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# DECISION
## of 23 April 1998

**Case Number:** T 0095/95 - 3.4.1

**Application Number:** 87310085.3

**Publication Number:** 0269336

**IPC:** H01L 23/50

**Language of the proceedings:** EN

**Title of invention:**
Semiconductor integrated circuit packages

**Applicant:**
AT&T Corp.

**Opponent:**
-

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 56

**Keyword:**
"Inventive step - no"

**Decisions cited:**
-

**Catchword:**
-

**Case Number:** T 0095/95 - 3.4.1

# DECISION
## of the Technical Board of Appeal 3.4.1
## of 23 April 1998

**Appellant:**

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**Representative:**

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**Decision under appeal:**

**Decision of the Examining Division of the European Patent Office posted 15 September 1994 refusing European patent application No. 87 310 085.3 pursuant to Article 97(1) EPC.**

**Composition of the Board:**

**Chairman:** G. Davies
**Members:** G. Assi
R. K. Shukla

## Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal, received on 10 November 1994, against the decision of the Examining Division, dispatched on 15 September 1994, refusing the European application No. 87 310 085.3 (EP-A-0 269 336). The statement setting out the grounds of appeal was received on 13 January 1995. The fee for the appeal was paid on 8 November 1994.

In its decision, the Examining Division held that the application did not meet the requirements of

- Article 123(2) EPC (Claim 6),
- Article 84 EPC (Claims 6 to 10), and
- Articles 52(1) and 56 EPC (Claims 1 to 10),

having regard to following documents:

D1: Patent Abstracts of Japan, Vol. 6, No. 215(E-138)(1093), 28 October 1982; & JP-A-57-118658, 23 July 1982,

D2: Patent Abstracts of Japan, Vol. 10, No. 228(E-426)(2284), 8 August 1986; & JP-A-61-63047, 1 April 1986,

D3: Patent Abstracts of Japan, Vol. 6, No. 144(E-122)(1022), 3 August 1982; & JP-A-57-66655, 22 April 1982,

D4: EP-A-0 053 966.

With the statement setting out the grounds of appeal, dated 13 January 1995, the appellant filed the following document:

D1a: English translation of D1, pages 1 to 4.

II. Oral proceedings were held on 23 April 1998.

At the oral proceedings, the appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the documents according to any one of the following requests:

**Main request**:

- **Claims:**
  No. 1 to 10 as filed during the oral proceedings on 23 April 1998

- **Description**:
  Page 1 as originally filed
  Pages 2,3,4 as filed during the oral proceedings on 23 April 1998

- **Drawings:**
  Sheets 1/3,2/3 as originally filed
  Sheet 3/3 as filed during the oral proceedings on 23 April 1998

**First auxiliary request**:

- **Claims:**
  No. 1 to 8 as filed during the oral proceedings on 23 April 1998

- **Description and drawings:**
  according to the main request

**Second auxiliary request**:

- **Claims:**
  No. 1 to 10 as filed during the oral proceedings on 23 April 1998

- **Description and drawings:**
  according to the main request

**Third auxiliary request**:

- **Claims:**
  No. 1 to 8 as filed during the oral proceedings on 23 April 1998

- **Description and drawings:**
  according to the main request

III. The wording of **Claim 1** according to the **main request** and the **first auxiliary request** reads as follows:

"1. A lead frame arrangement for a semiconductor integrated circuit package, said arrangement comprising an external mounting frame (13) in association with a lead frame including a paddle (3) upon which an integrated circuit chip is to be mounted, paddle support arms (9) extending between the external mounting frame and the paddle to support the latter, and a plurality of fingers (7) connected to the external mounting frame, the paddle being in a depressed position with respect to the external mounting frame and fingers, CHARACTERISED IN THAT each paddle support arm has a deformable member (11) that deforms during depression of the paddle by constricting in a direction perpendicular to the axis of the paddle support arm so as to maintain the desired mechanical and electrical characteristics of the paddle support arm."

