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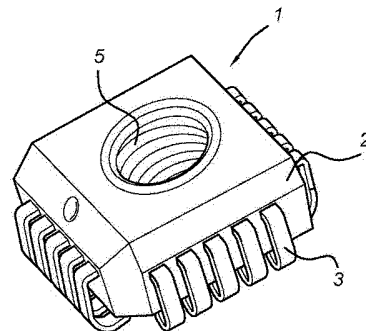
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54 **Integrated circuit package.**

57 Integrated circuit package comprising an integrated circuit, external connection elements (3) connected to the integrated circuit, a package material (2) enclosing the integrated circuit, and a mechanical element (5, 6, 7) allowing a mechanical connection of a further element to the integrated circuit package (1).  
The mechanical element (5, 6, 7) is e.g. an attachment element (5); a mechanical element (5) with a thread; a bushing element; a bearing element (7); an electrical connector (6).



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Dit octrooi is verleend ongeacht het bijgevoegde resultaat van het onderzoek naar de stand van de techniek en schriftelijke opinie. Het octrooischrift komt overeen met de oorspronkelijk ingediende stukken.

## Integrated circuit package

### **Field of the invention**

The present invention relates to an integrated circuit package comprising an  
5 integrated circuit, external connection elements connected to the integrated circuit, and  
a package material enclosing the integrated circuit.

### **Prior art**

Such an integrated circuit package is known from European patent publication  
10 EP-A-2 090 873 of applicant. In the embodiments shown here, the integrated circuit  
may comprise various components, such as a sensor assembly with a sensor surface, a  
carrier element for holding the sensor assembly and further associated components,  
such as processing electronics (IC or ASIC).

### **Summary of the invention**

The present invention seeks to provide an improved integrated circuit package,  
allowing more robust and reliable operation of the integrated circuit package, e.g. as a  
complete sensor package with a sensor, such as a pressure, temperature or position  
sensor.

20 According to the present invention, an integrated circuit package according to  
the preamble defined above is provided, the integrated circuit package further  
comprising a mechanical element allowing a mechanical connection of a further  
element to the integrated circuit package. The mechanical element can be of an open  
type (through hole) or a closed version type.

25 By adding such a mechanical element in an integrated circuit package, further  
functional capabilities, external connection implementations, and low-cost solutions  
can be provided for integrated circuit packages, especially for integrated circuit  
packages including a sensor. The external connection elements are e.g. bended leads,  
leads, pins, lead pads, solder balls, connection-holes, etc.

30 In an embodiment, the mechanical element is selected from the group consisting  
of: an attachment element; a mechanical element with a(n internal) thread; a bushing  
element; a bearing element; an electrical connector. This allows various connections to

be implemented with an integrated circuit package, ranging from mechanical to electrical connections.

The integrated circuit package may comprise a sensor element connected to the integrated circuit in a further embodiment, wherein the mechanical element is not providing an external communication channel to the sensor element. E.g. the external communication channel may be provided in a part of the integrated circuit package where it cannot interfere with the mechanical element of the present invention embodiments.

In a further embodiment, the mechanical element is attached to a structural element of the integrated circuit package, such as a lead frame, a support frame, a ceramic substrate or a multi chip module. This results in an improved strength of the total integrated circuit package, and allows a more easy assembly process for molding the package.

The mechanical element is suspended in the integrated circuit package in an even further group of embodiments. This may be implemented in an embodiment, wherein the package material is formed by a two step molding process. No functional relationship is then present between mechanical element and sensor element of other (structural) parts of the integrated circuit package.

In a further embodiment, the integrated circuit package further comprises a sensor element connected to the integrated circuit, and a communication channel to the sensor element is provided via the suspended mechanical element. This allows external connection of further elements, such as tubing, to allow external environmental elements, e.g. external air, to reach the sensor surface.

The mechanical element may be provided with an external interface surface in a further embodiment, and the integrated circuit package material is present (e.g. molded) around the remaining external surface of the mechanical element. This allows a good mechanical interface with further components outside the integrated circuit package, yet also allows proper protection of the covered parts of the mechanical element.

In an exemplary embodiment, the mechanical element is a bearing element, and the integrated circuit package further comprising a sensor inside the package, an external connection axis supported by the bearing element, and a sensor activation element attached to the external connection axis. The sensor may be a Hall or magneto-restrictive sensor. and the sensor activation element is an active-type element (such as a

magnet or magnetized element) or a passive-type element (whereby the magnetization is replaced by a tooth structure).

### **Short description of drawings**

5           The present invention will be discussed in more detail below, using a number of exemplary embodiments, with reference to the attached drawings, in which

Fig. 1 shows a perspective view of a first embodiment of the present invention;

Fig. 2 shows a perspective view of a second embodiment of the present invention;

10           Fig. 3 shows a perspective view of a third embodiment of the present invention;

Fig. 4 shows a perspective view of an alternative of the third embodiment of the present invention;

Fig. 5 shows a perspective view of an even further embodiment of the present invention;

15           Fig. 6 shows a three dimensional view with a part cut-out view of the embodiment of Fig. 5; and

Fig. 7A-C show a cross sectional view of further embodiments of the present invention.

### **20 Detailed description of exemplary embodiments**

Fig. 1 to 3 each show an embodiment of an integrated circuit package according to the present invention. The package comprises an integrated circuit and external connection elements 3 connected to the integrated circuit inside the package (e.g. using bond wires or flip chip). The external connection elements 3 can be connected to an  
25 electrical circuit on e.g. a printed circuit board.

Package material 2 of the integrated circuit package 1 encloses the integrated circuit tightly, thereby providing protection. The integrated circuit package further comprises a mechanical element 5, 6, 7 allowing a mechanical connection of a further element to the integrated circuit package 1. The further element is e.g. a cooling body  
30 or attachment element(s) for such a cooling body, an electrical connector (e.g. a (mini-) USB connector, a guiding element for alignment purposes, or an axis as part of a sensor assembly.

The surprising technical effect of the presence of the mechanical element 5, 6, 7 is that the integrated circuit package 1 can be mechanically mounted and/or centered and/or electrically connected to other parts or subassemblies. The mechanical element 5, 6, 7 provides robust mechanical fixation on next level assemblies and/or onto other elements such as cooling blocks. Further electrical connections can also be made through the mechanical element 6, for example, the mechanical element 6 may provide an electrical connection to a power supply, further electronics, a computer etc. The mechanical element 6 in the form of an electrical connector can be implemented in many variants, such as the USB connector mentioned above, or e.g. a wire-connection (known in the field as e.g. 'schneidklemmtechnik').

In an embodiment, the mechanical element 5, 6, 7 is selected from the group consisting of: an attachment element 5; a mechanical element 5 with a thread; a bushing element; a bearing element 7; an electrical connector 6.

In typical embodiments, the package material 2 is a duroplast plastic material for providing solid anchoring and encapsulation of the mechanical element 5, 6, 7.

In an embodiment, the attachment element 5 may be a snap fit connector for a rapid and easy connection. In a further embodiment, the mechanical element 5 may be a standardized bolt or nut, so that the mechanical element 5 may comprise an internal and/or external threaded part.

