



(51) International Patent Classification:
G11C 8/00 (2006.01)

(21) International Application Number:
PCT/IL2008/001233

(22) International Filing Date:
17 September 2008 (17.09.2008)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/996,782 5 December 2007 (05.12.2007) US
61/006,120 19 December 2007 (19.12.2007) US
61/006,805 31 January 2008 (31.01.2008) US
61/064,853 31 March 2008 (31.03.2008) US
61/071,464 30 April 2008 (30.04.2008) US
61/071,465 30 April 2008 (30.04.2008) US
61/129,608 8 July 2008 (08.07.2008) US

(71) Applicant (for all designated States except US): **DENSBITS TECHNOLOGIES LTD.** [IL/IL]; Building 30, Flr 3, Matam Industrial Park, P.O.Box 15111, 31015 Haifa (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WEINGARTEN, Hanan** [IL/IL]; Hayarden 2, 46377 Herzliya (IL). **LEVY, Shmuel** [IL/IL]; 9 Fish Street, 36025 Tivon (IL). **KATZ, Michael** [IL/IL]; 75 Moriah Ave., 34616 Haifa (IL).

(74) Agent: **PEARL COHEN ZEDEK LATZER**; 5 Shenkar Street, P.O. Box 12704, Herzlia 46733 (IL).

(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, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, 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, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, 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))

(88) Date of publication of the international search report:
4 March 2010

(54) Title: FLASH MEMORY APPARATUS AND METHODS USING A PLURALITY OF DECODING STAGES INCLUDING OPTIONAL USE OF CONCATENATED BCH CODES

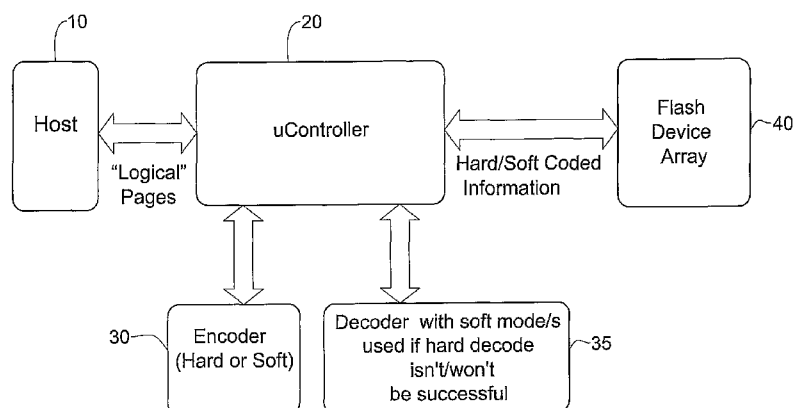


Figure 1

(57) Abstract: A method for decoding a plurality of flash memory cells which are error-correction-coded as a unit, the method comprising providing a hard-decoding success indication indicating whether or not hard-decoding is at least likely to be successful; and soft-decoding the plurality of flash memory cells at a first resolution only if the hard-decoding success indication indicates that the hard-decoding is not at least likely to be successful.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IL 08/01233

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G11C 8/00 (2009.01)

USPC - 365/230.06

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)

USPC: 365/230.06

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 365/185.11, 185.13, 185.22, 185.23, 185.29, 185.33, 189.09, 218, 230.04 (view search terms below)Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); DialogPRO; WIPO, EPO, CITESEER, Google patents, Google scholar. Search Terms Used:
decode, decoding, flash memory, error correction-coded, error- correcting code, ECC, forward error correction code, FEC, hard-
decoding, hard-decode, hardware ECC, software ECC, success

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 2007/0263439 A1 (CORNWELL et al.) 15 November 2007 (15.11.2007) entire document especially abstract, para [0004], [0016], [0038], [0043]-[0044], [0064]-[0066], [0080]-[0085] and [0098]-[0100].	1-32, 40 ----- 33-39, 41-46
Y	US 2003/0101404 A1 (ZHAO et al.) 29 May 2003 (29.05.2003) entire document especially abstract, para [0010] and [0037]-[0039].	33-39, 41-46
Y	US 2007/0124652 A1 (LITSYN et al.) 31 May 2007 (31.05.2007) entire document especially para [0020]-[0021], [0107]-[0112], [0269]-[0270] and [0283]-[0284].	36-39
A	US 2007/0171730 A1 (RAMAMOORTHY et al.) 26 July 2007 (26.07.2007) entire document	1-46

☐ Further documents are listed in the continuation of Box C.

* 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

16 January 2009 (16.01.2009)

Date of mailing of the international search report

28 JAN 2009

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents

P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774