

(51) International Patent Classification:
G11C 7/22 (2006.01) *G11C 7/10* (2006.01)(21) International Application Number:
PCT/US2011/021762(22) International Filing Date:
19 January 2011 (19.01.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/690,064 19 January 2010 (19.01.2010) US(71) Applicant (for all designated States except US): **ALTERA CORPORATION** [US/US]; 101 Innovation Drive, San Jose, CA (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CHONG, Yan** [CN/US]; 101 Innovation Drive, San Jose, CA 95134 (US). **HUANG, Joseph** [US/US]; 101 Innovation Drive, San Jose, CA 95134 (US). **NAGARAJAN, Pradeep** [IN/US]; 101 Innovation Drive, San Jose, CA 95134 (US). **SUNG, Chiakang** [US/US]; 101 Innovation Drive, San Jose, CA 95134 (US).(74) Agent: **GENCARELLA, Michael, L.**; Martine Penilla & Gencarella, LLP, 710 Lakeway Drive, Suite 200, Sunnyvale, CA 94085 (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, RO, RS, RU, 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, 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))

[Continued on next page]

(54) Title: DUTY CYCLE CORRECTION CIRCUIT FOR MEMORY INTERFACES IN INTEGRATED CIRCUITS

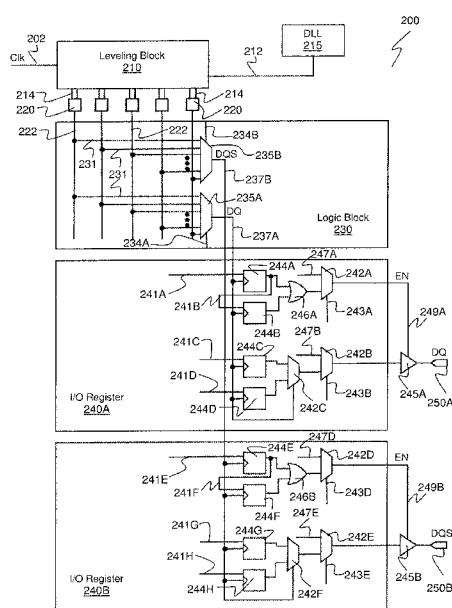


Fig. 2A

(57) Abstract: Circuits and a method for correcting duty cycle distortions in an integrated circuit (IC) are disclosed. The IC includes a splitter circuit that is coupled to receive a clock signal. The clock signal is split into two different clock signals. One of the clock signals is an inverted version of the other. A delay circuit is coupled to each of the clock signals. Each of the delay circuits generates a delayed version of the corresponding clock signal. A corrector circuit is coupled to receive both the delayed versions of the clock signals. The corrector circuit generates a clock output signal with a corrected duty cycle.



-
- *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:**
17 November 2011

A. CLASSIFICATION OF SUBJECT MATTER*G11C 7/22(2006.01)i, G11C 7/10(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)

IPC : G11C, H03D, H03L

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: duty, clock, correction, phase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2008-0164920 A1 (CHO) 10 July 2008 See the abstract, figures 1,4-5.	1,6-21 2-5
A	US 2007-0069782 A1 (SHIN) 29 March 2007 See the abstract, figures 7-8.	1-21
A	US 2005-0286672 A1 (LIN et al.) 29 December 2005 See the abstract, figures 1-4.	1-21



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

14 SEPTEMBER 2011 (14.09.2011)

Date of mailing of the international search report

14 SEPTEMBER 2011 (14.09.2011)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsa-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

YOON, Nan Young

Telephone No. 82-42-481-8188



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/021762

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008-0164920 A1	10.07.2008	KR 10-0837822 B1	16.06.2008
US 2007-0069782 A1	29.03.2007	JP 2007-097181 A	12.04.2007
		KR 10-0834400 B1	04.06.2008
		US 2008-0164921 A1	10.07.2008
		US 2010-0073053 A1	25.03.2010
		US 7365583 B2	29.04.2008
		US 7649390 B2	19.01.2010
		US 7994833 B2	09.08.2011
US 2005-0286672 A1	29.12.2005	US 2002-0172314 A1	21.11.2002
		US 2011-0102036 A1	05.05.2011
		US 6950487 B2	27.09.2005
		US 7873131 B2	18.01.2011