA 94088-3453 (US).
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- (71) Applicant: ADVANCED MICRO DEVICES, INC. [US/US]; One AMD Place, Mail Stop 68, Sunnyvale, CA 94088-3453 (US).
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- (72) Inventors: HAMILTON, Darlene, G.; 5824 Ponce, San Jose, CA 95118 (US). DERHACOBIAN, Narbeh; 1518 Williams Avenue, Belmont, CA 94002 (US). WANG, Janet, S., Y.; 1999 Broadway #42, San Francisco, CA 94109 (US). TANPAIROJ, Kulachet; 948 Wing Place, Palo Alto, CA 94305 (US).
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[Continued on next page]

(54) Title: HIGHER PROGRAM THRESHOLD VOLTAGE AND FASTER PROGRAMMING RATES BASED ON IMPROVED ERASE METHODS



(57) Abstract: A method and system for programming of the normal bits of a memory array of dual bit memory cells (68) is accomplished by programming at a substantially high delta VT. The substantially higher VT assures that stresses and/or customer operation over substantial periods of time. Furthermore, by utilizing substantially high gate and drain voltages during programming, programming times are kept short without degrading charge loss. A methodology is provided that determines the charge loss for single bit operation during program and erase cycles. The charge losses over cycling and stress are then utilized to determine an appropriate delta VT to be programmed into a command logic (64) and state machine (65).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

Application No
PCT/US 01/45700

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 G11C16/10 G11C16/34 G11C29/00

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 7 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, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 011 725 A (EITAN BOAZ) 4 January 2000 (2000-01-04) column 15, line 32 - line 49; figure 5B column 26, line 41 - line 45 column 29, line 55 - line 57 ---	1,2,7,8
A	WO 99 60631 A (SAIFUN SEMICONDUCTORS LTD ;EITAN BOAZ (IL)) 25 November 1999 (1999-11-25) page 3, line 13 - line 19 ---	1,7
A	US 6 044 022 A (NACHUMOVSKY ISHAI) 28 March 2000 (2000-03-28) abstract; figures 5-8 ---	1-3,7-10
A	US 6 157 570 A (NACHUMOVSKY ISHAI) 5 December 2000 (2000-12-05) figures 7,9A,9B,13 ---	7
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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier document but published on or after the international filing date	"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
"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)	"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.
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 16 September 2002	Date of mailing of the international search report 29. 01. 2003
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Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer CUMMINGS A.
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/45700

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 081 456 A (DADASHEV OLEG) 27 June 2000 (2000-06-27) figures 7-9 -----	7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 01/45700

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 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 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.:
1-3, 7-10

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- 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: 1-3, 7-10

Method and system for programming ONO dual-bit memory cells.

2. Claims: 4-6

Method for determining delta VT (i.e. required change in threshold voltage) for programming bits in an array of ONO dual-bit memory cells.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 01/45700

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
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			EP 1010182 A2	21-06-2000
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US 6081456	A	27-06-2000	NONE	
