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**Datasheet for the decision
of 22 September 2006**

Case Number: T 0977/04 - 3.4.03

Application Number: 97116886.9

Publication Number: 0834919

IPC: H01L 23/485

Language of the proceedings: EN

Title of invention:

Semiconductor element having a bump electrode

Applicant:

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.

Opponent:

-

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56

Keyword:

"Inventive step - yes (after amendment)"

Decisions cited:

-

Catchword:

-



Case Number: T 0977/04 - 3.4.03

D E C I S I O N
of the Technical Board of Appeal 3.4.03
of 22 September 2006

Appellant: MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.
1006, Oaza Kadoma
Kadoma-shi, Osaka-fu (JP)

Representative: Eisenführ, Speiser & Partner
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 16 January 2004
refusing European application No. 97116886.9
pursuant to Article 97(1) EPC.

Composition of the Board:

Chair: R. G. O'Connell
Members: G. Eliasson
J. Van Moer

Summary of Facts and Submissions

- I. This is an appeal against the decision of the examining division refusing European patent application 97 116 886.9 for lack of novelty.

In the examination procedure, the following prior art documents *inter alia* were cited:

- D3: EP 0 320 244 A; and
D5: Patent Abstracts of Japan, vol. 1996, no. 06
& JP 08 055 855 A.

- II. With the statement of grounds of appeal, the appellant applicant filed amended application documents.

- III. At oral proceedings before the board, the appellant applicant requested that the decision under appeal be set aside and a patent granted in the following version:

Claims 1 to 5 filed at the oral proceedings;

Description pages 1 to 4, 4a, 4b, 8 to 24 filed with the statement of grounds of appeal,
description pages 5, 5a, 5b, 6 and 7 filed at the oral proceedings;

Drawings: Sheets 1/9 to 9/9 filed with the statement of grounds of appeal.

IV. Claim 1 according to the appellant applicant's request reads as follows:

"1. A method of forming a bump electrode on an IC electrode, comprising:

forming a ball bond portion (115) on an IC electrode (104) at the end of a wire (101) by a wire bonding apparatus having a bonding capillary (113) being positioned above said IC electrode (104), wherein the bonding capillary (113) is positioned in a ball bond forming position;

moving the bonding capillary (113) upward with respect to the IC electrode (104);

moving the bonding capillary (113) sideways and then downward with respect to the IC electrode (104);

bonding a wire (101) to the ball bond portion (115); and

cutting the wire (101)

characterized in that the wire (101) is prevented from coming in contact with portions around the ball bond portion (115) other than the ball bond portion (115) itself by presetting a descent position of the bonding capillary (113) to a position higher than the ball bond forming position and

that the ball bond portion (115) is provided with a sloping upper surface and the wire (101) is bonded to the ball bond portion (115) in the area of said sloping upper surface."

V. The appellant applicant's arguments can be summarized as follows:

- (a) Document D3 did not disclose that the descent position of the bonding capillary was at a higher vertical position than that of the ball bonding position. On the contrary, as shown in Figures 2, 3, 5(g) and 7, the tip end of the bonded wire lay at the same height as the upper peripheral edge of the ball bond portion which meant that the capillary at the wire bonding step was pressed down to the same height as in the ball bond forming step.

- (b) None of the cited prior art discloses a bump electrode having an upper sloping surface. Therefore, the skilled person would have no suggestion from the prior art which would lead him to the claimed method.

Reasons for the Decision

1. The appeal is admissible.

2. *Amendments and Clarity*

Claim 1 is based on claim 1 as filed with the additional specifications that that the wire is

prevented from coming in contact with portions around the ball bond portion (115) other than the ball bond portion (115) itself, and that the wire (101) bonded to the ball bond portion is provided with a sloping upper surface where the wire is bonded. These features are disclosed in the application as published at column 13, lines 28 to 34, and column 12, lines 45 to 50, respectively. Claim 1 has also been amended for clarity.

Thus, the requirements of Article 123(2) and 84 EPC are met.

3. *Novelty and inventive step*

3.1 Document D3 is considered the closest prior art and discloses a method of forming a bump electrode on an IC electrode comprising the following steps (see Figures 5a to 5g and column 6, line 54, to column 8, line 38):

- forming a bump bond portion 7 on an IC electrode 2 at the end of a wire 5 by a wire bonding apparatus having a bonding capillary 3 being positioned above said IC electrode, wherein the bonding capillary 3 is positioned in a ball bond forming position (Figure 5c and column 7, lines 37 to 48);
- moving the bonding capillary 3 sideways and then downward with respect to the IC electrode (Figures 5d and 5e and column 7, line 49, to column 8, line 15);
- bonding the wire to the ball bond portion (Figure 5f and column 8, lines 29 to 33); and

- cutting the wire (Figure 5g and column 8, lines 34 to 38).

3.2 The appellant argued that document D3 did not disclose a descent position of the bonding capillary in the step of bonding the wire to the ball bond portion which is higher than the ball bonding position (see item V(a) above). This question is however no longer relevant for the outcome of the present case, since document D3 in any case does not disclose a ball bond portion provided with a sloping upper surface where the wire is bonded to the ball bond portion in the area of the sloping upper surface. In the method of document D3, the ball bond portion is provided with a horizontal upper surface on which the wire is bonded (see Figures 5d to 5g).

The subject matter of claim 1 is therefore new (Article 54 EPC).

3.3 A wire bond on a sloping upper surface of the ball bond portion solves the problem of allowing an exact vertical positioning of the bond between the wire and the ball bond portion independently of variations in size of the ball bond portion, which in turn has the effect of reliably preventing the wire from contacting portions other than the ball bond portion itself (cf. application as published, column 12, line 45, to column 13, line 10, and column 13, lines 28 to 46).

3.4 Document D5 is the only available prior art document which discloses a method of forming a bump electrode where the ball bond portion 3 is provided with a sloping upper surface (see abstract). Contrary to the

claimed process, however, the descent position of the bonding capillary 1 is at a position lower than the ball bond forming position (see figure in abstract). Moreover, document D5 is not concerned with the problem of preventing the wire from contacting portions other than the ball bond portion itself but relates instead to the final step in the method of producing a bump electrode where the wire has to be torn off in a consistent manner from the ball bond portion. Therefore, a combination of the teaching of document D3 with that of document D5 would not arrive at the claimed method.

For the above reasons, in the board's judgement, the subject matter of claim 1 involves an inventive step within the meaning of Article 56 EPC.

4. In the judgement of the board, the application meets the requirements of the EPC.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent in the version as specified in the appellant's request (point III).

Registrar

Chair

S. Sánchez Chiquero

R. G. O'Connell