The integrated circuit package 1 can then be robustly mounted and attached to other subassemblies. This embodiment may also be advantageous in view of vibratory environments, where the external connection elements 3 and/or a delicate sensor inside the integrated circuit packages 1 cannot sustain long periods of harsh vibrations. A firm fixation through a mechanical element 5 having a threaded part may resolve this issue. In addition to the fixation/vibration solution the mechanical element 5 can function as a cooling element as well. The heat generated by the integrated circuit element 4 e.g. a IGBT or MOSFET can be dissipated to the ambient via the mechanical element 5 acting as a heat sink.

In further embodiments, centering the integrated circuit package 1 with respect to other parts or subassemblies is readily accomplished by a mechanical bushing element 5, e.g. a guide bushing. Such a bushing element 5 provides high precision centering of the integrated circuit package 1 but may allow for some rotational and

linear sliding movement with respect to a connecting element disposed in the bushing element 5.

For example, the integrated circuit package 1 may comprise a position sensor and should be able to move with respect to e.g. a connecting element slidably disposed inside the bushing element. Further, the integrated circuit package 1 may be subjected to temperature and/or pressure changes, so that allowing for some sliding movement of the mechanical bushing element 5 with respect to a connecting element disposed therein may minimize stress and strain forces inside the integrated circuit package 1 as a result of such temperature and/or pressure changes.

In certain situations the integrated circuit package 1 is intended to be connected to various different external devices. In an embodiment, the mechanical element 6 may comprise an electrical connector for utilizing standard communication protocols for an external device, e.g. USB, FireWire, HDMI etc. Embedding such an electrical connector 6 in the integrated circuit package 1 avoids additional external connecting element 3, thereby simplifying e.g. a printed circuit board (PCB) onto which the integrated circuit package 1 may be mounted. The mechanical element 6 in the form of an electrical connector 6 may thus provide supplemental functionality that need not be implemented into a PCB onto which the integrated circuit package 1 is mounted.

In further embodiments, the mechanical element 7 may be a mechanical bearing element 7 allowing a shaft or axis to be rotatably mounted in the integrated circuit package 1. Such a mechanical bearing element 7 may be particularly advantageous in case the package 1 comprises e.g. a position sensor, e.g. a rotational (Magneto Resistive) MR sensor type, wherein rotating a connecting element inside the bearing 7 with respect to the integrated circuit package 1 measures a rotation of said package 1 with respect to the connecting element inside the bearing 7.

The type of mechanical element 5, 6, 7 used may be determined by a particular application of the integrated circuit package 1. For example, in case the package 1 comprises a temperature or pressure sensor, fixation through a mechanical threaded element 5 may be desired. Should the integrated circuit package 1 comprise a mechanical motion sensor, embedding a mechanical bearing element 7 is advantageously used.

It is also possible that the mechanical element 5, 6, 7 is chosen based on an assembly process. For example, having a mechanical bushing element 5 embedded in

the integrated circuit package 1 may facilitate the use of pick-and-place robots for handling the integrated circuit package 1. In such an application a robot may slidably insert a pin element inside the bushing 5 and slidably rotate/orientate the integrated circuit package 1 with respect to e.g. a PCB.

5           In the embodiments of Fig. 1 to 3, the integrated circuit package 1 may further comprise an external communication channel through the package material 2 for exposing a sensing surface of a sensor element inside the package 1 to the outside environment, thereby facilitating e.g. temperature and/or pressure measurements. Such an external communication channel is conveniently provided by an embedded (hollow)  
10           mechanical element 5 in the package material 2, such as a nut and/or or guide bushing which typically comprise a bore running there through. The bore of the mechanical element 5 then comprises at least in part the external communication channel.

          In a further embodiment of an integrated circuit package 1, the package 1 comprises a sensor element 20 connected to the integrated circuit, and the mechanical  
15           element 5, 6, 7 is not providing an external communication channel to the sensor element 20. In this embodiment, the mechanical element 5, 6, 7 is embedded in the package material 2 away from the sensor element 20, i.e. in no direct contact with the sensor die or sensor surface of the sensor element 20. This may be possible when the sensor element 20 does not require a direct exposure to the outside environment  
20           through an external communication channel. This embodiment is particular suitable for a sensor element 20 utilizing field phenomena, such as a magnetic and/or electric field, which easily penetrate the package material 2. In an alternative to this embodiment, the sensor element 20 is in communication with the external environment using an external communication channel routed away from the mechanical element 5, 6, 7 (e.g. via a  
25           back side of the package 1).

          According to a further invention embodiment, the mechanical element 5, 6, 7 is suspended in the integrated circuit package 1. In this embodiment the mechanical element 5, 6,7, is in a suspended arrangement with respect to the package material 2, so that the mechanical element is solely supported by package material 2 and does not  
30           come into contact with a structural element 22, sensor element 20, or the external connecting elements (e.g. lead frame) 21 in the integrated circuit package 1. Suspending the mechanical element 5, 6, 7 solely in package material 2 reduces the risk of damaging internal parts the package 1, such as sensitive and delicate sensing

materials and/or various electronics. This embodiment may be accomplished using a two-stage process, as explained in greater detail with reference to Fig. 7 below.

Fig. 4 shows another embodiment of the integrated circuit package 1 of the present invention. In this embodiment, the mechanical element 7 has an external interface surface 7a and the package material 2 is present (e.g. molded) around the remaining external surface of the mechanical element 7. In this embodiment the interface surface 7a (e.g. parallel to a main surface of the integrated circuit package 1) remains free from package material 2, so that said surface 7a may abut against another surface part or subassembly. This embodiment is advantageous in case a snug and precise fit of the mechanical element 5, 6, 7 against another surface part is required, as might be the case when the mechanical element 5, 6, 7, is implemented as a bearing element 7.

In a further embodiment, the integrated circuit package 1 comprises a projection 2a of package material 2, wherein the mechanical element 5, 6, 7 is at least in part embedded in the projection 2a distal to the integrated circuit package 1. The projection allows for an offset of the mechanical element 5, 6, 7, with respect to the integrated circuit package 1.

Fig. 5 and 6 show embodiments of the integrated circuit package 1 of the present invention, wherein the mechanical element 5, 6, 7 is a bearing element 7, and the integrated circuit package 1 further comprises a sensor element 20 inside the package 1, an external connection axis 15 supported by the bearing element 7, and a sensor activation element 17 attached to the external connection axis 15. The external connection axis 15 is attached to an external housing 16 and configured for rotating the activation element 17. The activation element can be an active-type (magnetized) or passive-type whereby the magnetization is replaced by a tooth structure. In further embodiments the external connection axis 15 is provided with a cog 18 for rotation thereof, allowing a mechanical connection to an external subassembly in a simple and reliable manner. The external connection axis 15 (and hence mechanical element 7 in the form of a bearing element) may penetrate entirely through the integrated circuit package 1, or alternatively, may be present only on one side (closed version of the mechanical element) of the integrated circuit package 1.

In an embodiment, the sensor element 20 is a Hall or magneto-restrictive (MR) sensor and the sensor activation element 17 is a magnet. Here the mechanical element 7



need not provide a direct external communication channel to the outside environment as the sensor element 20 senses a magnetic field change between north and south poles penetrating the package material 2.

