



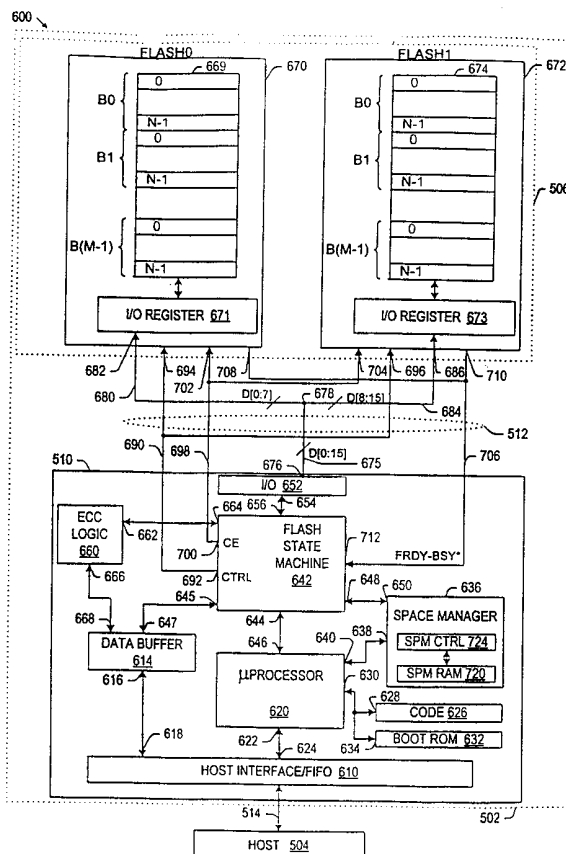
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G06F 12/00, 12/10		A3	(11) International Publication Number: WO 99/44113
			(43) International Publication Date: 2 September 1999 (02.09.99)
(21) International Application Number: PCT/US99/04247 (22) International Filing Date: 25 February 1999 (25.02.99) (30) Priority Data: 09/030,697 25 February 1998 (25.02.98) US (71) Applicant (for all designated States except US): LEXAR MEDIA, INC. [US/US]; 47421 Bayside Parkway, Fremont, CA 94538 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): ESTAKHRI, Petro [US/US]; 7966 Foothills Knolls, Pleasanton, CA 94566 (US). IMAN, Berhanu [US/US]; 946 Iris Avenue, Sunnyvale, CA 94086 (US). (74) Agents: IMAM, Maryam et al.; Oppenheimer Wolff & Donnelly LLP, Suite 400, 101 Park Center Plaza, San Jose, CA 95113 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 7 October 1999 (07.10.99)	

(54) Title: INCREASING MEMORY PERFORMANCE IN FLASH MEMORY DEVICES BY PERFORMING SIMULTANEOUS WRITE OPERATION TO MULTIPLE DEVICES

(57) Abstract

The present invention includes a digital system (600) having a controller semiconductor device (510) coupled to a host (504) and a nonvolatile memory bank (506) including a plurality of nonvolatile memory devices (670, 672). The controller transfers information, organized in sectors, with each sector including a user data portion and an overhead portion, between the host and the nonvolatile memory bank and stores and reads two bytes of information relating to the same sector simultaneously within two nonvolatile memory devices. Each nonvolatile memory device is defined by a row of memory locations wherein corresponding rows of at least two semiconductor devices maintain two sectors of information therein with the overhead information related to the two sectors maintained in one of the memory rows of the nonvolatile memory device. Thirty two sectors of information define a block identified by a virtual physical block address with a block of information expanding between two memory devices.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US99/04247

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 12/00, 12/10

US CL : 711/103, 168, 173, 202, 206

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)

U.S. : 711/103, 168, 173, 202, 206

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 practicable, search terms used)

APS. DIALOG

search terms: sectors, concurrent or simultaneous, flash memory

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,375,222 A [ROBINSON et al.] 20 December 1994, C 5, L 39-44; C 25, L 1-19; C 24, L 38-68; C 4, L 60-62; C 11, L 24-68; C 12, L 24-68; C 6, L 56-59; C 7, L 7-35	1-7 12-19, 22-25
A,P	US 5,732,208 A [TAMURA et al] 24 March 1998, C 2, L 65-67; C 3, L 1-32;	1, 12-19, 22-25
X,P	US 5,748,528 A [CAMPARDO et al.] 05 May 1998, C 2, L 12-27	12-14, 22-24
A,E	US 5,890,192 A [LEE et al.] 30 March 1999, C 1, L 27-67	1, 12-19, 22-25

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents	*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
A document defining the general state of the art which is not considered to be of particular relevance	*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
E earlier document published on or after the international filing date	*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
F 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)	*Z* document member of the same patent family
G 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	

Date of the actual completion of the international search

11 JUNE 1999

Date of mailing of the international search report

17 AUG 1999

 Name and mailing address of the ISA/US
 Commissioner of Patents and Trademarks
 Box PCT
 Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

KIMBERLY MCLELLAN

Telephone No. (703) 308-9592

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/04247

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 5,603,001 A [SUKEGAWA et al.] 11 February 1997, C 4, L 13-30	1, 12-19, 22-25
X,P	US 5,745,418 A [MA et al.], 28 April 1998, C 4, L 24-49; C 8, L 50-67; C 9, L 1-35	9-11, 20-21, 26