The wording of **Claim 1** according to the **second auxiliary request** and the **third auxiliary request** reads as follows:

"1. A lead frame arrangement for a semiconductor integrated circuit package, said arrangement comprising an external mounting frame (13) in association with a lead frame including a paddle (3) upon which an integrated chip is to be mounted, paddle support arms (9) connected between the external mounting frame and the paddle to support the latter, and a plurality of fingers (7) connected to the external mounting frame, the paddle being in a depressed position with respect to the external mounting frame and fingers, CHARACTERISED IN THAT each of the four paddle support arms is connected to a corner of said paddle and has a deformable member (11) for deforming during depression of the paddle and maintaining desired physical and mechanical characteristics of the paddle support arms during and after the depression of the paddle."

The spelling of "external" in the wording of Claim 1 according to the second auxiliary request and the third auxiliary request has been corrected by the Board.

IV. The appellant argued as follows:

The present invention is directed to a lead frame assembly for integrated circuits, the lead frame assembly including a depressed paddle. The process of depressing the paddle results in the constriction of deformable members provided in the paddle support arms, in a direction perpendicular to the arms. The deformable members thus maintain the desired mechanical and electrical characteristics of the arms after the depression of the paddle.

Document D1 (see also D1a) also concerns a lead frame assembly with a depressed tab supported by tab suspenders. The deformed areas provided in the tab suspenders, however, have altogether a different function to that of the deformable members of the present invention. During the step of depressing the tab, the tab suspenders tend to deflect upwards as opposed to the direction in which the tab is forced. This results in an upward tilt of the tab suspenders (see Figure 2). The resulting stress in the suspenders is accommodated by the deformed members which act like a spring and prevent deformation of the tab suspenders. The deformed members, therefore, do not constrict in a direction perpendicular to the tab suspenders.

Thus, the present application and D1 are directed to completely different problems and propose different solutions. The invention is directed to deformation absorbing members utilized to maintain the physical and electrical properties of the paddle support arms. D1 relates to alleviating the upward movement of the tab suspenders and uses a pair of relatively narrow areas which do not deform during down setting the tab, unlike the suspenders which are stretched, so that their physical and electrical properties are worsened.

Moreover, a difference in topology between the present invention and D1 consists in that, according to the invention, the paddle support arms are disposed below the plane of the external mounting frame, whereas in D1 the tab suspenders - including the deformed areas - remain in a plane above the tab.

As regards document D2, the skilled person would consider using the shape of the flexible structure disclosed there, but only after he had considered using a deformable member according to the invention.

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## Reasons for the Decision

1. The appeal is admissible.

2. *Article 56 EPC*

The Board is satisfied that the amendments proposed in the main and auxiliary requests meet the requirements of Articles 123(2) and 84 EPC. However, for the reasons explained below, they do not meet the requirements of Article 56 EPC.

The present application relates generally to lead frame arrangements for semiconductor integrated circuits, comprising a plurality of fingers for electrical connections to a chip and a paddle for mounting thereon the chip, the paddle being connected physically to an external mounting frame by means of support arms. The paddle is depressed with respect to an external mounting frame and the fingers. The operation of depressing the paddle leads to physical deformation, in particular a constriction in the transverse direction, of the paddle support arms, which could lead to loss of physical integrity of the arms and, if the arms are also used for electrical connection purposes, undesirable changes in their electrical characteristics.

The object of the present application is thus to maintain the physical and electrical properties of the paddle support arms. This object is achieved by the provision of deformable members which are so designed to maintain the said characteristics after the paddle depression.

## 2.1 Main request and first auxiliary request

### 2.1.1 Claim 1

D1 (see Figures 1 to 3) (in the following, the terminology used in the present application will be used) discloses a lead frame arrangement for a semiconductor integrated circuit package, said arrangement comprising an external mounting frame in association with a lead frame including a paddle 11 upon which an integrated circuit chip is to be mounted, paddle support arms 12, 13 extending between the external mounting frame and the paddle to support the latter, and a plurality of fingers 14, 15 connected to the external mounting frame, the paddle being in a depressed position with respect to the external mounting frame and fingers.

