

**Internal distribution code:**

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

**Datasheet for the decision  
of 16 May 2022**

**Case Number:** T 0308/16 - 3.4.01

**Application Number:** 10195143.2

**Publication Number:** 2290379

**IPC:** G01R15/20, G01R33/02,  
G01R33/06, G01R33/07,  
G01R33/09, H01L43/06

**Language of the proceedings:** EN

**Title of invention:**

Arrangements for an Integrated Sensor

**Patent Proprietor:**

Allegro MicroSystems, LLC

**Opponent:**

Micronas GmbH

**Headword:**

Two magnetic sensors III / ALLEGRO MICROSYSTEMS

**Relevant legal provisions:**

EPC Art. 56

**Keyword:**

Inventive step - (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 0308/16 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 16 May 2022**

**Appellant:** Micronas GmbH  
(Opponent) Hans-Bunte-Strasse 19  
79108 Freiburg (DE)

**Representative:** Koch, Bertram  
Koch Müller  
Patentanwalts-gesellschaft mbH  
Maaßstraße 32/1  
69123 Heidelberg (DE)

**Respondent:** Allegro MicroSystems, LLC  
(Patent Proprietor) 955 Perimeter Road,  
Manchester, NH 03103-3353 (US)

**Representative:** South, Nicholas Geoffrey  
AA Thornton IP LLP  
Octagon Point  
5 Cheapside  
London EC2V 6AA (GB)

**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
17 December 2015 concerning maintenance of the  
European Patent No. 2290379 in amended form.**

**Composition of the Board:**

**Chair** P. Scriven  
**Members:** B. Noll  
D. Rogers

## **Summary of Facts and Submissions**

- I. The Opposition Division decided that the patent in amended form meets the requirement of the EPC. The opponent appeals this decision.
  
- II. With the statement of grounds of appeal, the opponent submitted new documents, labelled as B1 to B3, and argued, in view of them, that claim 1, held allowable by the decision, lacked an inventive step (Article 56 EPC).
  
- III. With its response to the appeal, the proprietor submitted auxiliary requests 1 to 3. The proprietor argued that none of documents submitted with the statement of grounds of appeal should be admitted into the proceedings or, if any were admitted, that the case be remitted to the opposition division for further consideration.
  
- IV. In a communication, the Board indicated that it intended to consider B2 and that claim 1 as considered allowable and claim 1 of each of auxiliary requests 1 to 3 lacked an inventive step having regard to

D20: WO 2005/059967 A2and

B2: FR 2 860 592.

- V. In a letter submitted in response to the Board's communication, the proprietor withdrew auxiliary request 2 and submitted a new auxiliary request 1A.
- VI. The final request by the opponent was that the decision under appeal be set aside and the patent revoked.
- VII. The proprietor's final requests were that, as a main request, the appeal be dismissed, or alternatively, that the decision under appeal be set aside and the patent maintained on the basis of one of auxiliary requests 1, 1A, or 3. The proprietor further requested that the case be remitted to the Opposition Division if any of the documents submitted with the statement of grounds of appeal were admitted into the proceedings.
- VIII. Claim 1 of the main request (as maintained in the decision under appeal) reads:

*An integrated circuit, comprising:  
a lead frame;  
a first substrate having first and second  
opposing surfaces, wherein the first  
substrate is coupled to the lead frame such  
that the second surface of the first  
substrate is above the lead frame and the  
first surface of the first substrate is  
above the second surface of the first  
substrate;  
a second substrate having first and second  
opposing surfaces, wherein the first  
substrate and the second substrate are  
coupled such that either: (i) the first*

*surface of the second substrate is proximate to the first surface of the first substrate and the second surface of the second substrate is distal from the second surface of the first substrate; or (ii) the second surface of the second substrate is above the first surface of the first substrate and the first surface of the second substrate is above the second surface of the second substrate; an electronic component disposed on the first surface of the first substrate; characterised in that the integrated circuit further comprises a first magnetic field sensing element disposed on the first surface of the second substrate; and a second magnetic field sensing element disposed on the first surface of the first substrate, wherein the first magnetic field sensing element has a first sensitivity to a magnetic field, the second magnetic field sensing element has a second different sensitivity to the magnetic field, and wherein the integrated circuit is configured to provide a first operating range responsive to the first magnetic field sensing element and a second different operating range responsive to the second magnetic field sensing element.*

IX. Claim 1 of auxiliary request 1 adds (at the end of claim 1 of the main request):

*... wherein the first substrate is comprised of a selected one of Si, GaAs, InP, InSb, InGaAs, InGaAsP, or SiGe and the second substrate is comprised of a selected one of Si, GaAs, InP, InSb, InGaAs, InGaAsP, or SiGe.*