5 In the embodiment of Fig. 5 and 6, the mechanical element 5, 6, 7 is attached to a structural element 22 of the integrated circuit package 1, such as a lead frame, a support frame, a (ceramic or PCB) substrate or a multi chip module. Having the mechanical element 5, 6, 7, in direct contact with the structural element 22 may provide further strength to the embedded arrangement of the mechanical element 5, 6, 7 in the package material 2.

10 Fig. 7 shows a cross sectional view of an integrated circuit package 1 according to a further embodiment. The package 1 comprises external connector elements 3 (cf. embodiments of Fig. 1-3), such as a lead frame, electrically connected to an integrated circuit element 4 through one or more bonding wires 3a. The integrated circuit element 4 typically comprises an IC chip and/or a semiconductor die having a sensitive surface area 4a, wherein the sensing surface 4a is exposed to the outside environment through  
15 an external communication channel 8.

The package material 2 forming the integrated circuit package 1 is formed in a two-step process. First, the integrated circuit element 4, lead frame 3 and bonding wires 3a are enclosed by package material (e.g. using a molding process), where the  
20 communication channel 8 towards the sensor surface 4a is kept free from packaging material, and a first package part 2b is formed. The mechanical element 5 (having a bore running there through) is then positioned on top of the first package part 2b and aligned with the external communication channel 8 (thus extending the external communication channel 8) at least in part. In the second step, package material is again  
25 added to a further mold on top of the first package part 2b, thus forming the second package part 2c. When viewed from the sensing surface 4a, the external communication channel 8 is then defined by the first package part 2b, the bore of the mechanical element 5, and the second package part 2c.

This first package material layer 2b is particularly advantageous in cases where  
30 the mechanical element 5 should not come into direct contact with a delicate integrated circuit element 4 and/or sensing surface 4a. To that end, the mechanical element 5 is disposed on the first package material layer 2b instead, resulting in an offset from the integrated circuit element 4 and/or sensing surface 4a by a predefined distance  $d$ .

Offsetting the mechanical element 5 may reduce any form of interference with the IC element 4 and or sensing surface 4a for improving measurement accuracy.

In the embodiment shown in Fig. 7A, the integrated circuit element 4 is suspended in package material 2 and electrically connected to the external connector elements 3 through the one or more bonding wires 3a. In a further embodiment the  
 5 integrated circuit element 4 may also be supported by the external connecting elements 3, such as a lead frame. In yet a further embodiment, the integrated circuit package 1 comprises a substrate 4b (e.g. a ceramic or glass substrate, possibly as part of a multi chip module, MCM). and the integrated circuit element 4 is supported thereby.

10 A further embodiment is shown in Fig 7B, which shows a suspended mechanical element 5 by using the two step molding. In this case there is no contact with the semiconductor element 4 or a sensor element/sensing surface 4a nor a carrier 4b (lead frame, PCB, ceramic etc). An even further embodiment is shown in Fig 7 C, which depicts a suspended mechanical element 5 by using the two step molding. In this case  
 15 the mechanical element 5 is a closed version type (in this case a closed off bottom).

The above embodiments where the mechanical element 5 is a mechanical connection element, such as an element with an internal screw thread, may be advantageously used in an integrated circuit package 1 with a sensor element 4 and an external communication channel 8. Alternatively, the mechanical element 5 is provided  
 20 with an internal diameter larger than the sensor surface 4a (or even larger than sensor die 4), and attached to an underlying lead frame 3 or other structural frame element. This would still provide an external communication channel 8 that can be connected to a further element (e.g. a flexible conduit or tubing) and still providing an air tight space to the sensor surface 4a.

25 The invention can be described as a number of embodiments:

Embodiment 1. Integrated circuit package comprising an integrated circuit, external connection elements (3) connected to the integrated circuit, a package material (2) enclosing the integrated circuit, and a mechanical element (5, 6, 7) allowing a mechanical connection of a further element to the integrated circuit package (1).

30 Embodiment 2. Integrated circuit package according to embodiment 1, wherein the mechanical element (5, 6, 7) is selected from the group consisting of: an attachment element (5); a mechanical element (5) with a thread; a bushing element; a bearing element (7); an electrical connector (6).

- Embodiment 3. Integrated circuit package according to embodiment 1 or 2, wherein the integrated circuit package further comprises a sensor element (20) connected to the integrated circuit, and the mechanical element (5, 6, 7) is not providing an external communication channel to the sensor element (20).  
5
- Embodiment 4. Integrated circuit package according to any one of embodiments 1-3, wherein the mechanical element (5, 6, 7) is attached to a structural element (22) of the integrated circuit package (1), such as a lead frame, a support frame, a ceramic substrate or a multi chip module.
- 10 Embodiment 5. Integrated circuit package according to any one of embodiments 1-4, wherein the mechanical element (5, 6, 7) is suspended in the integrated circuit package (1).
- Embodiment 6. Integrated circuit package according to embodiment 5, wherein the package material (2) is formed by a two step molding process.
- 15 Embodiment 7. Integrated circuit package according to embodiment 5 or 6, wherein the integrated circuit package further comprises a sensor element (20) connected to the integrated circuit, and a communication channel (8) to the sensor element (20) is provided via the suspended mechanical element (5, 6, 7).
- Embodiment 8. Integrated circuit package according to any one of embodiments 20 1-7, wherein the mechanical element (7) has an external interface surface (7a), and the integrated circuit package material (2) is present around the remaining external surface of the mechanical element (7).
- Embodiment 9. Integrated circuit package according to any one of embodiments 1-8, wherein the mechanical element (5, 6, 7) is a bearing element (7), and the  
25 integrated circuit package (1) further comprising a sensor (20) inside the package (1), an external connection axis (15) supported by the bearing element (7), and a sensor activation element (17) attached to the external connection axis (15).
- Embodiment 10. Integrated circuit package according to embodiment 9, wherein the sensor (20) is a Hall or magneto-restrictive sensor.
- 30 Embodiment 11. Integrated circuit package according to embodiment 9 or 10, wherein the sensor activation element (17) is an active-type element or a passive-type element.

The present invention embodiments have been described above with reference to a number of exemplary embodiments as shown in the drawings. Modifications and alternative implementations of some parts or elements are possible, and are included in the scope of protection as defined in the appended claims. The integrated circuit package 1 (and its contents) may be one of many types, and includes but is not limited to the following examples: a dual-in line package (DIL), surface mount device (SMD) package, ball grid array (BGA) package, land grid array (LGA), quad flat no-leads (QFN) package, dual flat no-leads (DFN) package, etc.

