



(51) International Patent Classification:  
**G06F 9/38** (2006.01) **G06F 12/10** (2006.01)

(21) International Application Number:  
PCT/US2009/067409

(22) International Filing Date:  
10 December 2009 (10.12.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
12/337,159 17 December 2008 (17.12.2008) US

(71) Applicant (for all designated States except US): **ADVANCED MICRO DEVICES, INC.** [US/US]; One AMD Place, P.O. Box 3453, Sunnyvale, California 94088 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **FRANK, Michael** [DE/US]; 1325 Yarmouth Terrace, Sunnyvale, California 94087 (US).

(74) Agent: **MUNYON, Dean, M.**; Meyertons, Hood, Kivlin, Kowert & Goetzl, P.C., P.O. Box 398, Austin, Texas 78767-0398 (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, 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, MK, MT, NL, NO, PL, PT, RO, 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))

(88) Date of publication of the international search report:  
27 January 2011

(54) Title: COPROCESSOR UNIT WITH SHARED INSTRUCTION STREAM

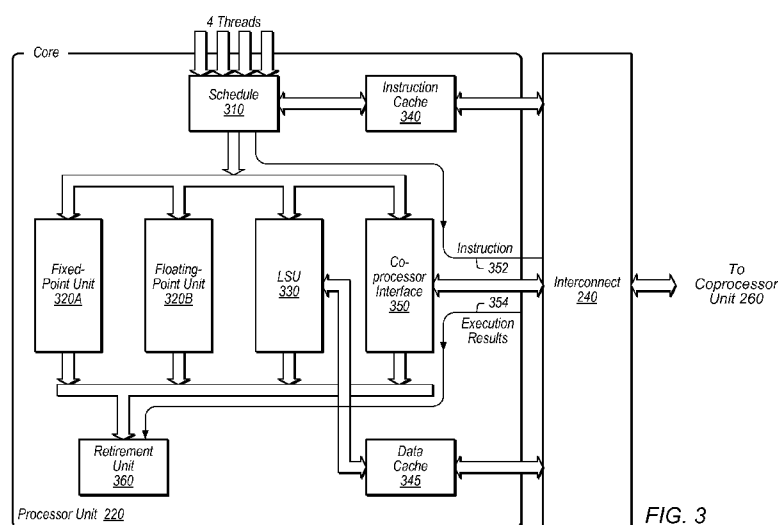


FIG. 3

(57) Abstract: A processor unit and a coprocessor unit are disclosed. In one embodiment, the processor unit includes a functional unit that receives a set of instructions in an instruction stream and provides the set of instructions to the coprocessor unit. The coprocessor executes the instructions and initiates transmission of a set of execution results corresponding to the set of instructions to the processor unit's functional unit. The processor functional unit may be coupled to the coprocessor unit through a shared bus circuit implementing a packet-based protocol. The processor unit and the coprocessor unit may share a coherent view of system memory. In various embodiments, the functional unit may alter entries in a translation lookaside buffer (TLB) located in the coprocessor unit, resume and suspend a thread executing on the coprocessor unit, etc.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2009/067409

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. G06F9/38 G06F12/10  
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)  
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         | US 2008/059771 A1 (SVENDSEN KJELD [US] ET AL) 6 March 2008 (2008-03-06)                                                                                        | 1-7, 12, 14           |
| Y         | paragraph [0006]; figures 1A, 1B<br>paragraph [0023] - paragraph [0026]<br>paragraph [0038] - paragraph [0041]<br>paragraphs [0050], [0053], [0057], [0061]    | 8-11, 13, 15-18       |
| X         | US 2002/010848 A1 (KAMANO SHOICHI [JP] ET AL) 24 January 2002 (2002-01-24)<br>paragraphs [0025], [0 27]<br>paragraph [0043] - paragraph [0044]<br>figures 1, 4 | 14, 19                |

☒ 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 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

29 June 2010

Date of mailing of the international search report

06/07/2010

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

Daskalakis, T

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2009/067409

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                                                                                                                                    | Relevant to claim No. |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | <p>"HyperTransport"<br/>Wikipedia</p> <p>2 December 2008 (2008-12-02), pages 1-5,<br/>XP002574176<br/>Retrieved from the Internet:<br/>URL: <a href="http://en.wikipedia.org/w/index.php?title=HyperTransport&amp;oldid=255465882">http://en.wikipedia.org/w/index.php?title=HyperTransport&amp;oldid=255465882</a><br/>[retrieved on 2010-03-19]<br/>page 3: Co-processor interconnect<br/>-----</p> | 5,6                   |
| Y         | <p>EP 1 139 222 A1 (TEXAS INSTRUMENTS INC<br/>[US]; TEXAS INSTRUMENTS FRANCE [FR])<br/>4 October 2001 (2001-10-04)<br/>paragraphs [0019], [0026]<br/>paragraph [0032] - paragraph [0033]<br/>paragraph [0036]; figures 3,4<br/>-----</p>                                                                                                                                                              | 8,9,<br>15-17         |
| Y         | <p>US 2008/301408 A1 (KRANICH)<br/>4 December 2008 (2008-12-04)<br/>paragraph [0019] - paragraph [0021]<br/>paragraph [0033] - paragraph [0034]<br/>paragraph [0050]<br/>paragraph [0063] - paragraph [0064]<br/>paragraph [0089] - paragraph [0090]<br/>paragraphs [0095], [0110]<br/>paragraph [0118] - paragraph [0122]<br/>-----</p>                                                              | 10,11,<br>13,18       |

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2009/067409

## 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.: 20  
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:  
see FURTHER INFORMATION sheet PCT/ISA/210
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.:

### 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

Continuation of Box II.2

Claims Nos.: 20

Claim 20 seeks protection for any computer program suitable to run on a computer comprising a coprocessor visible to the instruction set architecture. However, although the instruction set architecture of a processor may be technical it cannot confer a technical character to a claim, inasmuch as physical modifications of the hardware deriving from the execution of an instruction cannot be used to distinguish programs for computers with a technical character from programs for computers with no technical content. Therefore, since the program of claim 20 does not comprise any distinguishing feature, other than it comprises instructions suitable for a computer system with a coprocessor visible to the instruction set, it does not have a technical character in that there is no "further technical effect" deriving from the execution of said program. Consequently, the subject matter of claim 20 fall under the provisions of Rule 39.1(vi) PCT.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7, 12, 14, 19

Coprocessor coupled to the processor by a bus implementing a packet based protocol shared with memory.

---

2. claims: 8, 9, 15-17

Coprocessor comprising translation lookaside buffer and cache

---

3. claims: 10, 11, 13, 18

Multithreaded processor comprising a multithreaded coprocessor

---

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/067409

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s) | Publication<br>date |
|-------------------------------------------|----|---------------------|----------------------------|---------------------|
| US 2008059771                             | A1 | 06-03-2008          | NONE                       |                     |
| US 2002010848                             | A1 | 24-01-2002          | NONE                       |                     |
| EP 1139222                                | A1 | 04-10-2001          | JP 2001290706 A            | 19-10-2001          |
| US 2008301408                             | A1 | 04-12-2008          | DE 102007025397 A1         | 04-12-2008          |
|                                           |    |                     | EP 2171575 A1              | 07-04-2010          |
|                                           |    |                     | GB 2461841 A               | 20-01-2010          |
|                                           |    |                     | KR 20100036279 A           | 07-04-2010          |
|                                           |    |                     | WO 2008153797 A1           | 18-12-2008          |