

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
10 May 2007 (10.05.2007)

(10) International Publication Number
WO 2007/053839 A3

(51) International Patent Classification:
G06F 1/32 (2006.01)

[US/US]; 3246 Rancho Milagro, Carlsbad, California 92009 (US). **JUNG, Seong-Ook** [KR/US]; 15015 Cross Stone Drive, San Diego, California 92127 (US).

(21) International Application Number:

PCT/US2006/060410

(74) Agents: **WADSWORTH, Philip, R.** et al.; 5775 Morehouse Drive, San Diego, California 92121 (US).

(22) International Filing Date:

31 October 2006 (31.10.2006)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, 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, LV, LY, MA, MD, 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, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/732,228 31 October 2005 (31.10.2005) US
11/286,087 22 November 2005 (22.11.2005) US

(71) Applicant (for all designated States except US): **QUALCOMM INCORPORATED** [US/US]; 5775 Morehouse Drive, San Diego, California 92121 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **ELGEBALY, Mohamed** [CA/US]; 5325 Toscana Way, #613, San Diego, California 92122 (US). **MALIK, Khurram Zaka** [US/US]; 3901 Lickmill Boulevard, #229, Santa Clara, California 95054 (US). **CHUA-EOAN, Lew, G.**

(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, HU, IE, IS, IT, LT, LU, LV, MC,

[Continued on next page]

(54) Title: ADAPTIVE VOLTAGE SCALING FOR AN ELECTRONICS DEVICE

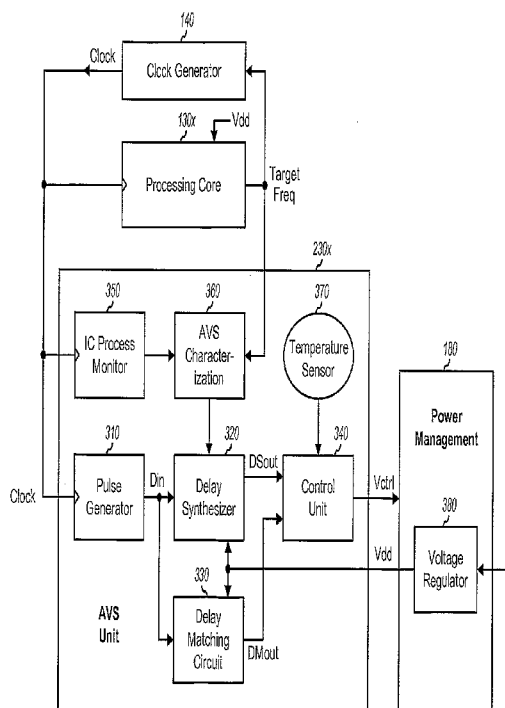


FIG. 3

(57) Abstract: Techniques for adaptively scaling voltage for a processing core are described. In one scheme, the logic speed and the wire speed for the processing core are characterized, e.g., using a ring oscillator having multiple signal paths composed of different circuit components. A target clock frequency for the processing core is determined, e.g., based on computational requirements for the core. A replicated critical path is formed based on the characterized logic speed and wire speed and the target clock frequency. This replicated critical path emulates the actual critical path in the processing core and may include different types of circuit components such as logic cells with different threshold voltages, dynamic cells, bit line cells, wires, drivers with different threshold voltages and/or fan-outs, and so on. The supply voltage for the processing core and the replicated critical path is adjusted such that both achieve the desired performance.

WO 2007/053839 A3

NL, 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))*
- *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))*

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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

7 January 2010

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/060410

A. CLASSIFICATION OF SUBJECT MATTER INV. G06F1/32				
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				
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 practical, 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	EP 1 223 493 A1 (SONY CORP [JP]) 17 July 2002 (2002-07-17) abstract paragraph [0001] paragraph [0037] - paragraph [0041] paragraph [0094] - paragraph [0150]; figures 1-4	1-19, 30-45		
A	----- US 2004/239395 A1 (NAKAI MASAKATSU [JP]) 2 December 2004 (2004-12-02) abstract paragraph [0001] - paragraph [0008] paragraph [0023] - paragraph [0032] paragraph [0042] - paragraph [0068]; figures 1-2 -----	1-19, 30-45		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents :				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document 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 </td> <td style="width: 50%; vertical-align: top;"> *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 </td> </tr> </table>			*A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document 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
A document defining the general state of the art which is not considered to be of particular relevance *E* earlier document 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	Date of mailing of the international search report			
7 September 2009	19/11/2009			
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 Vieira, Alexandre			

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2006/060410

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.:

please see additional sheet(s)

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: 1-19, 30-45

how to more accurately emulate the signal path in the processing core.

2. claims: 20-24

how to correct for the delay introduced by extra circuitry present in the synthesizer.

3. claims: 25-26

how to account for temperature gradients across the IC die.

4. claims: 27-29

how to account for deviations in speed dependent on integrated circuit process.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/060410

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
EP 1223493	A1	17-07-2002	WO 0171445 A1	27-09-2001
			JP 2002100967 A	05-04-2002
			US 2002190283 A1	19-12-2002
<hr/>				
US 2004239395	A1	02-12-2004	JP 2004303882 A	28-10-2004
<hr/>				