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**D E C I S I O N**  
**of 5 July 2001**

**Case Number:** T 0831/96 - 3.4.3

**Application Number:** 91103752.1

**Publication Number:** 0446868

**IPC:** H01L 23/498

**Language of the proceedings:** EN

**Title of invention:**

Tape carrier having improved test pads

**Applicant:**

Kabushiki Kaisha Toshiba

**Opponent:**

-

**Headword:**

-

**Relevant legal provisions:**

EPC Art. 123(2), 56

**Keyword:**

"Inventive step (no) - objective problem"

**Decisions cited:**

T 0001/89, T 0024/81

**Catchword:**

-



Case Number: T 0831/96 - 3.4.3

**D E C I S I O N**  
**of the Technical Board of Appeal 3.4.3**  
**of 5 July 2001**

**Appellant:** Kabushiki Kaisha Toshiba  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 25 April 1996  
refusing European patent application  
No. 91 103 752.1 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** R. K. Shukla  
**Members:** V. L. P. Frank  
M. B. Günzel

## Summary of Facts and Submissions

- I. The appeal lies from the examining division's decision, dated 25 April 1996, refusing European patent application No. 91 103 752.1 on the ground that the application was amended in such a way that it contained subject-matter extending beyond the content of the application as filed, contrary to Article 123(2) EPC.

The single claim forming the basis of the decision under appeal reads as follows:

"A tape carrier comprising:

- (a) a tape carrier body (1) having a mounting portion (3) for mounting a semiconductor integrated circuit (4);
- (b) a test pad array including a row of signal test pads (7) away from said mounting portion (3) and separated from it by a slit (6);
- (c) first leads (8) having first ends for connecting to signal circuit pads (5) on said semiconductor integrated circuit (4) and second ends connected to said signal test pads (7);
- (d) a power supply test pad (7n) arranged at an outermost end of said row of test pads in said array;
- (e) a second lead (8n; 11) having a first end for connecting to a power supply circuit pad (5a, 5b) of said semiconductor integrated circuit (4) located on said mounting portion (3), and a second

end (8o) connected to said power supply test pad (7n) located on said tape carrier body (1) away from said mounting portion (3); and

(f) a portion of the second lead from the second end (8n; 11) to the slit (6) is wider than the second ends of the first leads side of the slit leading to said first end of said second lead (8n; 11);

characterized in that

(g) the second lead is connected to more than one power supply test pad for each power supply circuit pad, and in that

(h) the width of the first ends of the first leads is the same as the width of the first end of the second lead."

II. Although in the decision under appeal the application was refused pursuant to Article 123(2) EPC, it follows from the Summary of Facts and Submissions in the decision under appeal, that the claims as originally filed were considered by the examining division as lacking an inventive step pursuant to Article 56 EPC having regard to the following prior art documents:

D1: EP-A-0 311 513

D2: EP-A-0 324 244

III. The appellant (applicant) lodged an appeal on 25 June 1996 and paid the appeal fee the same day. The statement setting out the grounds of appeal was filed on 23 August 1996. Amended claims 1 and 2 forming the basis of the main request were filed on 16 December

1996.

IV. In the annex to the summons to attend oral proceedings the Board referred to document

D3: EP-A-0 293 838

cited in the European search report and expressed its provisional opinion that the subject-matter of claim 1 of the appellant's only request did not appear to involve an inventive step.

V. The appellant filed with his letter dated 4 June 2001 an amended claim, description pages 1 to 6 and new drawing sheets 3/5 to 5/5, and requested the grant of a patent on the basis of these documents.

The wording of the single claim of the appellant's request reads as follows:

"A tape carrier comprising:

- (a) a tape carrier body (1) having a mounting portion (3) for mounting a semiconductor integrated circuit (4);
- (b) a row of test pads (7) on said tape carrier body spaced away from said mounting portion (3), said row comprising a first array of signal test pads (7); and
- (c) first leads (8) having first ends for connecting to signal circuit pads (5) on said semiconductor integrated circuit (4) and second ends connected to said signal test pads (7);

characterized by:

- (d) said row of test pads further comprising a second array of power supply test pads, one (7n) of which is at an end of said row; and
  
- (e) said tape carrier further comprising a second lead (8n) having a first end for connecting to a power supply circuit pad (5a) of said semiconductor integrated circuit (4) when mounted on said mounting portion (3), and a second end connected to said power supply test pad (7n) located on said tape carrier body (1) at said end of said row, said second lead (8n) including a first portion located between the second end thereof and a slit (6) separating said row of test pads (7) from said mounting portion (3) and a second portion (8o) located between the slit and the first end thereof, said first portion gradually widening from its end adjacent the slit to its end adjacent the second end of the second lead;

the total number of the power supply and signal test pads (7n, 7) being larger than that of the power supply circuit pads (5a) and the signal pads (5) on said semiconductor integrated circuit and said second lead being connected to all of the power supply test pads of said second array."

