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D E C I S I O N
of 3 July 1996

Case Number: T 0532/93 - 3.4.1

Application Number: 87402749.3

Publication Number: 0270461

IPC: H01L 23/50

Language of the proceedings: EN

Title of invention:
Universal leadframe carrier and insert for holding and bonding semiconductor chip to leadframe leads

Applicant:
SGS-THOMSON MICROELECTRONICS, INC.

Opponent:
-

Headword:
Leadframe carrier/SGS-THOMSON

Relevant legal provisions:
EPC Art. 52(1), 56

Keyword:
"Inventive step - (no)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0532/93 - 3.4.1

D E C I S I O N
of the Technical Board of Appeal 3.4.1
of 3 July 1996

Appellant: SGS-THOMSON MICROELECTRONICS, INC.
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Decision under appeal: **Decision of the Examining Division of the European Patent Office dated 22 March 1993 refusing European patent application No. 87 402 749.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. D. Paterson
Members: R. K. Shukla
U. G. O. Himmler

Summary of Facts and Submissions

I. European patent application No. 87 402 749.3 was refused by a decision of the Examining Division on the ground that the subject matter of claim 1 did not involve an inventive step as required by Article 52(1) EPC, having regard to the following prior art documents:

D1: US-A-3 868 759

D2: US-A-3 868 765

D3: WO-A-85/04520

II. Independent claim 1 forming the basis for the above decision reads as follows:

"A leadframe carrier assembly including cooperative first and second carrier members (13,13') for holding therebetween in stacked relationship a carrier insert (34) for supporting a plurality of semiconductor chips and a strip (33) of leadframes to be bonded respectively to said chips, characterised in that (i) one said carrier member (13) is a lower member for the assembly and provides an elongated channel along its length (ii) the carrier insert (34) is formed as a flat strip and fits in, and extends along, said channel when the assembly is stacked, and (iii) said other carrier member (13') is an upper member and has an elongated aperture (13'') which extends over a plurality of chips (55) on said carrier insert to permit access through said aperture to a plurality of chips for application of heat to bond leads from said leadframes to respective chips,

whereby the assembly provides a universal carrier with the same first and second carrier members holding one of a plurality of carrier inserts having respectively different configurations of chips supported thereby."

III. The reasons for the refusal of the application, according to the above decision can be summarised as follows:

The invention as claimed is distinguished over the closest prior art document D1 in that

(a) a carrier insert for supporting semiconductor chips fits in an elongated channel in a lower carrier member, and

(b) an upper carrier member has an elongated aperture.

In the field of chip handling assemblies the need to provide fixed relationship between adjoining assembly parts is well recognised. Thus, for example, in document D3 a strip of lead frame fits into an elongated recess provided in a carrier member. For a skilled person, therefore, incorporation of feature (a) in the assembly known from D1 was obvious.

A skilled person confronted with the task of adapting the leadframe carrier assembly of document D1 to different chip sizes would increase the size of openings 36 in the upper carrier member shown in Figure 2 of document D1, so as to guarantee the supply of heat to relatively large size chips, and would eventually, when the chips are large enough, arrive at a situation requiring the individual openings 36 to merge together into a single elongated opening. Feature (b) of the claimed invention would therefore be obvious to the skilled person.

IV. The Applicant lodged an appeal against the decision of the Examining Division and now requests that a patent be granted on the basis of an amended claim 1 filed with the Statement of grounds of appeal, the claim having been amended primarily to base its precharacterising part on the disclosure in document D3 rather than that in document D1.

Amended claim 1 has the following wording:

"A leadframe carrier assembly including cooperative first and second carrier members (13,13') defining in combination an inner elongated aperture and for holding therebetween in stacked relationship a plurality of semiconductor chips and a strip (33) of leadframes to be bonded respectively to said chips, in which one said carrier member (13) is a lower member for the assembly and provides an elongated channel along its length characterised in that (i) a carrier insert (34) is formed as a flat strip for supporting a plurality of semiconductor chips and fits in, and extends along, said channel when the assembly is stacked, and (ii) said other carrier member (13') is an upper member and has an elongated aperture (13'') which extends over a plurality of chips (55) on said carrier insert to permit access through said aperture to a plurality of chips for application of heat to bond leads from said leadframes to respective chips, whereby the assembly provides a universal carrier with the same first and second carrier members holding one of a plurality of carrier inserts having respectively different configurations of chips supported thereby."