## CONCLUSIES

1. Verpakking voor geïntegreerde schakeling, omvattende een geïntegreerde schakeling, externe verbindingselementen (3) die verbonden zijn met de geïntegreerde schakeling, een verpakkingsmateriaal (2) dat de geïntegreerde schakeling omsluit, en een mechanisch element (5, 6, 7) waarmee een mechanische verbinding mogelijk is van een verder element met de verpakking voor geïntegreerde schakeling (1).
2. Verpakking voor geïntegreerde schakeling volgens conclusies 1, waarbij het mechanische element (5, 6, 7) wordt gekozen uit de groep die omvat: een bevestigingselement (5); een mechanisch element (5) met een schroefdraad; een buselement; een lagerelement (7); een elektrische connector (6).
3. Verpakking voor geïntegreerde schakeling volgens conclusie 1 of 2, waarbij de verpakking voor geïntegreerde schakeling verder een sensorelement (20) omvat dat verbonden is met de geïntegreerde schakeling, en waarbij het mechanische element (5, 6, 7) geen extern communicatiekanaal naar het sensorelement (20) verschaft.
4. Verpakking voor geïntegreerde schakeling volgens één van de conclusies 1-3, waarbij het mechanische element (5, 6, 7) gekoppeld is aan een structureel element (22) van de verpakking voor geïntegreerde schakeling (1), zoals een lead-frame, een draagframe, een keramisch substraat of een multi-chip module.
5. Verpakking voor geïntegreerde schakeling volgens een van de conclusies 1-4, waarbij het mechanische element (5, 6, 7) zwevend is opgenomen in de verpakking voor geïntegreerde schakeling (1).
6. Verpakking voor geïntegreerde schakeling volgens conclusie 5, waarbij het verpakkingsmateriaal (2) wordt gevormd door een tweestaps vormproces.

7. Verpakking voor geïntegreerde schakeling volgens conclusie 5 of 6, waarbij de verpakking voor geïntegreerde schakeling verder een sensorelement (20) omvat dat verbonden is met de geïntegreerde schakeling, en een communicatiekanaal (8) naar het sensorelement (20) is verschaft via het zwevende mechanische element (5, 6, 7).

5

8. Verpakking voor geïntegreerde schakeling volgens een van de conclusies 1-7, waarbij het mechanische element (7) een extern interfaceoppervlak (7a) heeft, en het verpakkingsmateriaal (2) van de verpakking voor geïntegreerde schakeling aanwezig is rondom het resterende buitenoppervlak van het mechanische element (7).

10

9. Verpakking voor geïntegreerde schakeling volgens een van de conclusies 1-8, waarbij het mechanische element (5, 6, 7) een lagerelement (7) is, en de verpakking voor geïntegreerde schakeling (1) verder een sensor (20) in de verpakking (1), een externe verbindingsas (15) die wordt ondersteund door het lagerelement (7), en een sensoractiveringselement (17) dat gekoppeld is aan de externe verbindingsas (15) omvat.

15

10. Verpakking voor geïntegreerde schakeling volgens conclusie 9, waarbij de sensor (20) een Hall of magnetorestrictieve sensor is.

20

11. Verpakking voor geïntegreerde schakeling volgens conclusie 9 of 10, waarbij het sensoractiveringselement (17) een actief type of passief type element is.

