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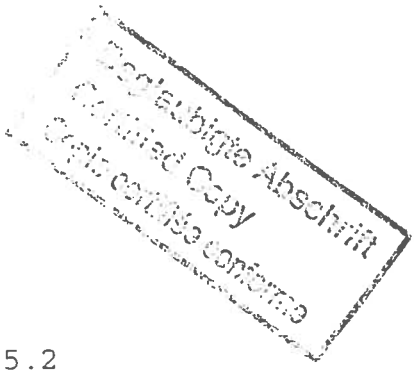

D E C I S I O N
of 25 March 1998

Case Number: T 0835/96 - 3.5.2

Application Number: 91310192.9

Publication Number: 0485151

IPC: H03H 9/05

Language of the proceedings: EN

Title of invention:
Surface acoustic wave device and method of manufacture

Applicant:
Fujitsu Limited

Opponent:
-

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Novelty (after amendment, yes)"
"Inventive step (after amendment, yes)"

Decisions cited:
-

Catchword:
-

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Case Number: T 0835/96 - 3.5.2

D E C I S I O N
of the Technical Board of Appeal 3.5.2
of 25 March 1998

Appellant: Fujitsu Limited
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Representative: Billington, Lawrence Emlyn
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 2 May 1996 refusing European patent application No. 91 310 192.9 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: W. J. L. Wheeler
Members: M. R. J. Villemin
B. J. Schachenmann

Summary of Facts and Submissions

I. The Appellant contests the decision of the Examining Division to refuse European patent application No. 91 310 192.9. The reason given for the refusal was that the subject-matter of claim 1 then on file was not new, having regard to the earlier European patent application:

D5: EP-A-472 856,

and did not involve an inventive step, having regard to the prior art document:

D2: US-A-4 864 470.

II. In reply to a communication from the Board, the Appellant filed with the letter dated 12 February 1998 a new set of claims 1 to 8 and amended pages 1, 2, 4, 4a, and 5 to 12 of the description.

III. Claim 1 presently on file is worded as follows:

"A surface-acoustic-wave device in which a surface-acoustic-wave device element (1) comprising interdigital electrodes (15) on a piezoelectric substrate (10) is packaged in a package (2) provided with a metal pattern (21), the package including a frame (25, 23) surrounding the piezoelectric substrate (10) and a lid (20, 20', 34) aligned with the frame, the metal pattern (21) being provided on the lid of the package (2), at least one metal bump (11) being formed on a bonding pad section of the surface-acoustic-wave device element, wherein the lid is arranged to seal the

substrate and to press the or each metal bump (11) of the device element in such a way as to establish a contact connection between the bump and the said metal pattern (21) of the lid."

Claims 2 to 8 are dependent claims relating to various embodiments of the device according to claim 1.

IV. The Appellant explained that the amendments performed in the application followed the suggestions of the Board and should therefore lead to the grant of a patent. Claim 1 had been cast in a one-part form because the device disclosed in D2 did not have a lid, so that a delimitation in the two-part form based on this document would have entailed a substantial amount of splitting of the features of this claim.

V. The Appellant requested that the decision under appeal be set aside and a patent granted on the basis of the application in its present form, namely:

Claims: No. 1 to 8 filed with the letter dated 12 February 1998;

Description: pages 1, 2, 4, 4a, and 5 to 12 filed with the letter dated 12 February 1998; page 3 as originally filed;

Drawings: sheets 1/14 to 14/14 as originally filed.

The Appellant also requested oral proceedings if the Board intended to dismiss the appeal.

Reasons for the Decision

1. The appeal is admissible.

2. *Admissibility of the amendments*

Claims:

The features recited in claims 1 to 8 presently on file were all disclosed in the application as originally filed. The one-part form of claim 1 is appropriate since a two-part form with the preamble based on D2 would lead to an awkward splitting up of the various features of the claim, as will be apparent from section 4.2 below.

Description:

Page 4 now includes the citation of prior art documents D2 and D5 to meet the conditions of Rule 27(1)(b) EPC. On page 5 the reference to Figure 8 as an embodiment of the invention as now claimed in claim 1 has been deleted, because this embodiment is not provided with a lid.

Linguistic amendments performed to remove obvious errors and/or improve clarity on pages 1, 2, 6, 7, 8, 10 and 11 are allowable under Rule 88 EPC.

In the opinion of the Board, the present form of the application does not infringe Article 123(2) EPC.

3. *Prior art and novelty*

3.1 The term "bonding", mentioned in claim 1, generally involves some coalescence, fusion or amalgamation, between parts to be connected. However, the Board agrees with the Appellant and the Examining division that, in the claimed SAW device, only mechanical pressure but no thermocompression or melting for producing "bonding" in the sense indicated above, is applied to the metal bumps (11) by the metal pattern (21) provided on the lid to establish electrical contact connection between them and said metal pattern. It is clear from the description that the metal bumps can be lifted at any time from the metal pattern and are not bonded to it in the sense mentioned above.

