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H01L 25/16 *(2023.01)* ***H01L 25/18*** *(2023.01)*
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(54) **MICROELECTRONIC ASSEMBLIES**

(57) Microelectronic assemblies, related devices and methods, are disclosed herein. In some embodiments, a microelectronic assembly may include a package substrate having a first surface and an opposing second surface; a first die having a first surface and an opposing second surface embedded in a first dielectric layer, where the first surface of the first die is coupled to the second surface of the package substrate by first interconnects; a second die having a first surface and an opposing second surface embedded in a second dielectric layer, where the first surface of the second die is coupled to the second surface of the first die by second interconnects; and a third die having a first surface and an opposing second surface embedded in a third dielectric layer, where the first surface of the third die is coupled to the second surface of the second die by third interconnects.

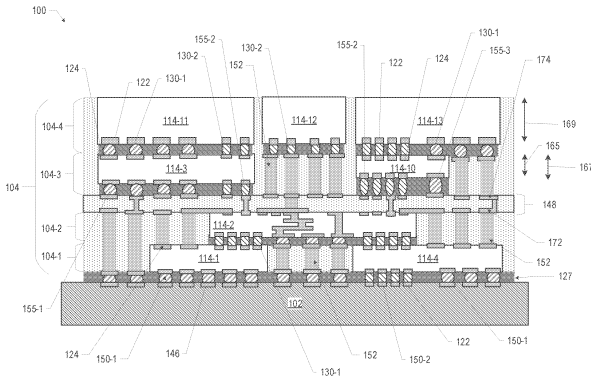

FIG. 5

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H01L 25/50; H01L 23/481; H01L 24/06;
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H01L 2224/17181; H01L 2224/2919;
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H01L 2224/95001; H01L 2225/06513;
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H01L 2224/05647, H01L 2924/00014;
H01L 2224/13105, H01L 2924/014,
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H01L 2224/13344, H01L 2924/00014;
H01L 2224/13347, H01L 2924/00014;
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H01L 2224/13455, H01L 2924/00014;
H01L 2224/1349, H01L 2924/00014;
H01L 2224/2919, H01L 2924/0665,
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H01L 2224/73204, H01L 2224/16145,
H01L 2224/32145, H01L 2924/00012;
H01L 2224/73204, H01L 2224/16225,
H01L 2224/32225, H01L 2924/00;
H01L 2924/181, H01L 2924/00012

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 22 21 7283

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2012/248439 A1 (LEE JONGJOO [KR]) 4 October 2012 (2012-10-04) * paragraph [0055] - paragraph [0056]; figure 3B * * paragraph [0085] - paragraph [0088] *	1	INV. H01L23/528 H01L23/525 H01L23/522 H01L25/065 H01L23/00 H01L25/00 H01L25/04 H01L25/10 H01L25/16 H01L25/18 H01L23/538 ADD. H01L23/48
X	US 2013/075903 A1 (PAGAILA REZA A [SG] ET AL) 28 March 2013 (2013-03-28) * paragraph [0053] - paragraph [0054]; figures 6, 9 * * paragraph [0062] * * paragraph [0088] *	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01L

INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
Munich	21 August 2023	Hirsch, Alexander

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04E07)

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 22 21 7283

Claim(s) searched incompletely:
1

Claim(s) not searched:
2-15

Reason for the limitation of the search:

The present divisional application relates to earlier application EP19819772.
The pending claims do not comply with the provisions of Article 76(1) EPC.
The earlier application as well as the priority document relate to microelectronic assemblies comprising inter alia a stacked arrangement of first, second and third dies embedded in respective first, second and third insulating material layers and each interconnected with respective interconnects.
Upon entry into the European phase, the earlier application has been amended so as to extend beyond the original disclosure, contrary to the requirements of Article 123(2) EPC, leading to an objection in that procedure.
In the present divisional application no literal basis for pending independent claim 1 can be found in the earlier application. The scope of the new claims has been amended to relate to a first insulating material layer with a first die therein and to a second insulating material layer with a second and a third die therein, wherein a redistribution layer is disposed between said first and second insulating material layers. This subject-matter does not have a basis in the original claims and it cannot be derived directly and unambiguously from any of the described embodiments.
The only described embodiment which comprises a redistribution layer is the embodiment of fig. 5 and the corresponding method in figs. 6A-F as well as the description in pars. [0064]-[0072]. However, the pending independent device claim is generalised (e.g. by omission of features) compared to this embodiment inter alia with respect to
- the number of dies,
- differences in die thicknesses,
- the structural arrangement of respective pluralities of dies within the respective upper and lower insulating material layers, namely adjacent, stacked and offset arrangements in four layers,
- the structural details of various different conductive pillars extending between package substrate and redistribution layer, between a die and the redistribution layer or between a die and the package substrate and
- the role of conductive contacts in electrical and mechanical coupling as well as differences in contact pitches.
In the invitation pursuant to Rule 63(1) EPC it has been emphasised that the isolation of features from originally disclosed embodiments clearly constitutes an intermediate generalisation in the sense of Guidelines H-V, 3.2.1. The disclosure of a particular embodiment must not be considered to be a reservoir from which features can be chosen in order to artificially create a new embodiment. Furthermore the use of the term "may" cannot be taken as indication for a feature being truly optional in view of the vast usage of this term "may" throughout the entire

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INCOMPLETE SEARCH
SHEET C

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disclosure.
None of the pending dependent product claims 2-7 remedies the above defects.
This argumentation applies mutatis mutandis to the corresponding method claims 8-15.
For these reasons none of the pending claims meet the requirements of Article 76(1) EPC.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 21 7283

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-08-2023

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US 2013075903 A1	28-03-2013	US 2012056316 A1	08-03-2012
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82