25

Fig. 1

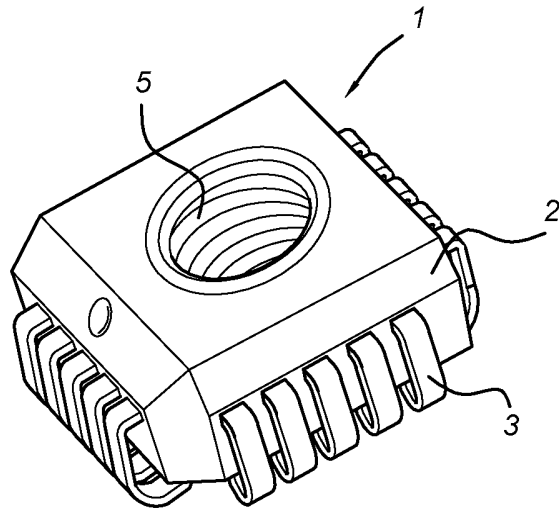


Fig. 2

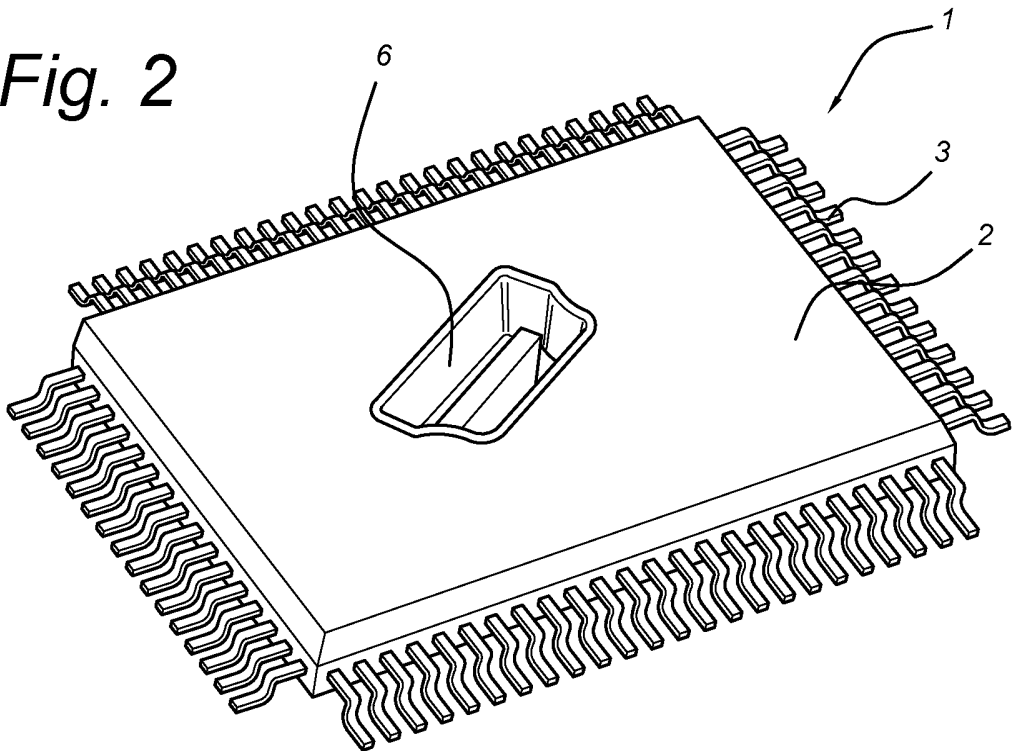


Fig. 3

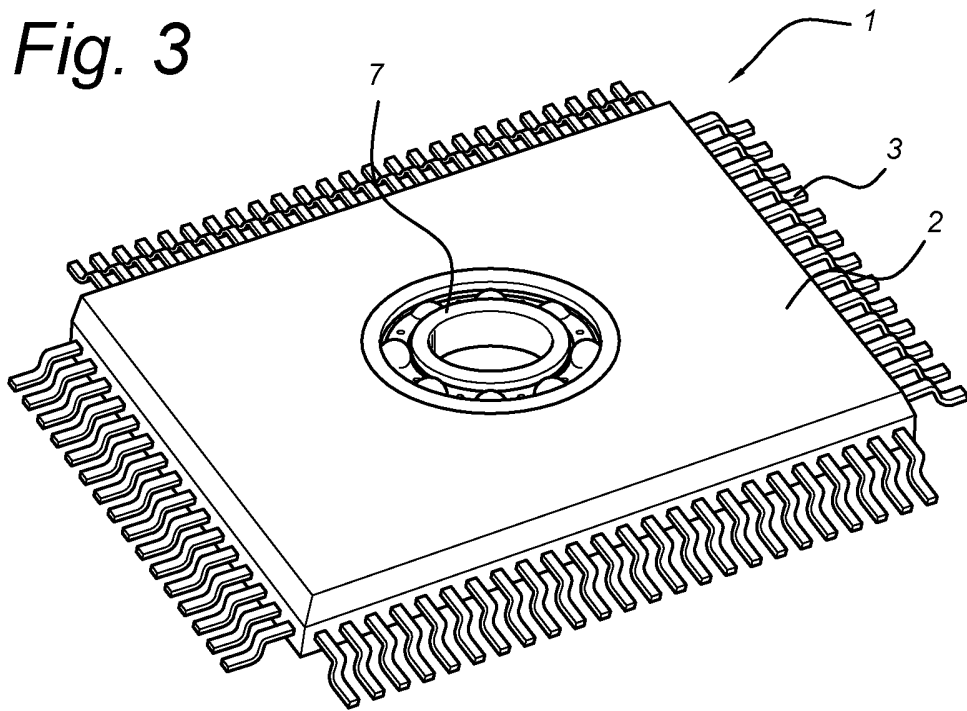
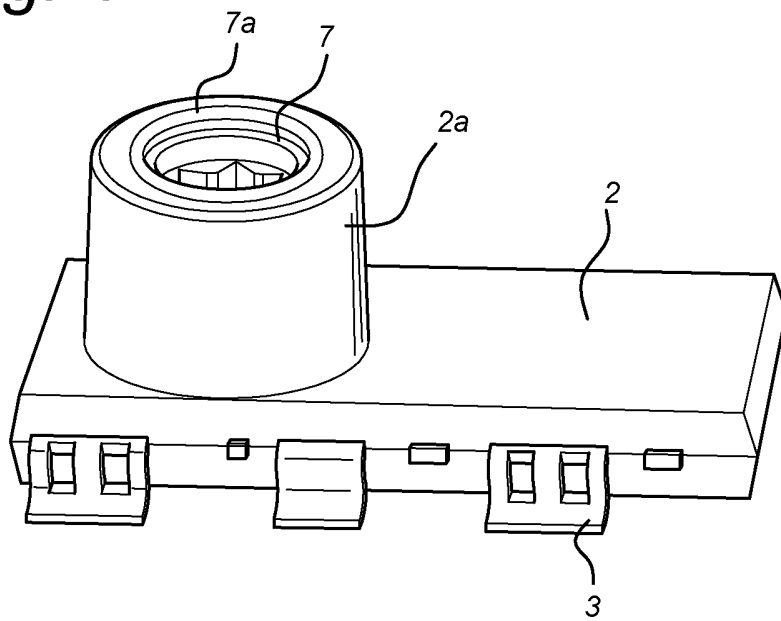
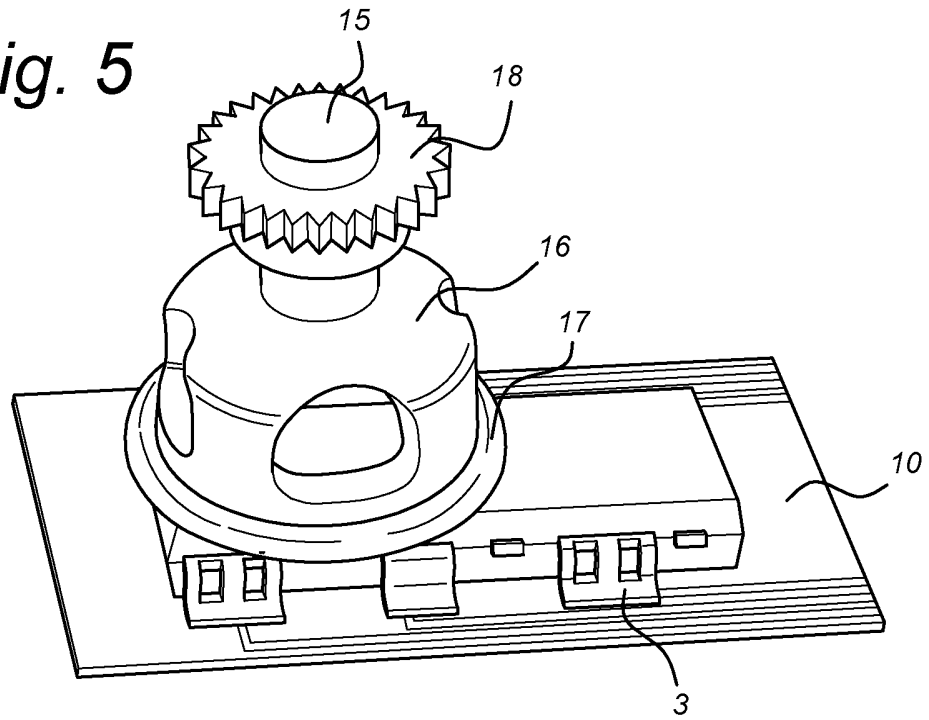


