



- (51) **International Patent Classification:**
G06F 12/08 (2006.01) G06F 11/10 (2006.01)
G06F 13/14 (2006.01)
- (21) **International Application Number:**
PCT/US2012/031095
- (22) **International Filing Date:**
29 March 2012 (29.03.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
13/078,704 1 April 2011 (01.04.2011) US
- (71) **Applicant (for all designated States except US):** INTEL CORPORATION [US/US]; 2200 Mission College Boulevard, M/S: RNB-4-150, Santa Clara, CA 95052 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** MCGINNIS, Darrell, S. [US/US]; 860 N 28th Ave, Cornelius, OR 97113 (US). HUDDLESTON, C. Scott [US/US]; 13850 SW Harness Lane, Beaverton, OR 97008 (US). AGARWAL, Rajat [US/US]; 16548 NW Talkingstick Way, Beaverton, OR 97006 (US). CHINTHAMANI, Meenakshisundaram R. [US/US]; 2616 NE Nova Avenue, Hillsboro, OR 97124 (US).
- (74) **Agents:** VINCENT, Lester J. et al.; Blakely, Sokoloff, Taylor & Zafman LLP, 1279 Oakmead Parkway, Sunnyvale, CA 94085-4040 (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, 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, 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, MD, 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:**
27 December 2012

(54) **Title:** MECHANISMS AND TECHNIQUES FOR PROVIDING CACHE TAGS IN DYNAMIC RANDOM ACCESS MEMORY

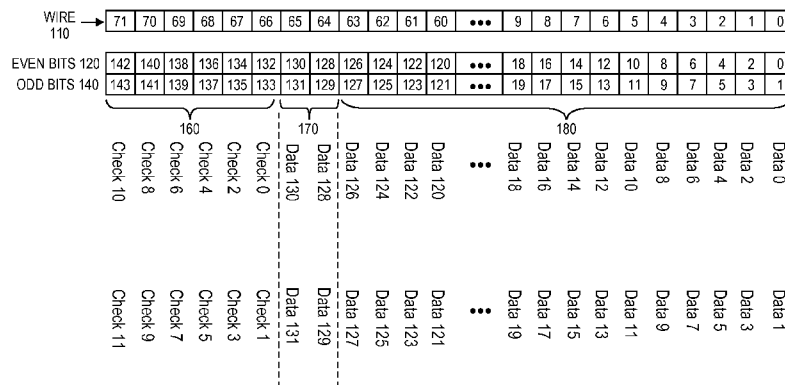
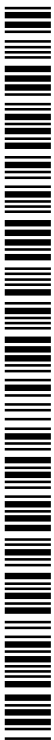


FIG. 1

(57) **Abstract:** A dynamic random access memory (DRAM) is operated as a cache memory coupled with a processor core. A block of data is transmitted to the DRAM as even and odd pairs of bits from the processor core. The block of data includes N error correcting code (ECC) bits and 11*N data bits. Two or more cache lines are to be stored in a memory page with tag bits aggregated together within the page.



A. CLASSIFICATION OF SUBJECT MATTER**G06F 12/08(2006.01)i, G06F 13/14(2006.01)i, G06F 11/10(2006.01)i**

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)

G06F 12/08; G06K 5/04; G06F 12/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: cache, DRAM, ECC, tag, page

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2004-0024958 A1 (BAINS, KULJIT, S. et al.) 05 February 2004 See paragraphs [0018]-[0035]; figures 1-3C.	1-27
A	US 6654854 B1 (JANAKIRAMAN, GOPALAKRISHNAN et al.) 25 November 2003 See column 3, line 51 - column 4, line 31; figures 7-9.	1-27
A	US 2008-0163008 A1 (JACOB, ROJIT) 03 July 2008 See paragraphs [0017]-[0023]; figure 1.	1-27
A	US 2002-0069325 A1 (PONG, FONG et al.) 06 June 2002 See paragraphs [0022]-[0025]; claims 1 and 4; figures 7, 8.	1-27

 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 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

24 OCTOBER 2012 (24.10.2012)

Date of mailing of the international search report

25 OCTOBER 2012 (25.10.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
189 Cheongsu-ro, Seo-gu, Daejeon Metropolitan
City, 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

JANG Ho Keun

Telephone No. 82-42-481-8187



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/031095

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2004-0024958 A1	05.02.2004	US 2006-0117129 A1 US 7054999 B2 US 7350016 B2	01.06.2006 30.05.2006 25.03.2008
US 6654854 B1	25.11.2003	None	
US 2008-0163008 A1	03.07.2008	US 7840874 B2 WO 2008-082919 A1	23.11.2010 10.07.2008
US 2002-0069325 A1	06.06.2002	US 6449690 B1	10.09.2002