



- (51) **International Patent Classification:**
G11C 16/26 (2006.01) *G06F 11/10* (2006.01)
- (21) **International Application Number:**
PCT/US2012/059447
- (22) **International Filing Date:**
10 October 2012 (10.10.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/556,793 7 November 2011 (07.11.2011) US
13/602,031 31 August 2012 (31.08.2012) US
- (71) **Applicant:** SANDISK ENTERPRISE IP LLC [US/US];
601 McCarthy Blvd., Milpitas, CA 95035 (US).
- (72) **Inventors:** TAI, Ying Yu; 601 McCarthy Blvd., Milpitas, CA 95035 (US). MA, Yueh Yale; 601 McCarthy Blvd., Milpitas, CA 95035 (US).
- (74) **Agents:** WILLIAMS, Gary, S. et al.; Morgan Lewis & Bockius LLP, 2 Palo Alto Square, 3000 El Camino Real, Suite 700, Palo Alto, CA 94306 (US).
- (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, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, 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, 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, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, 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, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

- (88) **Date of publication of the international search report:**
25 July 2013

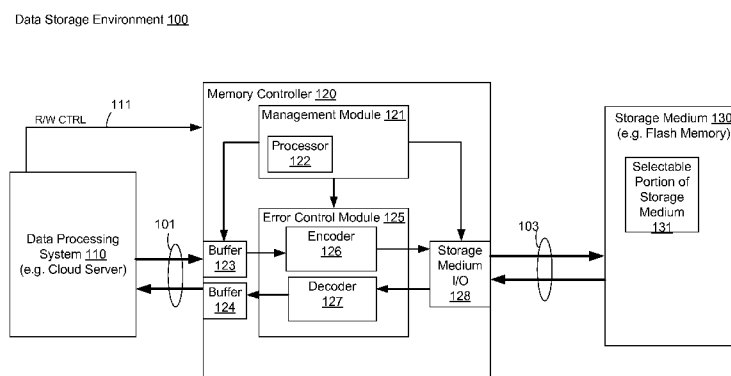
(54) **Title:** STATISTICAL READ COMPARISON SIGNAL GENERATION FOR MEMORY SYSTEMS

Figure 1

(57) **Abstract:** Implementations include systems, methods and/or devices suitable for use in a memory system that may enhance the performance of error control codes used to improve the reliability with which data can be stored and read. Some implementations include systems, methods and/or devices enabled to generate and utilize soft information for decoding encoded data read from a storage medium. More specifically, some implementations utilize a collection of characterization vectors that include soft information values for bit-tuples that may be read from the storage medium for various combinations of the storage medium characterization parameter values. Some implementations are enabled to determine and utilize read comparison signal values associated with one or more storage medium characterization parameter values. And some implementations are enabled to determine and utilize shifted read comparison signal values associated with one or more storage medium characterization parameter values and an identified error condition.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/059447

A. CLASSIFICATION OF SUBJECT MATTER
INV. G11C16/26 G06F11/10
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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/003058 A1 (KANG DONG-KU [KR]) 1 January 2009 (2009-01-01) page 3, paragraph 48 - page 6, paragraph 74; figures 2,4-6	1-18

X	US 2011/205823 A1 (HEMINK GERRIT JAN [JP] ET AL) 25 August 2011 (2011-08-25) page 8, paragraph 93 - page 9, paragraph 102 page 11, paragraph 114 - page 13, paragraph 125 figures 14-18,22	1-18

	-/--	



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 February 2013

Date of mailing of the international search report

06/06/2013

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

Bauer, Regine

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/059447

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/080586 A2 (SAIFUN SEMICONDUCTORS LTD [IL]; RIZEL ARIK [IL]; COHEN GUY [IL]) 19 July 2007 (2007-07-19) page 17, lines 46-30 page 21, line 9 - page 27, line 39; figure 9	1-18
X	----- US 2003/189856 A1 (CHO TAE-HEE [KR] ET AL) 9 October 2003 (2003-10-09) page 2, paragraph 19-23 page 3, paragraph 43 - page 4, paragraph 50; claims 1,3,4; figures 5,7 -----	1-18

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/059447

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2009003058	A1	01-01-2009	CN	101335047 A		31-12-2008
			JP	2009009688 A		15-01-2009
			KR	20090000466 A		07-01-2009
			US	2009003058 A1		01-01-2009

US 2011205823	A1	25-08-2011	CN	102893337 A		23-01-2013
			EP	2537157 A1		26-12-2012
			TW	201203273 A		16-01-2012
			US	2011205823 A1		25-08-2011
			US	2012236670 A1		20-09-2012
			WO	2011103013 A1		25-08-2011

WO 2007080586	A2	19-07-2007	US	2009003073 A1		01-01-2009
			WO	2007080586 A2		19-07-2007

US 2003189856	A1	09-10-2003	JP	4122248 B2		23-07-2008
			JP	2003303496 A		24-10-2003
			KR	20030079425 A		10-10-2003
			US	2003189856 A1		09-10-2003

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/059447

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.:
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.:

1-18

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: 1-18

A device for reading from a storage medium with selectable read comparison signal values. The read comparison signal values are selected based on characterization parameter values of the storage medium (e.g. temperature, P/E cycles).

2. claims: 19-26

A method of testing a storage medium at the manufacturing site for generating statistics regarding read comparison signal values of the storage medium.