V. In an official communication the Board agreed with the Appellant's submission that document D3 represented the closest prior art, and gave its preliminary view that starting from the leadframe assembly known from this

document and having regard to the routine expertise of the one skilled in the art, the claimed invention did not appear to involve an inventive step.

VI. In its response, the Appellant maintained its request as set out in paragraph IV above, and submitted further arguments in support thereof.

The Appellant's arguments submitted in the proceedings before the Board can be summarized as follows:

Document D1 is essentially concerned with a prealignment operation in a stacked assembly before the chips are transported to a bonding station. The rubber strip (20) in the leadframe assembly of document D1 does not act as a lower carrier member during the bonding operation, so that the rubber strip does not correspond to the lower carrier member of the present invention. In the leadframe assembly of document D1 there is no carrier insert in the form of a flat strip fitting in a channel in the lower carrier member. Moreover, in document D1 the upper member 34 has individual apertures 36 for the semiconductor chips. These apertures are essential to the assembly of document D1 in order to hold the leadframes 28 planar over each chip when the magnetic and vibratory pre-alignment is done. A modification of the cover plate of document D1 to have an elongated aperture might therefore render the device of document D1 inoperative. Consequently, document D1 cannot be regarded as the closest prior art document.

Document D3 constitutes the closest prior art. However, in the leadframe carrier assembly disclosed in this document, a carrier insert for supporting semiconductor chips is not provided between a lower carrier member and

an upper carrier member. Moreover, the upper carrier member has no aperture for permitting access of heat to chips during the bonding operation.

In relation to the leadframe carrier assembly known from document D3, the present invention has the advantage that the carrier can be made universal, so that when chips of different sizes are to be bonded, it is only necessary to supply a different carrier insert for the different sizes of chips, while the upper and lower member may remain the same. Furthermore, the elongated aperture allows applied heat to be immediately accessible to the chips regardless of their size or longitudinal distribution. Although document D3 recognizes the benefit of a universal carrier member (see page 3, lines 1 to 4) there is no suggestion of a flat insert member. Furthermore, document D3 does not contain any teaching of the use of the channel member as something which provides lateral location within the carrier; instead, the function of the lateral shelves (7-112 in Figure 7) is to provide an abutment surface to give correct deflection of the tips of the leadframe. Consequently, the present invention does not follow plainly and logically from document D3.

Reasons for the Decision

1. *Inventive step*

In the present appeal the only issue to be decided is that of inventive step.

1.1 The Board agrees with the Appellant's submissions regarding document D1 in paragraph VI above, and considers that document D3, and not document D1, represents the closest prior art.

This document discloses (see in particular Figure 7 and the corresponding description on pages 14 and 15), in the wording of claim 1 under consideration, a leadframe carrier assembly including cooperative first and second carrier members (7-110, 7,120) defining in combination an inner elongated aperture (the spacing between the members) and for holding therebetween in stacked relationship a plurality of semiconductor chips (7-230) and a strip (5-125) of leadframes to be bonded respectively to said chips, in which one said carrier member (7-110) is a lower member for the assembly and provides an elongated channel along its length and in which said other carrier member (7-120) is an upper member.

The claimed subject matter thus differs from the prior art disclosed in document D3 in that:

(i) the assembly also comprises a carrier insert which is formed as a flat strip for supporting a plurality of semiconductor chips and which, when the assembly is stacked, fits in and extends along the channel provided in the lower member; and

(ii) the upper carrier member has an elongated aperture which extends over a plurality of chips on said carrier insert.