Fig. 4

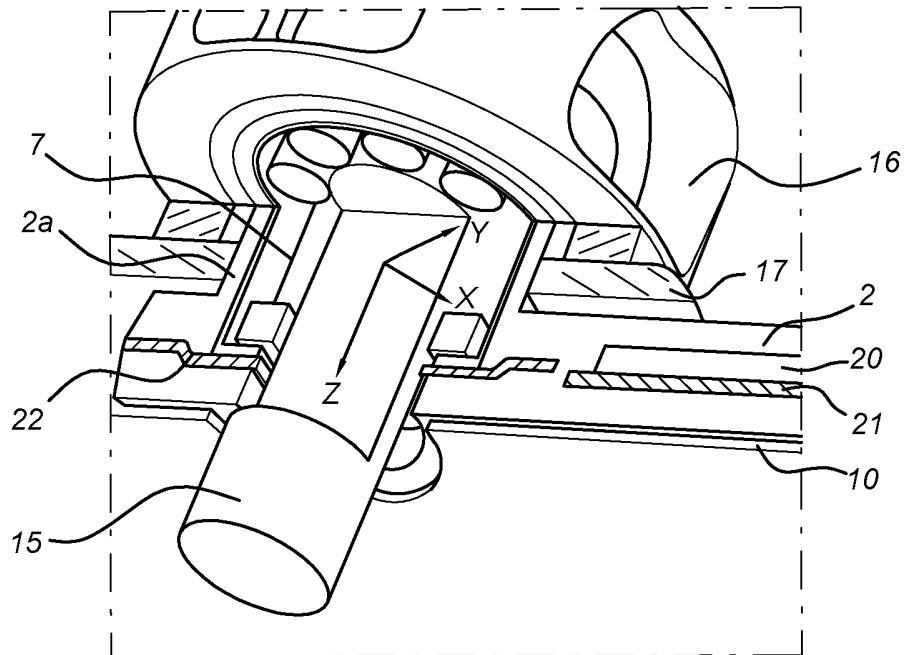




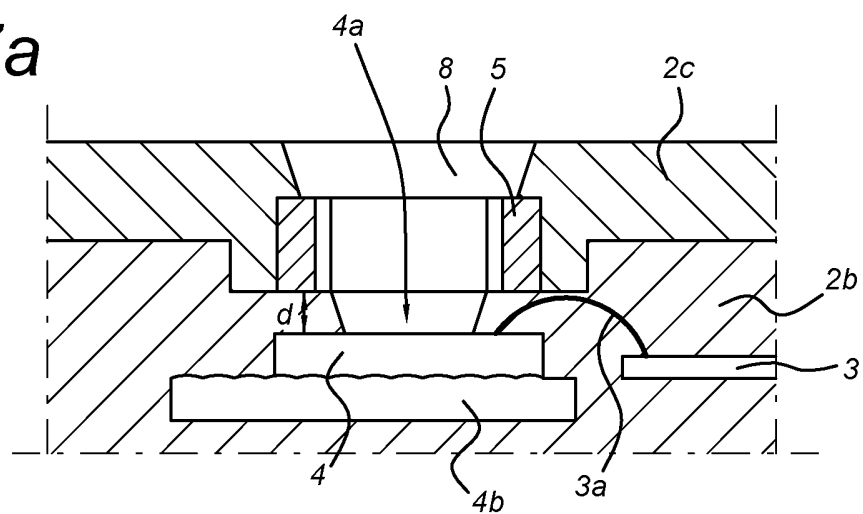
*Fig. 5*



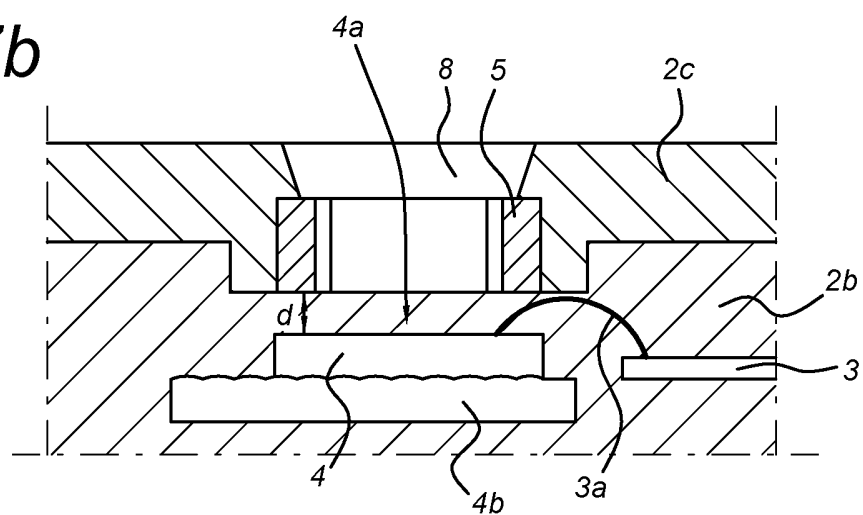
*Fig. 6*



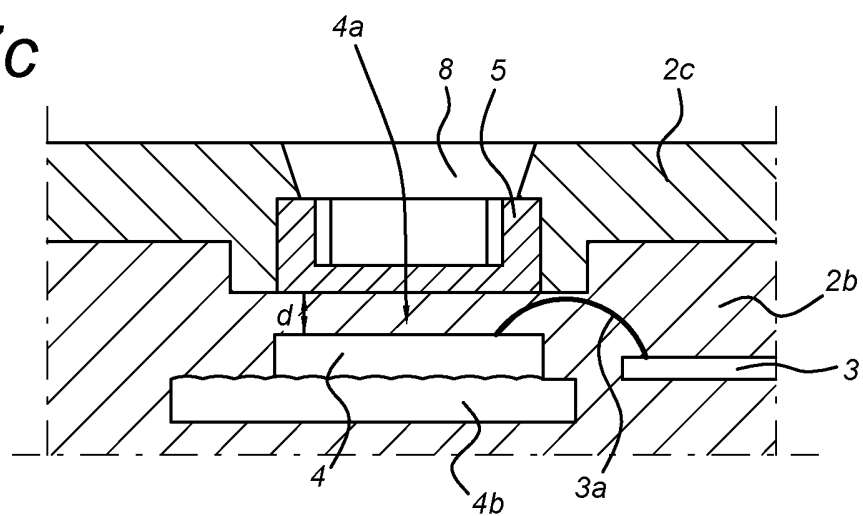
*Fig. 7a*



*Fig. 7b*



*Fig. 7c*



# SAMENWERKINGSVERDRAG (PCT)

## RAPPORT BETREFFENDE NIEUWHEIDSONDERZOEK VAN INTERNATIONAAL TYPE

IDENTIFICATIE VAN DE NATIONALE AANVRAGE	KENMERK VAN DE AANVRAGER OF VAN DE GEMACHTIGDE
	<b>P6047756NL</b>
Nederlands aanvraag nr.	Indieningsdatum
<b>2011638</b>	<b>18-10-2013</b>
	Ingeroepen voorrangsdatum
Aanvrager (Naam)	
<b>Sencio B.V.</b>	
Datum van het verzoek voor een onderzoek van internationaal type	Door de Instantie voor Internationaal Onderzoek aan het verzoek voor een onderzoek van internationaal type toegekend nr.
<b>06-01-2014</b>	<b>SN 61262</b>
<b>I. CLASSIFICATIE VAN HET ONDERWERP</b> (bij toepassing van verschillende classificaties, alle classificatiesymbolen opgeven)	
Volgens de internationale classificatie (IPC)	
<b>H01L23/31</b>	
<b>II. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK</b>	
Onderzochte minimumdocumentatie	
Classificatiesysteem	Classificatiesymbolen
<b>IPC</b>	<b>H01L</b>
Onderzochte andere documentatie dan de minimum documentatie, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen	
III. <input type="checkbox"/>	<b>GEEN ONDERZOEK MOGELIJK VOOR BEPAALDE CONCLUSIES</b> (opmerkingen op aanvullingsblad)
IV. <input checked="" type="checkbox"/>	<b>GEBREK AAN EENHEID</b> (opmerkingen op aanvullingsblad)

