



(43) International Publication Date
8 November 2012 (08.11.2012)

(51) International Patent Classification:
H01L 23/48 (2006.01)

(21) International Application Number:
PCT/US2012/029363

(22) International Filing Date:
16 March 2012 (16.03.2012)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/101,883 5 May 2011 (05.05.2011) US

(71) Applicant (for all designated States except US): **INTEL CORPORATION** [US/US]; 2200 Mission College Blvd., RNB-4-150, Santa Clara, California 95052 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KAMGAING, Telesphor** [CM/US]; 2204 E Firestone Drive, Chandler, Arizona 85249 (US). **RAO, Valluri R.** [US/US]; 15115 El Quito Way, Saratoga, California 95070 (US). **PALASKAS, Yorgos** [GR/US]; 2335 NW Raleigh Street, Apt 317, Portland, Oregon 97210 (US).

(74) Agents: **WINKLE, Robert, G.** et al.; Winkle, PLLC, c/o CPA Global, P.O. Box 52050, Minneapolis, MN 55402 (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))

(88) Date of publication of the international search report:
14 March 2013

(54) Title: CHIP PACKAGES INCLUDING THROUGH-SILICON VIA DICE WITH VERTICALLY INTEGRATED PHASED-ARRAY ANTENNAS AND LOW-FREQUENCY AND POWER DELIVERY SUBSTRATES

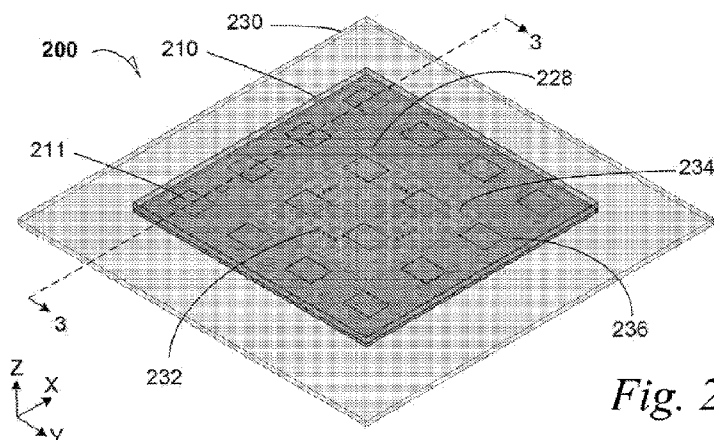


Fig. 2

(57) Abstract: An apparatus includes a die with through-silicon vias and radio frequency integrated circuit capabilities and it is vertically integrated with a phased-array antenna substrate. The through-silicon via and a radio frequency integrated circuit is coupled to a plurality of antenna elements disposed on the phased-array antenna substrate where each of the plurality of antenna elements is coupled to the through-silicon vias and radio frequency integrated circuit through a plurality of through-silicon vias. A process of assembling the through-silicon vias and radio frequency integrated circuit to the phased-array antenna substrate includes testing the apparatus.



A. CLASSIFICATION OF SUBJECT MATTER***H01L 23/48(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)

H01L 23/48; H01L 25/16; H01Q 23/00; H01L 23/34; H01L 21/02; H01Q 15/02; H01Q 1/36

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: through-silicon via, radio frequency integrated circuit, die, phased-array antenna, substrate, vertically integrated

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011-0068433 A1 (JONGHAE KIM et al.) 24 March 2011 See abstract; figures 1-7; and paragraphs [0006]-[0048].	1-32
A	US 2010-0127937 A1 (ARVIND CHANDRASEKARAN et al.) 27 May 2010 See abstract; figures 1A-5; and paragraphs [0023]-[0054].	1-32
A	US 2008-0029886 A1 (JOHN MICHAEL COTTE et al.) 07 February 2008 See abstract; figures 1-5A; and paragraphs [0024]-[0031].	1-32
A	US 2005-0237267 A1 (STEPHEN B. BROWN et al.) 27 October 2005 See abstract; figures 2-7C; and paragraphs [0031]-[0062].	1-32



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

26 OCTOBER 2012 (26.10.2012)

Date of mailing of the international search report

29 OCTOBER 2012 (29.10.2012)

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

CHOI, SANGWON

Telephone No. 82-42-481-5695



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/029363

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2011-0068433 A1	24.03.2011	WO 2011-038289 A1	31.03.2011
US 2010-0127937 A1	27.05.2010	CN 102224590 A	19.10.2011
		EP 2368400 A2	28.09.2011
		JP 2012-509653 A	19.04.2012
		KR 10-2011-0091561 A	11.08.2011
		TW 201034152 A	16.09.2010
		WO 2010-062946 A2	03.06.2010
		WO 2010-062946 A3	16.12.2010
		WO 2010-062946 A3	03.06.2010
US 2008-0029886 A1	07.02.2008	CN 100585843 C	27.01.2010
		CN 101118890 A	06.02.2008
		CN 101118890 C0	06.02.2008
		JP 04996384 B2	18.05.2012
		JP 2008-042904 A	21.02.2008
		US 2008-0186247 A1	07.08.2008
		US 7518229 B2	14.04.2009
		US 7808798 B2	05.10.2010
US 2005-0237267 A1	27.10.2005	US 2005-0057431 A1	17.03.2005
		US 6927745 B2	09.08.2005
		US 7173577 B2	06.02.2007