According to D1a, the lead frame is obtained by severing a predetermined pattern from a plate so as to form a structure comprising the paddle with the paddle support arms. Simultaneously or after the severing step, the paddle is depressed in order to situate it slightly below the plane containing the arms. During this operation, the arms are deformed. In particular, internal stresses cause deformation as shown by arrows A in Figure 2 of D1, so that the arms are not any more parallel to the plane of the paddle. This causes a problem when bonding a chip upon the paddle with solder. The problem is solved by the provision of relatively narrow deformed areas 12A, 13A in the paddle support arms, which areas act as a kind of spring to absorb internal stresses thereby avoiding undesired deformation of the arms which remain parallel to the plane of the paddle (see Figure 3 of D1).

The document does not give a clear teaching as regards how the paddle is clamped while being depressed. Figure 3 shows that the deformed areas are situated outside the bends produced between the paddle and the support arms. This means that it may reasonably be assumed that the deformed areas do not deform during depression of the paddle. Indeed, according to D1a, page 3, lines 10 to 16 and 20 to 23, undesired deformations of the paddle support arms are avoided. On the contrary, the arrangement of the present invention requires intentional deformation of the deformable members as it appears from the claims and the description, page 2, last two lines, page 3, lines 1 and 2.

This difference becomes even clearer if one considers that, according to the invention, each paddle support arm has a deformable member - as it should be, considering that each arm is deformed -, whereas, according to D1a (see the claim and page 2, lines 13 to 15), a deformed area may be provided in only one of the support arms.

It thus follows that, although D1 discloses a deformable member in at least one of the paddle support arms, this member does not deform during depression of the paddle, in particular by constricting in a direction perpendicular to the axis of the paddle support arm so as to maintain the desired mechanical and electrical characteristics of the paddle support arm, as in the invention as claimed. In this feature consists the novelty of Claim 1 (Article 54 EPC).

The skilled person starting from the arrangement known from D1 has to solve the above-mentioned problem of avoiding a damage to the paddle support arms during depression of the paddle, which would cause an undesired worsening of the physical and electrical properties of the arms. As already discussed above, the deformed areas 12A, 13A disclosed in D1 do not address this problem. The skilled person would therefore look for suitable solutions in other documents in the field of the application.

Document D2 shows a lead frame arrangement for a resin sealed type semiconductor device. The arrangement comprises an external mounting frame 4 in association with a lead frame including a paddle 1, paddle support arms 2 extending between the external mounting frame and the paddle to support the latter, and a plurality of fingers 3 connected to the external mounting frame. To avoid any deformation of the paddle support arms while filling resin, each arm has a deformable member 6, 9 situated at the end of the arm connected to the external frame, the member being so conceived as to be flexible in the axial direction of the arm only. It is immediately evident that, should such deformable members be used in the support arms of a paddle which is to be depressed, as it is the case in D1, they will deform by constricting in a direction perpendicular to the axis of the arm. Moreover, since the deformation takes place in a controlled way in such deformable members, the support arms will not be damaged, i.e. they will maintain the desired mechanical and electrical characteristics.

It is obvious to the person skilled in the art to use the feature of the deformable members known from D2, with corresponding effect, in the lead frame arrangement according to D1, thus arriving at the claimed arrangement.

Therefore, the subject-matter of Claim 1 of the main request and the first auxiliary request does not involve an inventive step (Article 56 EPC).

2.2 Second auxiliary request and third auxiliary request

2.2.1 Claim 1

Claim 1 according to the second auxiliary request and the third auxiliary request essentially differs from Claim 1 of the main request and the first auxiliary request in that **four** arms are provided for supporting the paddle, each arm being connected to a corner of the paddle. The provision of four arms, instead of two as shown in D1 and D2, comes within the scope of the routine activities of the skilled person, especially as the advantage of a better paddle stability thus achieved can be readily contemplated in advance.

In view of the above considerations and the reasons mentioned with regard to Claim 1 of the main request and the first auxiliary request, the subject-matter of Claim 1 of the second auxiliary request and the third auxiliary request does not involve an inventive step.

3. Thus, none of the appellant's requests are allowable.

## Order

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

The appeal is dismissed.

The Registrar: The Chairman:

M. Beer G. Davies