

**Internal distribution code:**

- (A) [ - ] Publication in OJ
- (B) [ - ] To Chairmen and Members
- (C) [ - ] To Chairmen
- (D) [ X ] No distribution

**Datasheet for the decision  
of 11 July 2019**

**Case Number:** T 0794/16 - 3.4.02

**Application Number:** 08797283.2

**Publication Number:** 2167419

**IPC:** B81B7/02, G01C19/5769,  
G01P15/08, G01P15/18, G01P1/02,  
G01C19/56, G01P15/125

**Language of the proceedings:** EN

**Title of invention:**

INTEGRATED MOTION PROCESSING UNIT (MPU) WITH MEMS INERTIAL  
SENSING AND EMBEDDED DIGITAL ELECTRONICS

**Applicant:**

InvenSense, Inc.

**Relevant legal provisions:**

EPC Art. 52(1), 54(1), 56

**Keyword:**

Novelty (main request: no)  
Inventive step (auxiliary request: no)



**Beschwerdekammern**  
**Boards of Appeal**  
**Chambres de recours**

Boards of Appeal of the  
European Patent Office  
Richard-Reitzner-Allee 8  
85540 Haar  
GERMANY  
Tel. +49 (0)89 2399-0  
Fax +49 (0)89 2399-4465

Case Number: T 0794/16 - 3.4.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.02**  
**of 11 July 2019**

**Appellant:** InvenSense, Inc.  
(Applicant) 1197 Borregas Avenue  
Sunnyvale, California 94089 (US)

**Representative:** Brookes IP  
Windsor House  
6-10 Mount Ephraim Road  
Tunbridge Wells, Kent TN1 1EE (GB)

**Decision under appeal:** **Decision of the Examining Division of the  
European Patent Office posted on 6 November 2015  
refusing European patent application No.  
08797283.2 pursuant to Article 97(2) EPC.**

**Composition of the Board:**

**Chairman** R. Bekkering  
**Members:** F. J. Narganes-Quijano  
T. Karamanli

## **Summary of Facts and Submissions**

- I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 08797283.2.

In its decision the examining division held that the subject-matter of claim 1 of the request then on file did not involve an inventive step (Article 56 EPC) in view of the disclosure of document

D1: US 2007 0029629 A1.

- II. With the statement setting out the grounds of appeal the appellant filed claims according to a main and an auxiliary request. The appellant requested that the decision under appeal be set aside and a patent be granted on the basis of the claims of the main request or the auxiliary request.

- III. In a communication annexed to the summons to oral proceedings the board gave a preliminary assessment of the case. In this communication the board referred to document D1 and also to document

A1: US 2006 0208326 A1

cited in the international search report and in the description of the international application as published, and introduced the following document into the proceedings:

A2: US 2004 0016995 A1.

IV. In reply to the summons to oral proceedings the appellant announced by letter dated 24 June 2019 that they would not be attending the oral proceedings.

V. Oral proceedings were held before the board on 11 July 2019 in the absence of the duly summoned appellant.

The chairman noted that the appellant had requested in writing that the decision under appeal be set aside and that a patent be granted on the basis of the claims according to the main request or the auxiliary request, both requests filed with the statement setting out the grounds of appeal.

At the end of the oral proceedings the chairman announced the decision of the board.

VI. Claim 1 of the main request reads as follows:

"An inertial measurement unit (IMU) operable to be mounted onto a surface of a board, the IMU comprising:

a 3-axis linear accelerometer, the 3-axis linear accelerometer operable to provide a first measurement output corresponding to a measurement of linear acceleration in three axes, wherein the three axes are orthogonal and the 3-axis linear accelerometer is disposed on a plane, wherein the 3-axis linear accelerometer is formed on a first substrate;

a 3-axis gyroscope, the 3-axis gyroscope operable to provide a second measurement output corresponding to a measurement of rotation about three axes, wherein the three axes are orthogonal and the 3-axis gyroscope is disposed on the plane, wherein the 3-axis gyroscope is formed on the first substrate; and

an application specific integrated circuit (ASIC) operable to receive both the first measurement output from the 3-axis linear accelerometer and the second measurement output from the 3-axis gyroscope,

wherein the ASIC comprises an analog-to-digital converter (ADC), a built-in logic, and a memory, wherein the ADC converts data related to the first measurement outputs and the second measurement outputs into digital data and the built in logic processes the digital data."

Claim 1 of the auxiliary request differs from claim 1 of the main request in that the antepenultimate and the penultimate paragraphs are replaced by the following paragraphs:

"a 3-axis gyroscope, the 3-axis gyroscope operable to provide a second measurement output corresponding to a measurement of rotation about three axes, wherein the three axes are orthogonal and the 3-axis gyroscope is disposed on the plane, wherein the 3-axis gyroscope is formed on the first substrate (800); and

an application specific integrated circuit (ASIC) formed on a second substrate (802) operable to receive both the first measurement output from the 3-axis linear accelerometer and the second measurement output from the 3-axis gyroscope, and

a bond fabricated between the first substrate and the second substrate;

wherein the bond provides a hermetic seal and electrical connection between the first substrate and the second substrate;".