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek  
**NL 2011638**

<p>A. CLASSIFICATIE VAN HET ONDERWERP INV. H01L23/31 ADD.</p>		
<p>Volgens de Internationale Classificatie van octrooien (IPC) of zowel volgens de nationale classificatie als volgens de IPC.</p>		
<p>B. ONDERZOCHE GEBIEDEN VAN DE TECHNIEK</p>		
<p>Onderzochte minimum documentatie (classificatie gevolgd door classificatiesymbolen) H01L</p>		
<p>Onderzochte andere documentatie dan de minimum documentatie, voor dergelijke documenten, voor zover dergelijke documenten in de onderzochte gebieden zijn opgenomen</p>		
<p>Tijdens het onderzoek geraadpleegde elektronische gegevensbestanden (naam van de gegevensbestanden en, waar uitvoerbaar, gebruikte trefwoorden) EPO-Internat</p>		
<p>C. VAN BELANG GEACHTE DOCUMENTEN</p>		
<p>Categorie °</p>	<p>Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages</p>	<p>Van belang voor conclusie nr.</p>
<p>X</p>	<p>EENHEID VAN UITVINDING ONTBREEKT zie aanvullingsblad B ----- US 2007/215999 A1 (KASHIMOTO HIRONORI [JP] ET AL) 20 september 2007 (2007-09-20) * alineas [0048] - [0057]; figuren 5,6 *</p>	<p>1,2,4,5, 8</p>
<p>X</p>	<p>US 6 293 711 B1 (SASAKI SEIMI [JP]) 25 september 2001 (2001-09-25) * kolom 6, regel 48 - kolom 7, regel 61; figuren 6-10 *</p>	<p>1,2,4,8</p>
<p>X</p>	<p>US 2013/215585 A1 (KUSANO YOSHIYUKI [JP] ET AL) 22 augustus 2013 (2013-08-22) * het gehele document *</p>	<p>1,2,4,5, 8</p>
	<p>----- -/--</p>	
<p><input checked="" type="checkbox"/> Verdere documenten worden vermeld in het vervolg van vak C.      <input checked="" type="checkbox"/> Leden van dezelfde octroofamilie zijn vermeld in een bijlage</p>		
<p>° Speciale categorieën van aangehaalde documenten</p>		
<p>*A* niet tot de categorie X of Y behorende literatuur die de stand van de techniek beschrijft</p>		<p>*T* na de indieningsdatum of de voorrangsdatum gepubliceerde literatuur die niet bezwarend is voor de octrooiaanvraag, maar wordt vermeld ter verheldering van de theorie of het principe dat ten grondslag ligt aan de uitvinding</p>
<p>*D* in de octrooiaanvraag vermeld</p>		<p>*X* de conclusie wordt als niet nieuw of niet inventief beschouwd ten opzichte van deze literatuur</p>
<p>*E* eerdere octrooi(aanvraag), gepubliceerd op of na de indieningsdatum, waarin dezelfde uitvinding wordt beschreven</p>		<p>*Y* de conclusie wordt als niet inventief beschouwd ten opzichte van de combinatie van deze literatuur met andere geciteerde literatuur van dezelfde categorie, waarbij de combinatie voor de vakman voor de hand liggend wordt geacht</p>
<p>*L* om andere redenen vermelde literatuur</p>		<p>*Z* lid van dezelfde octroofamilie of overeenkomstige octrooipublicatie</p>
<p>*O* niet-schriftelijke stand van de techniek</p>		
<p>*P* tussen de voorrangsdatum en de indieningsdatum gepubliceerde literatuur</p>		
<p>Datum waarop het onderzoek naar de stand van de techniek van internationaal type werd voltooid <b>4 juni 2014</b></p>		<p>Verzenddatum van het rapport van het onderzoek naar de stand van de techniek van internationaal type</p>
<p>Naam en adres van de instantie European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016</p>		<p>De bevoegde ambtenaar <b>Edmeades, Michael</b></p>

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek  
NL 2011638

C.(Vervolg). VAN BELANG GEACHTE DOCUMENTEN		
Categorie °	Geciteerde documenten, eventueel met aanduiding van speciaal van belang zijnde passages	Van belang voor conclusie nr.
X	US 2007/193359 A1 (ASADA SHINSUKE [JP] ET AL) 23 augustus 2007 (2007-08-23) * het gehele document *	1-4,6-8
X	----- US 6 091 147 A (FURUYAMA HIDETO [JP]) 18 juli 2000 (2000-07-18) * kolom 3, regels 34-64 *	1-8
A	----- EP 2 216 814 A2 (MITSUBISHI ELECTRIC CORP [JP]) 11 augustus 2010 (2010-08-11) * alinea [0034]; figuren 1,2 *	1-8
A	----- JP 2010 045315 A (DENSO CORP) 25 februari 2010 (2010-02-25) * samenvatting *	1-8
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## GEBREK AAN EENHEID VAN UITVINDING

Octrooiaanvraag Nr.:

SN 61262

NL 2011638

### AANVULLINGSBLAD B

De Instantie belast met het uitvoeren van het onderzoek naar de stand van de techniek heeft vastgesteld dat deze aanvraag meerdere uitvindingen bevat, te weten:

1. conclusies: 1(compleet); 2-8(gedeeltelijk)

Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package. Dependent claim 2 first specifies the element to be an attachment element. While searching this embodiment documents pertaining to threaded elements and electrical connectors were found with no additional search effort.

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2. conclusies: 9-11(compleet); 2-8(gedeeltelijk)

I.c package wherein the mechanical element is a bushing or bearing element.

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Het vooronderzoek werd tot het eerste onderwerp beperkt.

An integrated circuit package in accordance with claim 1 is already known in the prior art, see either US2007215999, Figs.5,6 and [048-057] (i.c 20,30; connection elements 60, package material 70; mechanical element 90) or US6293711, see Figs.9,10(ic 10,12; connection elements 24; package material 44; mechanical element 18,30).

Dependent claim 2 lists four alternatives for the connection elements, namely an attachment element, a threaded element, a bushing element, a bearing element and an electrical connector.

The overlying concept that could serve to unify these alternatives, as explained above, is already known. Hence the alternatives of claim 2 are considered to be non-unitary alternatives.

Moreover, consideration of the technical problems addressed by these different alternatives supports the view that they are not linked by any unifying concept or problem: the package of Figure 1 relates to a threaded mechanical connection 5, such as a heat sink; the package of Figure 2 relates to a socket 6 for an electrical connection to the chip; whereas the embodiments of Figure 3 relates to a rotational bearing.

During the search of the first alternative mentioned in the claims, namely the attachment element, relevant documents pertaining to threaded elements and electrical connectors were found and consequently the search may be considered to include such elements. Embodiments relating to a bushing element and a bearing element have not been searched.

**ONDERZOEKSRAPPORT BETREFFENDE HET  
RESULTAAT VAN HET ONDERZOEK NAAR DE STAND  
VAN DE TECHNIEK VAN HET INTERNATIONALE TYPE**

Informatie over leden van dezelfde octroofamilie

Nummer van het verzoek om een onderzoek naar  
de stand van de techniek

NL 2011638

In het rapport genoemd octrooigeschrift	Datum van publicatie	Overeenkomend(e) geschrift(en)	Datum van publicatie
US 2007215999	A1	20-09-2007	CN 101030570 A 05-09-2007
			DE 102006051454 A1 13-09-2007
			JP 2007235004 A 13-09-2007
			US 2007215999 A1 20-09-2007
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US 6293711	B1	25-09-2001	JP H11264920 A 28-09-1999
			US 6293711 B1 25-09-2001
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US 2013215585	A1	22-08-2013	CN 103180940 A 26-06-2013
			DE 112010005985 T5 14-08-2013
			KR 20130096280 A 29-08-2013
			US 2013215585 A1 22-08-2013
			WO 2012063321 A1 18-05-2012
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US 2007193359	A1	23-08-2007	DE 102006043884 A1 30-08-2007
			JP 4249193 B2 02-04-2009
			JP 2007218858 A 30-08-2007
			KR 20070083181 A 23-08-2007
			KR 20080041157 A 09-05-2008
			US 2007193359 A1 23-08-2007
			US 2008178681 A1 31-07-2008
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US 6091147	A	18-07-2000	JP 3320630 B2 03-09-2002
			JP H10303337 A 13-11-1998
			US 6091147 A 18-07-2000
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EP 2216814	A2	11-08-2010	EP 2216814 A2 11-08-2010
			JP 5272768 B2 28-08-2013
			JP 2010182879 A 19-08-2010
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JP 2010045315	A	25-02-2010	JP 5187065 B2 24-04-2013
			JP 2010045315 A 25-02-2010
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## WRITTEN OPINION

File No. SN61262	Filing date ( <i>day/month/year</i> ) 18.10.2013	Priority date ( <i>day/month/year</i> )	Application No. NL2011638
International Patent Classification (IPC) INV. H01L23/31			
Applicant Sencio B.V.			