The wording of claim 1, "to permit access through said aperture..... having respectively different configuration of chips supported thereby." does not include any additional constructional features, but explains functions of the features (i) and (ii) mentioned above, namely to provide a universal carrier with the same first and second carrier members holding one of a plurality of carrier inserts having respectively different configurations of chips supported thereby and to permit access through the aperture to a plurality of chips for the application of heat to bond the leads of the leadframe to respective chips.

1.2 Having regard to the distinguishing features (i) and (ii) above, the objective problem addressed by the application in suit can be regarded as providing a universal leadframe carrier assembly having a relatively low thermal load.

1.3 In the leadframe carrier assembly according Figure 7 of document D3, the lower member 7-110 has recesses 7-225 which are dimensioned so as to hold chips of the corresponding size(s). A person skilled in the art would realize that the assembly of document D3 can be used with only a given set of chips due, inter alia, to the fact that the recesses of a certain size corresponding to the size of the chips are provided in the lower carrier member. In order to overcome this drawback, it would, in the Board's view, be well within the expertise of the skilled person to provide separate carrier inserts having openings for receiving different sets of chips and to insert one of these carrier inserts in a channel provided in the lower member (i.e. the channel

formed by bottom portion 7-220 of the lower member and the side walls between the bottom portion and the shelves 7-112). Furthermore, in order to fit such a carrier insert between the upper and the lower member it would be obvious that the carrier insert should be formed as a flat strip.

Furthermore, the skilled person knows from document D1 that for reducing thermal load during bonding, openings can be provided in the upper member of the assembly. Also, as has been submitted by the Appellant (see paragraph VI above), individual openings for semiconductor chips are required in the assembly of document D1 so as to hold the leadframe structure securely during the prealignment operation. As the skilled person in the present case is not concerned with prealignment but with reducing thermal load during the bonding operation, in the Board's view, the provision in the upper member of the assembly disclosed in document D3 of an elongated opening, instead of individual openings, extending over a plurality of chips represents a mere workshop modification which would be obvious to the skilled person.

The skilled person would therefore arrive at the claimed subject matter without having to exercise any inventive activity.

1.4 The Appellant has contended that although document D3 recognizes the benefit of a universal carrier member, there is no suggestion in the document of an additional insert member. In the Board's view, however, to a skilled person it would be evident that document D3 is concerned with providing a universal - i.e. a single type of - leadframe for chips having different sizes (see Figure 5), and that the assembly of document D3 still suffers from the disadvantage that it can be used

only with a given set of chips which can be accommodated in recesses of predetermined size(s) provided in the lower carrier member. Having regard to this drawback, the use of an insert follows logically from document D3 for the above stated reasons.

Finally, the Appellant has cited the passage bridging pages 14 and 15 of document D3 to support its contention that the function of the lateral shelves 7-112 is to provide an abutment surface to give correct deflection of the tips of the leadframe, and that document D3 does not contain any teaching of the use of the channel member as something which provides lateral location within the carrier. In this connection, the statement bridging pages 14 and 15 of document D3 reads as follows:

"Cover 7-120 presses down on edge 5-110 of leadframe strip 5-125, which edges rest on shelves 7-112 to position the outer parts of the strip so that the contact tips will be deflected slightly."

In the Board's view, it is clear from the above statement that although the lateral shelves provide an abutment surface, the contact tips are deflected because **the cover presses down on the lead frame**. Also, in the Board's view, it is evident from Figure 7 and from the above statement "which edges (of the strip) rest on shelves 7-112 to position the outer parts of the strip" that the shelves are used for laterally aligning the strip to the chip. In any case such alignment is indispensable in an automated bonding process, and the skilled person would be aware of this requirement.

Notwithstanding the above, as already stated in paragraph 1.3 above, the skilled person would consider providing the insert so that it fits into a channel

formed by bottom portion 7-220 of the lower member and the side walls between the bottom portion 7-220 and the shelves 7-112. The shelves 7-112 may then be used as in document D3 for deflecting the contact tips of the leads.

1.5 For the above reasons, in the Board's judgement, the subject matter of claim 1 does not involve an inventive step within the meaning of Articles 52(1) and 56 EPC.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer G. D. Paterson