## **Reasons for the Decision**

1. The appeal is admissible.
2. *Main request - Novelty*
  - 2.1 Document D1 discloses a unit (unit 10 in Fig. 19 and 20, see the corresponding description) arranged to be mounted on the surface of a board (Fig. 18), the unit comprising a linear accelerometer (accelerometer 12, see paragraph [0026]) operable to provide a measurement output of linear acceleration, and a gyroscope (gyroscope 72, see paragraph [0048]) operable to provide a measurement output of rotation, both the linear accelerometer and the gyroscope being formed on a substrate (substrate 16 in Fig. 19) and being disposed on a plane (the plane of the upper side of substrate 16 in Fig. 19 and 20). Furthermore, the unit comprises an integrated circuit (the CMOS interface integrated circuitry 18 in Fig. 11, 12 and 13, see the sentence bridging the two columns on page 2, and the second sentence of paragraph [0043]) comprising an analog-to-digital converter for converting data related to the measurement outputs from the accelerometer and the gyroscope into digital data (paragraph [0041], lines 1 to 15; see also the "Latching comparator" in Fig. 12 and 13), the integrated circuit being arranged to process the digital data (see paragraphs [0041] and [0042], and claims 4 to 8, 21 and 22).

In addition, the linear accelerometer 12 and the gyroscope 72 of Fig. 19 and 20 are respectively disclosed as an in-plane axis (i.e. as an X-Y) accelerometer and as a Z-axis gyroscope (paragraphs [0026] and [0048]), but the document also discloses that these sensors can respectively be replaced by three-axis accelerometers and gyroscopes (paragraph

[0010], second sentence), these sensors implicitly providing measurement outputs corresponding to a measurement of linear acceleration in three orthogonal axes and to a measurement of rotation about three orthogonal axes, respectively.

Furthermore, the measurement outputs of the three-axis accelerometer and of the three-axis gyroscope are such that the unit can be used as, and therefore constitutes an inertial measurement unit within the meaning of the claimed invention.

In addition, the CMOS interface integrated circuit 18 (see Fig. 13 and the last sentence of paragraph [0041]) comprises components, such as the "Decimator & Digital LPF" of Fig. 13, that constitute built-in logic for processing the digital data, and also programmable components (see the external "BW Programming" represented in Fig. 13; see also paragraph [0041], last sentence) that require the provision of a memory. It also follows from the above considerations that the integrated circuit 18 constitutes an application specific integrated circuit (ASIC) within the meaning of the claimed invention (see document D1, paragraphs [0041] to [0043]).

2.2 In the statement setting out the grounds of appeal the appellant referred to features (see sentence "«a bond fabricated between the first substrate and the second substrate; wherein the bond provides a hermetic seal between the first substrate and the second substrate;» as recited in the independent claim 1" in the second paragraph of section "Main request") which, according to the appellant, would support inventive step of the claimed unit. However, the corresponding features are not defined in claim 1 of the main request, and for

this reason they cannot be relied upon in the assessment of novelty of the claimed subject-matter.

2.3 In view of the above considerations, the board concludes that the subject-matter of claim 1 of the main request lacks novelty over the disclosure of document D1 (Articles 52(1) and 54(1) EPC).

3. *Auxiliary request - Novelty and inventive step*

3.1 Novelty

3.1.1 Document A1 discloses an inertial measurement unit (Fig. 3A, together with paragraphs [0006] and [0007]) operable to be mounted onto a surface of a board (see "Bond Pads" in Fig. 3A, together with claims 8 and 19; see also paragraph [0024], lines 13 to 18), and comprising a MEMS (MEMS feature 108' in Fig. 3A) such as a linear accelerometer or a gyroscope (paragraph [0036], sub-paragraph (8), and paragraph [0006]) formed on a first substrate (substrate 102' in Fig. 3A) and disposed on a plane of the first substrate (see Fig. 3A), and an integrated circuit formed on a second substrate (CMOS substrate 104', and claims 6 and 17; see also Fig. 2B).

In addition, the unit disclosed in document A1 comprises a bond fabricated between the first and the second substrate (the "Seal Ring" in Fig. 3A) and providing a hermetic seal and electrical connection between the first and the second substrates (abstract, and paragraphs [0017] and [0040]).

