

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
8 May 2008 (08.05.2008)

PCT

(10) International Publication Number
WO 2008/054929 A3

(51) International Patent Classification:
H01L 23/495 (2006.01)

(21) International Application Number:
PCT/US2007/078444

(22) International Filing Date:
14 September 2007 (14.09.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/590,327 31 October 2006 (31.10.2006) US

(71) Applicant (for all designated States except US):
FREESCALE SEMICONDUCTOR INC. [US/US];
6501 William Cannon Drive West, Austin, Texas 78735
(US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **WANG, James, J.** [US/US]; 3131 E. Muirwood Drive, Phoenix, Arizona 85048 (US). **MCDONALD, William, G.** [US/US]; 1149 N. 92 Street #399, Scottsdale, Arizona 85256 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, 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.

(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, MT, 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
— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(74) Agents: **KING, Robert, L.** et al.; 7700 W. Parmer Lane, MD: TX32/PL02, Austin, TX 78729 (US).

(88) Date of publication of the international search report:
28 May 2009

(54) Title: METHODS AND APPARATUS FOR A QUAD FLAT NO-LEAD (QFN) PACKAGE

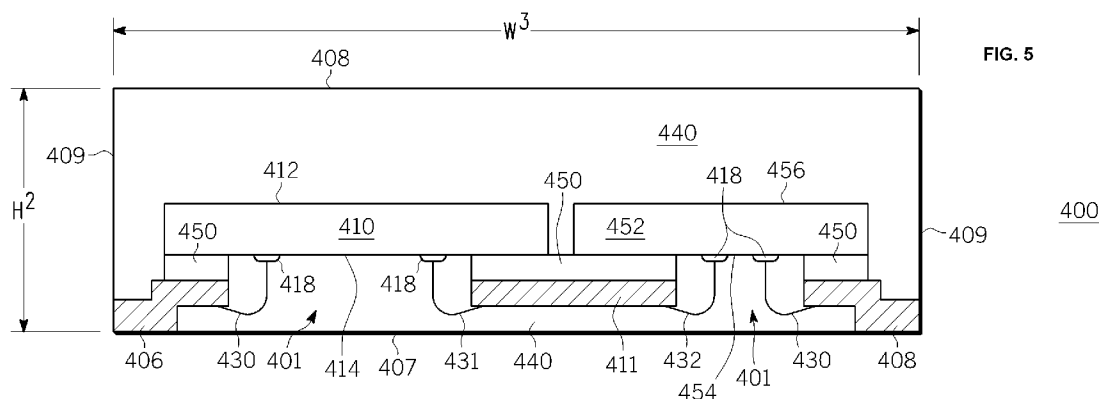


FIG. 5

(57) Abstract: Methods and apparatus are provided for decreasing the size of Quad Flat No-Lead (QFN) packages (300, 400) down to chip-scale packages. Such QFN packages include a first semiconductor chip (310, 410), a plurality of recessed leads (306, 406, 408, 411) having mold lock features, and a mold material 340, 440 substantially encasing all sides of the semiconductor chip. An active surface (314, 414) of the semiconductor chip is oriented toward a mounting side (307, 407) of the QFN package, and a plurality of wire bonds 330, 430 disposed between the active surface and the mounting side couple the active side to the leads. The QFN packages may also include a second semiconductor chip (452) coupled to a plurality of leads (408) and to the first semiconductor chip via wire bonds (431, 432) in a manner similar to the first semiconductor chip.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US07/78444

A. CLASSIFICATION OF SUBJECT MATTER

IPC: H01L 23/495(2006.01)

USPC: 257/676,666;438/123

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)

U.S. : 257/676,666; 438/123

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 practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,075,284 A (CHOI et al) 13 June 2000 (13.06.2000), Figure 6a	1-8,17-19
A	US 6,189,171 A (HUANG et al) 06 March 2001 (06.03.2001), Figure 7	1-23

☐ 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 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

15 April 2009 (15.04.2009)

Date of mailing of the international search report

15 APR 2009

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

Facsimile No. (571) 273-3201

Authorized officer

Roy Potter

Telephone No. 571-272-1842