Document D5 belongs to the prior art under Article 54(3) EPC. D5, see Figure 7 and column 10, lines 14 to 22, discloses a surface acoustic wave (SAW) device provided with a lid 970, 970a, arranged to seal the piezoelectric substrate of the SAW device 946 in such a way as to establish a contact connection between it and the metal pattern of the package through bumps 958. From the passage in column 4, lines 38 to 50, of D5, it is clear that the teaching of this document embraces the application of only pressure for producing contact connection between the metal bumps and the metal pattern ("metal pads") and is thus not limited to contact by bonding by heating.

Although the SAW device according to claim 1 has all the above mentioned features in common with that disclosed in D5, it differs therefrom in that the metal pattern (21) is provided on the lid of the package (2).

3.2 In contrast to the claimed SAW device, the SAW device described in D2 does not have a lid provided with a metal pattern. Therefore, the subject-matter of claim 1 is new over the prior art disclosed in D2.

3.3 It is concluded from the above that the subject-matter of claim 1 is new over the prior art disclosed in D2 or D5.

3.4 The Board notes that document D1 (US-A-4 737 742) and both documents D3 and D4 (Patent Abstracts of Japan) cited in the European search report are less relevant to the claimed subject-matter than documents D2 and D5. Therefore, these documents will not be further considered in this decision.

4. *Inventive step*

4.1 D5 is considered by the Board as disclosing the prior art closest to the invention. However, since D5 belongs to the state of the art according to Article 54(3) EPC, it cannot be taken into consideration for assessing inventive step, or considered in combination with any other prior art document. Thus, the main issue to be considered in the present appeal is whether the subject-matter of claim 1 involves an inventive step within the meaning of Article 56 EPC, with regard to the prior art disclosed in D2.

4.2 Important differences between the claimed SAW device and the device known from D2 (see Figures 1 to 3 and column 2, lines 32 to 58) can be seen in that:

- in the presently claimed device, the bumps (11a, 11b, 11c, Figures 3(A) to 3(F)) are formed on the SAW device element (10, 15), whereas according to D2, they are formed on electrodes 22 on a support constituted by a ceramic base plate 21, 28a.

- in the presently claimed device, only pressure is applied to establish contact between the bumps and the metal pattern, whereas according to D2, pressure **and heat** (emphasis added by the Board) are applied for electrically connecting the electrodes 30 of the SAW device 24 to the bumps 23. This suffers from the disadvantage of producing stress due to the difference in the coefficients of thermal expansion of the piezoelectric substrate 25 ("functional surface") of the SAW device 24 and the ceramic base plate 21, disturbing the wave propagation and thus adversely affecting the reliability of the device. Furthermore, the Board agrees with the Appellant that the use of a layer 27 made of shrink-setting resin, according to the embodiment of Figure 4 (see column 3, lines 16 to 30 of D2) may also lead to deleterious effects on the characteristics of the SAW device.

- the presently claimed device has a lid 20 provided with a metal pattern 21, whereas the metal pattern of the SAW device disclosed in D2 is constituted by the electrodes 30 disposed on the piezoelectric substrate 25 ("functional surface") of the SAW device 24 itself. Element 27 is merely a layer of adhesive or frit glass (embodiment of Figure 4). Although this layer may be considered as a lid for

sealing the piezoelectric substrate 25 of the SAW device 24, it is intended to fix the SAW device 24 to the ceramic base plate 28a, not to press the bumps 23 to establish the contact connection between them and the metal pattern 30 ("electrodes").

A further constructional distinction between the SAW device known from D2 and the claimed SAW device arises from the fact that according to D2 **both the interdigital electrodes and the metal pattern** 30 ("electrodes") are disposed on the piezoelectric substrate 25 (see Figure 3). The Board does not see why the skilled person should and would decide, on the sole basis of his technical knowledge, to modify the SAW device described in D2 by:

- removing the bumps 23 from the ceramic base plate 21, 28a and placing them on the piezoelectric substrate 25 of the SAW device together with the interdigital electrodes;

- removing the metal pattern 30 ("electrodes") from the piezoelectric substrate 25 and placing them on a lid;

- arranging the lid to seal the piezoelectric substrate 25 **and** make the metal pattern 30 of the lid press against the bumps 23 on the piezoelectric substrate 25 of the SAW device to establish a contact connection.

In the Board's opinion, the three technical steps required for performing the above-mentioned modifications involve an inventive step within the meaning of Article 56 EPC, having regard to the prior art disclosed in D2.

5. The Board concludes that the decision under appeal has to be set aside. Since the Board is not rejecting the Appellant's request, oral proceedings need not be held.

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 following version:

Claims: No. 1 to 8 filed with the letter dated 12 February 1998;

Description: pages 1, 2, 4, 4a, and 5 to 12 filed with the letter dated 12 February 1998; page 3 as originally filed;

Drawings: sheets 1/14 to 14/14 as originally filed.

The Registrar:

M. Kiehl

The Chairman:

W. J. L. Wheeler