The inertial measurement unit defined in claim 1 differs from the unit disclosed in document A1 in that



a) the unit does not comprise either an accelerometer or a gyroscope formed on a substrate, but both an accelerometer and a gyroscope formed on a same substrate;

b) the accelerometer and the gyroscope are both of the 3-axis type, thus providing measurement outputs corresponding to a measurement of linear acceleration in three orthogonal axes and to a measurement of rotation about three orthogonal axes; and

c) the integrated circuit constitutes an application specific integrated circuit (ASIC) comprising an analog-to-digital converter (ADC) for converting data related to the measurement outputs into digital data, a built-in logic for processing the digital data, and a memory.

3.1.2 Document D1 discloses an inertial measurement unit comprising the features mentioned in point 2.1 above.

The inertial measurement unit of claim 1 differs from the inertial measurement unit disclosed in document D1 in that the ASIC is not formed on the same substrate on which the accelerometer and the gyroscope are formed, but on a second substrate, and in that a bond is fabricated between the two substrates, the bond providing a hermetic seal and electrical connection between the two substrates.

3.1.3 The remaining documents on file are less pertinent for the issue of novelty.

3.1.4 Therefore, claim 1 of the auxiliary request defines novel subject-matter over the documents on file (Articles 52(1) and 54(1) EPC).

3.2 Claim 1 - Inventive step

3.2.1 In the board's view document A1 represents the closest state of the art.

The distinguishing features a), b) and c) of claim 1 of the auxiliary request identified in point 3.1.1 above have the technical effect of improving the measurement capability and the measurement data processing of the inertial measurement unit.

The objective technical problem can therefore be seen in improving the measurement capability and the measurement data processing of the inertial measurement unit of document A1.

Document D1 discloses extending the inertial measurement capability of an inertial measurement unit by the provision of multiple sensors such as integrated three-axis accelerometers and gyroscopes on a same substrate (paragraph [0010], lines 1 to 8, together with Fig. 19 and 20 and the corresponding description). The skilled person would therefore consider the replacement of the linear accelerometer and the gyroscope of document A1 by a three-axis accelerometer and a three-axis gyroscope, respectively, to solve the problem of improving the measurement capability of the inertial measurement unit of document A1.

In addition, for consistency with the disclosure of document A1, and in particular in order to maintain the manufacturing and technical characteristics of the inertial measurement unit disclosed in document A1 (paragraphs [0009], [0017] and [0040]), the skilled person would consider the provision of both the three-axis accelerometer and a three-axis gyroscope on a same substrate. It is noted in this respect that although

the explicit examples disclosed in document A1 involve a single sensor formed on the first substrate, it would be obvious for the skilled person that - as supported for instance by document A2 pertaining to the same technical field as document A1 and disclosing integrated sealed measurement units close to those of document A1 (see document A2, Fig. 5 and the corresponding description, in particular paragraph [0003], together with the bond providing an hermetic sealing and electrical connections between the substrate 300 of the MEMS sensors 315 and the circuit substrate 450 referred to in paragraphs [0029], [0068], [0093], and [0101]) - more than one sensor can be formed on the same substrate without any downside on the manufacturing and the technical characteristics (in particular, without any downside on the hermetic seal and the electrical connection provided by the bond between the two substrates) of the inertial measuring unit disclosed in document A1. It would therefore be obvious when applying the teaching of document D1 to the disclosure of document A1 to form both the three-axis accelerometer and the three-axis gyroscope on the same substrate.

In addition, document D1 also discloses improving the measurement data processing of the inertial measurement unit by the provision of the integrated circuit of the CMOS substrate of the unit in the form of an application specific integrated circuit (ASIC) (see point 2.1 above) as defined in claim 1. The skilled person would therefore consider the provision of the integrated circuit formed in a CMOS substrate of the inertial measurement unit disclosed in document A1 in the form of an ASIC as that defined in claim 1.

3.2.2 The arguments submitted by the appellant in the statement of grounds of appeal rely only on the disclosure of document D1 and are not persuasive because the provision of an integrated package comprising MEMS sensors formed on a first substrate, a control circuit formed on a second substrate, and a bond fabricated between the two substrates and providing a hermetic seal and electrical connections between the two substrates, as well as the technical improvements achieved therewith, were already known before the priority date of the application, see in this respect the disclosure of documents A1 and A2 referred to in points 3.1.1 and 3.2.1 above. Documents A1 and A2 were considered for the first time in the board's communication annexed to the summons to oral proceedings, and in the subsequent letter of reply (cf. point IV above) the appellant submitted no substantive argument in respect of the board's preliminary assessment of the disclosure of these documents.

3.2.3 For these reasons, in the board's opinion the subject-matter of claim 1 of the auxiliary request does not involve an inventive step (Article 56 EPC) over the disclosure of document A1 in combination with the teaching of document D1 and under consideration of document A2.

3.3 In view of the above, the appeal must be dismissed.

## **Order**

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

The appeal is dismissed.

The Registrar:

The Chairman:



M. Kiehl

R. Bekkering

Decision electronically authenticated