This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the application
- Box No. VIII Certain observations on the application

	Examiner Edmeades, Michael
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## WRITTEN OPINION

Application number

NL2011638

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### Box No. 1 Basis of this opinion

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1. This opinion has been established on the basis of the latest set of claims filed before the start of the search.
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the application and necessary to the claimed invention, this opinion has been established on the basis of:
  - a. type of material:
    - a sequence listing
    - table(s) related to the sequence listing
  - b. format of material:
    - on paper
    - in electronic form
  - c. time of filing/furnishing:
    - contained in the application as filed.
    - filed together with the application in electronic form.
    - furnished subsequently for the purposes of search.
3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

## WRITTEN OPINION

Application number  
NL2011638

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### Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

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The questions whether the claimed invention appears to be novel, to involve an inventive step, or to be industrially applicable have not been examined in respect of

- the entire application
- claims Nos. 9-11(compleet); 2-8(gedeeltelijk)

because:

- the said application, or the said claims Nos. relate to the following subject matter which does not require a search (*specify*):
- the description, claims or drawings (*indicate particular elements below*) or said claims Nos. are so unclear that no meaningful opinion could be formed (*specify*):
- the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed (*specify*):
- no search report has been established for the whole application or for said claims Nos. 9-11(compleet); 2-8(gedeeltelijk)
- a meaningful opinion could not be formed as the sequence listing was either not available, or was not furnished in the international format (WIPO ST25).
- a meaningful opinion could not be formed without the tables related to the sequence listings; or such tables were not available in electronic form.
- See Supplemental Box for further details.

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### Box No. IV Lack of unity of invention

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1. The requirement of unity of invention is not complied with for the following reasons:

**see separate sheet**

2. This report has been established in respect of the following parts of the application:

- all parts.
- the parts relating to claims Nos. (see Search Report)

## WRITTEN OPINION

Application number  
NL2011638

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**Box No. V Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement**

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1. Statement

Novelty	Yes: Claims	
	No: Claims	1(compleet); 2-8(gedeeltelijk)
Inventive step	Yes: Claims	
	No: Claims	1(compleet); 2-8(gedeeltelijk)
Industrial applicability	Yes: Claims	1(compleet); 2-8(gedeeltelijk)
	No: Claims	

2. Citations and explanations

**see separate sheet**

1

Reference is made to the following documents:

- D1 US 2007/215999 A1 (KASHIMOTO HIRONORI [JP] ET AL) 20 september 2007 (2007-09-20)
- D2 US 6 293 711 B1 (SASAKI SEIMI [JP]) 25 september 2001 (2001-09-25)
- D3 US 2013/215585 A1 (KUSANO YOSHIYUKI [JP] ET AL) 22 augustus 2013 (2013-08-22)
- D4 US 2007/193359 A1 (ASADA SHINSUKE [JP] ET AL) 23 augustus 2007 (2007-08-23)
- D5 US 6 091 147 A (FURUYAMA HIDETO [JP]) 18 juli 2000 (2000-07-18)

**Re Item IV**

**Lack of unity of invention**

- 1.1 It is considered that there are 5 inventions covered by the claims indicated as follows:
- Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package wherein the mechanical element is an attachment element.
  - Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package wherein the mechanical element is a threaded element.
  - Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package wherein the mechanical element is a bushing element.
  - Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package wherein the mechanical element is a bearing element.

- Integrated circuit package with external connection elements allowing mechanical connection to the interior of the package wherein the mechanical element is an electrical connector.

1.2 The reasons for which the inventions are not so linked as to form a single general inventive concept, are as follows:

An integrated circuit package in accordance with claim 1 is already known in the prior art, see for example either D1, Figs.5,6 and [048-057] (i.c 20,30; connection elements 60, package material 70; mechanical element 90) or D2, see Figs.9,10(ic 10,12; connection elements 24; package material 44; mechanical element 18,30) or D3 (see Figs.1,2).

Hence the subject-matter of independent claim 1 is already known. The requisite unity of invention therefore no longer exists inasmuch as a technical relationship involving one or more of the same or corresponding special technical features does not exist between the subject-matter of the alternatives listed in dependent claim 2.

Dependent claim 2 lists five alternatives for the connection elements, namely an attachment element, a threaded element, a bushing element, a bearing element and an electrical connector. The overlying concept that could serve to unify these alternatives, as explained above, is already known. Hence the alternatives of claim 2 are considered to be non-unitary alternatives.

Moreover, consideration of the technical problems addressed by these different alternatives supports the view that they are not linked by any unifying concept or problem: the package of Figure 1 relates to a threaded mechanical connection 5, such as a heat sink; the package of Figure 2 relates to a socket 6 for an electrical connection to the chip; whereas the embodiments of Figure 3 relates to a rotational bearing. These different applications of the package are technically unrelated and do not address any single technical problem other than the conventional one (see the cited prior art) of providing access to the interior of a moulded package body.

During the search of the first alternative mentioned in the claims, namely the attachment element, relevant documents pertaining to threaded elements and electrical connectors were found and consequently the search may be considered to include such elements. Embodiments relating to a bushing element and a bearing element, i.e. claims 9-11, have **not** been searched

**Re Item V**

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

- 1 The present application does not meet the criteria of patentability, because the subject-matter of claims 1-8 - as far as it may be understood - is not new.
- 1.1 D1 (see Figs.5,6 and [48-57]) discloses a device comprising all of the features of claims 1,2,4,5 and 8.
- 1.2 D2 (see Figs.6-10, Col.6, l.48 - Col.7, l.61) discloses a device comprising all the features of claims 1,2,4,8.
- 1.3 D3 (see Figs.1,2, [017-036]) discloses a device comprising all the features of claims 1,2,4,5,8.
- 1.4 D4 (see Figs.1,2,5) discloses a device comprising all of the features of claims 1-8: integrated circuit 20; connection elements 15; package material 3,27; mechanical element 8,1b.
- 1.5 D5 (see Fig.2 and Col.3, l.34-64) discloses a device comprising all of the features of claims 1 and 2.

**Re item VIII.**

**Certain observations on the application**

- 1 Claim 5 is unclear, as the expression "suspended in the ... package" does not define this arrangement in a clear manner. The definition of page 6, I.26 - page 7, I.2 has been used to interpret the claim, i.e. a double-moulded package type is employed.
  
- 2 Claim 6 is unclear, as the device is defined in terms of its method of manufacture.