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- *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))*

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(54) Title: ENHANCED THERMAL DISSIPATION BALL GRID ARRAY PACKAGE

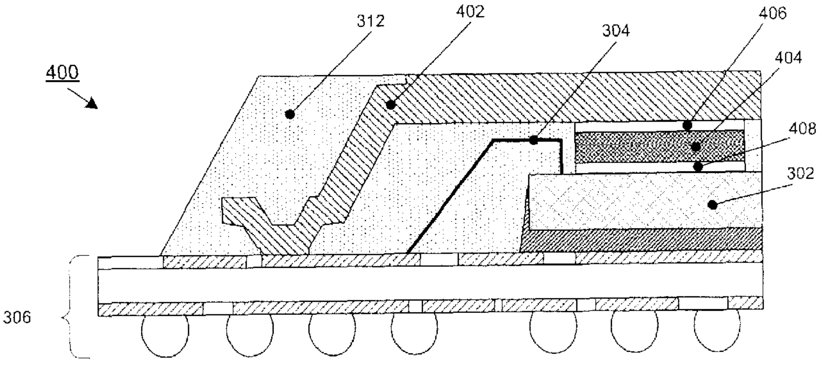

FIG. 4

(57) Abstract: In a semiconductor chip, a thermal adhesive is used to bond an internal heat spreader to an active functional die. In an alternative embodiment a dummy die is place directly on top of the active functional die and a thermal adhesive is used to bond an internal heat spreader to the dummy die. This provides a direct and relatively low thermal conductivity path from the heat source, i.e., the functional device to the top of the package, that is, the internal metal heat spreader which is also exposed to the air.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/038592

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L23/433

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

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/095875 A1 (HUANG CHIEN-PING [TW] ET AL) 5 May 2005 (2005-05-05) paragraphs [0006], [0043] - [0047]; figures 4-6 -----	1-4,15,16,20
X	WO 02/061830 A1 (KIM YOUNG SUN [KR]) 8 August 2002 (2002-08-08) page 8, line 30 - page 9, line 3; figure 6 -----	1-4,15-16,20
X	US 5 616 957 A (KAJIHARA MAMORU [JP]) 1 April 1997 (1997-04-01) figures 2,4c -----	1-4,15-16,20
X	US 7 126 218 B1 (DARVEAUX ROBERT F [US] ET AL) 24 October 2006 (2006-10-24) column 2, line 38 - column 3, paragraph 25; figure 1 ----- -/--	1,3-4,15,20

☒ 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
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- "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
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- "&" document member of the same patent family

Date of the actual completion of the international search 1 September 2009	Date of mailing of the international search report 29/10/2009
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 Zeisler, Peter

INTERNATIONAL SEARCH REPORT

International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 097 602 A (WITCHGER WILLIAM J [US]) 1 August 2000 (2000-08-01) column 2, line 65 - column 3, line 24; figure 1 -----	2,16
A	EP 0 987 757 A2 (KITAGAWA IND CO LTD [JP]) 22 March 2000 (2000-03-22) paragraphs [0027] - [0035]; figure 3a -----	2,16

INTERNATIONAL SEARCH REPORT

International application No.
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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 allsearchable 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 reportcovers 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.:

1-4, 15-16, 20

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: 1-4, 15-16, 20

   A semiconductor package comprising thermal adhesive material between the semiconductor die and the heat spreader

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2. claims: 5-14, 17-19

   A semiconductor package comprising a dummy semiconductor die for heat conduction which is inserted between the semiconductor die and the heat spreader

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2009/038592

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