V. The arguments presented by the appellant can be summarised as follows:

- (i) Prior to the present invention, the signal and power supply leads were connected to the test pads starting sequentially from the central test pad towards the ends of the row. The outermost

leads were the power supply leads and any test pads remaining were left unused at the end portions of the row. With this layout, however, the position of the power supply test pads shifted when an IC having a different number of signal pads had to be mounted (cf. Figures 5 and 6). Accordingly, the test socket, on which the pins for contacting the power supply test pads were provided, had to be modified. By connecting, according to the present invention, the power supply lead to the pad located at the end of the row, the position of the power supply test pads can be made device-independent on the tape carrier. Consequently, the layout of the test socket can also be made device-independent.

- (ii) By using the unused space between the power supply test pad and the first signal test pad, the power supply lead can be made wider (cf. Figure 2). This design reduces the inductance of the leads and the generation of noise.
  
- (iii) Document D1 represents the closest prior art, since it relates to the same technical field as the present invention, namely to tape carriers used for testing semiconductor integrated circuits (IC). The objective technical problem addressed by the invention is to allow the position of the power supply test pads and the layout of the test socket to be device-independent, to decrease the inductance of the wires in a package and thereby to prevent generation of noise (cf. column 2, lines 7 to 12 of the published application).

- (iv) Furthermore, the teaching of documents D2 and D3 cannot be combined with that of document D1, since the former relate to a different technical field, namely to packages for coupling an IC chip to a printed circuit board and not for testing purposes as in the application in suit. The testing of a device has, however, its particular requirements and constraints. Moreover, there is no motivation for a skilled person to consider documents D2 and D3, since these documents do not address the problem of making the layout of the signal and power supply leads device-independent.

## **Reasons for the Decision**

1. The appeal is admissible.
2. *Amendments (Article 123(2) EPC)*
  - 2.1 In the decision under appeal the objection under Article 123(2) was against the inclusion of feature (h) in the claim. As this feature has been omitted from the present claim, the objection no longer applies.
  - 2.2 The present claim is specifically directed to the embodiment shown in Figure 2 of the application in suit. The Board has examined the amendments and is satisfied that they comply with the requirements of Article 123(2) EPC. These amendments, however, will not be discussed here in detail, as the subject-matter of the claim is not allowable for the reasons which follow.



3. *Inventive step (Article 56 EPC)*

3.1 It is not in dispute that document D1 represents the closest prior art.

3.1.1 This document discloses (cf. column 1, lines 7 to 14; column 3, line 63 to column 4, line 34; column 4, lines 59 to 62; Figure 1) a tape carrier (10) having a lead frame (16) formed thereon. An integrated circuit (IC) chip (24) is bonded onto the central mounting area. The mounted IC chip is tested by electrically contacting pin-like probes to the conductor test pads (20) of the lead frame. These test pads are located on the four sides of the tape carrier. The central area of the tape carrier is separated from the area on which the test pads are formed by four slits (14). Signal and power supply leads (18) cross these slits and connect the test pads to the mounting area. The positions of the end of the leads on the mounting area correspond to the positions of the circuit pads on the IC to allow wireless bonding. Spare, unused test pads are located at the ends of each row of test pads on the tape carrier. However, there is no disclosure that the total number of test pads on the tape carrier is larger than the number of circuit pads on the integrated circuit device.

3.1.2 The tape carrier illustrated in this document (cf. Figure 1) comprises several leads that are wider than the rest. It is the Board's view, and this was also not contested by the appellant, that a skilled person would recognize the wider leads as being power supply or power return leads, since they have to carry larger currents than the signal leads. These power supply leads are connected to test pads located centrally of

the test pad row.

3.1.3 It is shown in Figure 1 of document D1 that the power supply leads widen stepwise in the area located between the slit and the test pads. A gradual widening of the power supply leads from the end adjacent the slit up to the test pads is, however, not disclosed in this document.

3.2 The invention as claimed differs, therefore, from the device disclosed in document D1 in that:

(i) a power supply lead is connected to the test pad at the end of the row,

(ii) the number of test pads on the tape carrier which are connected to leads is larger than the number of circuit pads on the integrated circuit,

(iii) the power supply lead is connected to all the spare test pads located between the pad at the end of the row and the first signal pad, and

(iv) the portion of the power supply lead located between the slit and the test pad gradually widens from its end adjacent the slit to its end adjacent the test pad.

