



(51) International Patent Classification:

G11C 5/14 (2006.01) G06F 1/32 (2006.01)
G11C 11/406 (2006.01) G06F 3/06 (2006.01)

(21) International Application Number:

PCT/US2015/065928

(22) International Filing Date:

16 December 2015 (16.12.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

14/614,425 5 February 2015 (05.02.2015) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,

[Continued on next page]

(54) Title: SOLID STATE DRIVE WITH SELF-REFRESH POWER-SAVING MODE

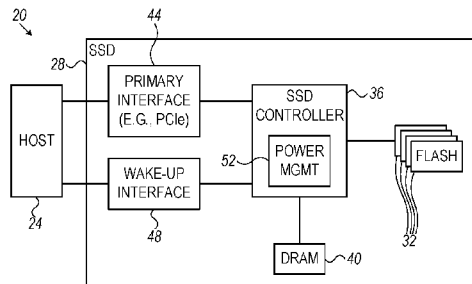


FIG. 1

(57) Abstract: A storage device (28) includes a non-volatile memory (32), a volatile memory (40) and a controller (36). The volatile memory supports a normal mode and a self-refresh mode. The controller is configured to store data for a host (24) in the non-volatile memory while using the volatile memory in the normal mode and, in response to receiving a power-down command from the host, to deactivate at least part of the storage device and to switch the volatile memory from the normal mode to the self-refresh mode.

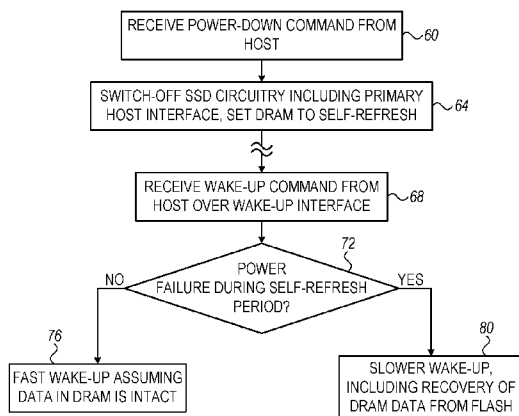


FIG. 2

WO 2016/126337 A3



DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT,
LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE,
SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA,
GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

— with amended claims (Art. 19(1))

(88) Date of publication of the international search report:

20 October 2016

Published:

— with international search report (Art. 21(3))

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/065928

A. CLASSIFICATION OF SUBJECT MATTER
 INV. G11C5/14 G11C11/406 G06F1/32 G06F3/06
 ADD.
 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)
 G11C G06F H04N
 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)
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/226400 A1 (KIMURA NAOKI [JP]) 14 August 2014 (2014-08-14)	1,2,4, 10,11, 13,19
Y A	paragraph [0082]; figures 1,3	3,12,20 5-7, 14-16
Y	----- US 5 805 910 A (LEE CHANG-HO [KR] ET AL) 8 September 1998 (1998-09-08) claim 1; figure 2	3,12,20
A	----- EP 1 828 901 A2 (INTEL CORP [US]) 5 September 2007 (2007-09-05) paragraph [0004]; figures 1,4 ----- -/--	5,14

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 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 26 August 2016	Date of mailing of the international search report 02/09/2016
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Wolff, Norbert

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/065928

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 2013/265604 A1 (YOKOYAMA HIDEHIKO [JP]) 10 October 2013 (2013-10-10) paragraph [0023] - paragraph [0025]; figure 2 paragraph [0047] -----	1-3, 10-12, 19,20

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/065928

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 all searchable 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.:

1-7, 10-16, 19, 20

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.

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, 10-12, 19, 20

SSD interface management in power down operation mode

2. claims: 4-7, 13-16

SSD with maintenance of volatile memory content in non-volatile memory during volatile memory self-refresh in power down mode for potential power interruption during self-refresh

3. claims: 8, 9, 17, 18

SSD back-up power source

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2015/065928

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2014226400 A1	14-08-2014	US 2014226400 A1	14-08-2014
		US 2016147473 A1	26-05-2016

US 5805910 A	08-09-1998	CN 1142085 A	05-02-1997
		US 5805910 A	08-09-1998

EP 1828901 A2	05-09-2007	AT 421119 T	15-01-2009
		CN 101099135 A	02-01-2008
		EP 1828901 A2	05-09-2007
		JP 2008522322 A	26-06-2008
		US 2006136765 A1	22-06-2006
		WO 2006060237 A2	08-06-2006

US 2013265604 A1	10-10-2013	JP 2013215976 A	24-10-2013
		US 2013265604 A1	10-10-2013
