

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
6 March 2008 (06.03.2008)

PCT

(10) International Publication Number
WO 2008/027708 A3

(51) International Patent Classification:
H01L 23/00 (2006.01)

(21) International Application Number:
PCT/US2007/075605

(22) International Filing Date: 9 August 2007 (09.08.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/512,941 29 August 2006 (29.08.2006) US

(71) Applicant (for all designated States except US):
FAIRCHILD SEMICONDUCTOR CORPORATION [US/US]; 82 Running Hill Road, MS 35-4E, South Portland, Maine 04106 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **LEE, SangDo** [KR/CN]; 1002, 3rd Building, Shihui Garden, Xinghai Road, SIP, Jiangsu, Suzhou 215000 (CN). **MALDO, Tiburcio A.** [PH/CN]; Block 14, Room 203, Xia Yuan Chun, Jin Ji Hu Road, Jiangsu, Suzhou City 215021 (CN).

(74) Agents: **JEWIK, Patrick, R.** et al.; Townsend and Townsend and Crew LLP, Two Embarcadero Center, 8th Floor, San Francisco, California 94111 (US).

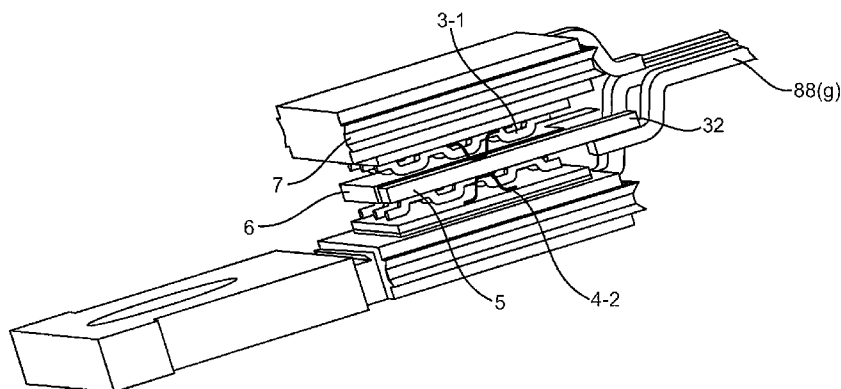
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, 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

(88) Date of publication of the international search report:
2 May 2008

(54) Title: SEMICONDUCTOR DIE PACKAGE INCLUDING STACKED DICE AND HEAT SINK STRUCTURES



(57) Abstract: A semiconductor package including stacked packages is disclosed. The semiconductor die package includes a first heat sink structure, a first semiconductor die attached to the first heat sink structure and having a first exterior surface, an intermediate conductive element attached to the first semiconductor die, a second semiconductor die attached to the second heat sink structure, and a second heat sink structure attached to the second semiconductor die and comprising a second exterior surface. A molding material is disposed around the first and second semiconductor dice, where the molding material exposes the first exterior surface of the first heat sink structure and exposes the second exterior surface of the second heat sink structure.

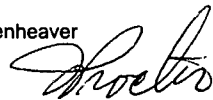


WO 2008/027708 A3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US07/75605

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(8) - H01L 23/00 (2007.10) USPC - 257/675 According to International Patent Classification (IPC) or to both national classification and IPC</p>																							
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) IPC(8) - 257/675, 678, 661, 686, 706 USPC - H01L 23/00, 23/34, 23/48, 23/52, 23/16, 23/36 (2007.10)</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) MicroPatent, Google Patent Search</p>																							
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 6,559,525 B2 (HUANG) 06 May 2003 (06.05.2003) entire document</td> <td>1,5,7,9,14-16</td> </tr> <tr> <td>---</td> <td></td> <td></td> </tr> <tr> <td>Y</td> <td></td> <td>2-4, 6, 8, 10-13, 17-18</td> </tr> <tr> <td>Y</td> <td>US 2002/0124955 A1 (TUNG et al) 12 September 2002 (12.09.2002) Sections [0005], [0025], [0026]</td> <td>2,6,12,13,17</td> </tr> <tr> <td>Y</td> <td>US 7,009,292 B2 (MIURA et al) 07 March 2006 (07.03.2006) col. 9 lines 57-59</td> <td>3,4,10,11</td> </tr> <tr> <td>Y</td> <td>US 5,323,060 A (FOGAL et al) 21 June 1994 (21.06.1994) col. 1 lines 6-7, col. 2 lines 19-30</td> <td>8,18</td> </tr> </tbody> </table>			Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 6,559,525 B2 (HUANG) 06 May 2003 (06.05.2003) entire document	1,5,7,9,14-16	---			Y		2-4, 6, 8, 10-13, 17-18	Y	US 2002/0124955 A1 (TUNG et al) 12 September 2002 (12.09.2002) Sections [0005], [0025], [0026]	2,6,12,13,17	Y	US 7,009,292 B2 (MIURA et al) 07 March 2006 (07.03.2006) col. 9 lines 57-59	3,4,10,11	Y	US 5,323,060 A (FOGAL et al) 21 June 1994 (21.06.1994) col. 1 lines 6-7, col. 2 lines 19-30	8,18
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.																					
X	US 6,559,525 B2 (HUANG) 06 May 2003 (06.05.2003) entire document	1,5,7,9,14-16																					

Y		2-4, 6, 8, 10-13, 17-18																					
Y	US 2002/0124955 A1 (TUNG et al) 12 September 2002 (12.09.2002) Sections [0005], [0025], [0026]	2,6,12,13,17																					
Y	US 7,009,292 B2 (MIURA et al) 07 March 2006 (07.03.2006) col. 9 lines 57-59	3,4,10,11																					
Y	US 5,323,060 A (FOGAL et al) 21 June 1994 (21.06.1994) col. 1 lines 6-7, col. 2 lines 19-30	8,18																					
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/></p>																							
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>“A” document defining the general state of the art which is not considered to be of particular relevance</td> <td>“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</td> </tr> <tr> <td>“E” earlier application or patent but published on or after the international filing date</td> <td>“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</td> </tr> <tr> <td>“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)</td> <td>“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</td> </tr> <tr> <td>“O” document referring to an oral disclosure, use, exhibition or other means</td> <td>“&” document member of the same patent family</td> </tr> <tr> <td>“P” document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			“A” document defining the general state of the art which is not considered to be of particular relevance	“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	“E” earlier application or patent but published on or after the international filing date	“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	“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)	“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	“O” document referring to an oral disclosure, use, exhibition or other means	“&” document member of the same patent family	“P” document published prior to the international filing date but later than the priority date claimed												
“A” document defining the general state of the art which is not considered to be of particular relevance	“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																						
“E” earlier application or patent but published on or after the international filing date	“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																						
“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)	“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																						
“O” document referring to an oral disclosure, use, exhibition or other means	“&” document member of the same patent family																						
“P” document published prior to the international filing date but later than the priority date claimed																							
<p>Date of the actual completion of the international search 13 December 2007</p>		<p>Date of mailing of the international search report 08 FEB 2008</p>																					
<p>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</p>		<p>Authorized officer: Blaine R. Copenheaver  PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774</p>																					