3.2.1 The Board concurs with the appellant's submission that from the description of the invention it follows that the provision of the spare pads and the location of the power supply test pad at the end of the row as set out in features (i) and (ii) above make it possible that the corresponding power supply pin of the test board

remains in the same position when a different IC device, having a different number of signal connections, is to be tested.

- 3.2.2 According to the application in suit, by widening the portion of the power supply lead located between the slit and the test pads, the free space between the power supply lead and the signal lead is reduced. This in turn reduces their mutual inductance. In consequence, feature (iv) achieves a reduction in inductance with respect to the tape carrier shown in Figure 1 of the application in suit in which the power supply lead is connected to the last test pad of the row. In this embodiment a large free space is formed between the power supply and the adjacent signal lead, since the width of the power supply lead is constant (cf. *inter alia* column 3, lines 32 to 35 and lines 54 to 57).

The tape carrier of Figure 1 of the application in suit is not known to belong to the prior art according to Article 54(2) EPC. The reduction of the inductance of the power supply lead, in the Board's view, cannot be a part of an objective formulation of the problem, since according to the established case law of the boards of appeal, an objective formulation of the technical problem requires a comparison of the subject-matter of the claimed invention with the closest prior art, which in the present case is the tape carrier as shown in Figure 1 of document D1 (cf. T 1/89 and T 24/81).

In the layout shown in Figure 1 of document D1 the distance between power supply and the adjacent signal lead is already small, as in the embodiment of the present invention, and, accordingly it is not evident

that a gradually widening portion of the power supply lead results in a reduction of inductance in relation to the tape carrier of document D1. In consequence, the reduction of inductance is not part of the technical problem addressed by the invention (cf. T 1/89 and T 24/81).

- 3.3 For this reasons, the Board considers that the objective problem addressed by the application in suit having regard to document D1 is the provision of a tape carrier permitting the position of the test pad for power supply to be independent of the number of signal lines present on an IC device, and, consequently, permitting the layout of power supply pins of a test socket to be independent of the IC device to be tested.
- 3.4 In the Board's view, a skilled person would have recognized the inconvenience and time loss caused by relocating the power supply pins of the test socket each time a different IC device had to be tested. Consequently, the Board cannot see an inventive step in the formulation of the above mentioned problem.
- 3.5 The skilled person faced with the above problem would have to take due account of the position of the power supply connection on the IC device and locate the power supply lead on the tape carrier to correspond to the position of the power supply connection on the IC device. The specific layout of the tape carrier depends, therefore, on the particular type of IC devices to be tested.

The tape carrier disclosed in document D1 is designed to be used with IC devices having power supply connections located centrally (cf. Figure 1). In this

case, however, a varying number of signal leads can be accommodated on both sides of the power supply leads without necessarily having to change the position of the power supply pad.

A different situation occurs when the IC device has power supply connections at the corners (cf. Figures 5 and 6 of the application in suit and D3, Figure 3). Under this circumstance, the skilled person would realize that the position of the power supply pin of the test socket would be independent of the number of signal lines only if the power supply lead and the corresponding test pad are located at the end.

No inventive step can be recognized by the Board in this solution, however, since it would be an obvious measure applied by the skilled person having recognized the underlying technical problem.

- 3.6 With regard to feature (iii), the application in suit states that the power supply lead is connected to the unused test pads (cf. column 3, lines 44 to 45).

The connection of the power supply lead to the remaining unused test pads is, however, in the Board's view, one of the several design alternatives available to the skilled person which he would consider depending upon the circumstances and involves, for this reason, no inventive step.

- 3.7 As mentioned under point 3.1.3, document D1 discloses a stepwise widening of the power supply leads in the area located between the slit and the test pads. For this reason, it is the Board's view, that for a skilled person the use of gradually widening power supply leads

would be a routine measure to be employed depending on the circumstances, in particular, to maintain the inductance of the leads at a value similar to the one achieved before connecting the power supply lead to the outermost test pad.

- 3.8 The Board agrees with the appellant that documents D2 and D3 are not relevant to the problem addressed in the application in suit, since they do not relate to the field of testing an IC device. However, these documents show that there was no prejudice against the provision of the power supply leads at the corners of the tape carrier.
4. For the foregoing reasons, it is the Board's judgement that the subject-matter of the claim does not involve an inventive step in the sense of Article 56 EPC.

## **Order**

### **For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

L. Martinuzzi

R. K. Shukla