- X. Claim 1 of auxiliary request 1A adds (at the end of claim 1 of the main request):

*... wherein the first substrate is comprised of a selected one of Si, GaAs, InP, InSb, InGaAs, InGaAsP, or SiGe and the second substrate is comprised of a different selected one of Si, GaAs, InP, InSb, InGaAs, InGaAsP, or SiGe.*

- XI. Claim 1 of auxiliary request 3 adds (at the end of claim 1 of the main request):

*... wherein the first substrate is comprised of Si and the second substrate is comprised of GaAs.*

- XII. The parties' submissions, insofar they are relevant for the decision, are discussed in the Reasons, below.

## **Reasons for the Decision**

### *Admissibility issues*

1. B2 was submitted under the Rules of Procedure of the Boards of Appeal 2007.
2. It was submitted as a reaction to point 39 of the decision, in which it was held that an operating range referred to the strengths of the magnetic field a sensor could measure and that the prior art did not suggest a sensing arrangement for measuring different operating ranges of one and the same component of a magnetic field. B2 is about applying separate magnetic field sensors, of different types (Hall-type, magnetoresistive type), in combination for measuring a component of a magnetic field over a larger range than either of the single sensors would be able to measure on its own. The filing of B2 is, therefore, a valid response to the Opposition Division's view, which was discussed for the first time at oral proceedings. For this reason, the Board decided to consider B2 in the appeal proceedings.

### *The request for remittal*

3. The Board is in a position to consider B2 without having an assessment of it by the Opposition Division. B2 does not, as argued by the proprietor, create a completely new case in the sense that a new objection is based on it. Rather, it supports the opponent's previous arguments. There is no need to remit the case to the Opposition Division and the proprietor's request

for remittal is rejected.

*Main request, claim 1, inventive step*

4. D20 discloses a module for housing multiple integrated circuit semiconductor chips packaged as a stack. Figure 1 shows a module having a substrate 12, a first die 14 and a second die 24 arranged above it. The substrate has a patterned metal layer, the purpose of the substrate is to provide circuitry (description, [0007]). The substrate 12 is, therefore, a "lead frame" in the terminology of the patent. The first die 14 has two surfaces. It is coupled to the substrate at one of them, a second surface which corresponds to the second surface of the first substrate in claim 1. The other, first surface of die 14 has pads of bond wires and is above the second surface. It is equivalent to the first surface of the first substrate in claim 1. The second die has a lower, second surface which is above the first surface of the first die 14. The upper, first surface of die 24 has pads of bond wires and is above the first surface. Figure 1 shows a configuration, in which pads of bonding wires of both dies are on the upper sides of the die. This corresponds to the second alternative (ii) in claim 1 of the contested patent. Figure 2 shows an alternative arrangement with die 224 in a configuration so that its first surface, having pads for bonding wires, faces down towards the first die 214. This corresponds to the first alternative (i) in claim 1 of the contested patent.
  
5. D20 further describes that the dies may have various types of circuit, e.g. a memory array or a DSP ([0005]), or different types of memory ([0100]). It further discloses that a die may comprise a photo



sensor ([0104], [0105]). D20, therefore, teaches that a module may comprise dies having various electronic or physical functions.

6. The parties agree that D20 discloses an integrated circuit having the above features.
7. The integrated circuit, as claimed, differs from that described in D20 by the following features:
  - (a) a first magnetic field sensing element is disposed on the first surface of the second substrate and a second magnetic field sensing element on the first surface of the first substrate;
  - (b) the first and second magnetic field sensing elements have different sensitivities to a magnetic field; and
  - (c) the integrated circuit is configured to provide a first operating range responsive to the first magnetic field sensing element and a second different operating range responsive to the second magnetic field sensing element.
8. The proprietor argued that, starting from D20, the technical problem to be solved might be formulated, as in the Board's communication, as identifying different sensing applications for the integrated circuit; or as providing a sensor having magnetic field sensing capability. In the proprietor's view, both formulations were valid as there was no substantial difference.
9. The Board considers the first formulation of the technical problem as the most appropriate, since it contains no direct pointer to magnetic field sensors and, hence, to features defining the invention.

10. In seeking applications for the integration of circuits in a module disclosed in D20, the skilled person would have considered known electrical circuit arrangements in which sensors are mounted on substrates. In particular, the skilled person would therefore also have considered B2. B2 discloses a circuit with two sensor elements as a magnetic field current sensor for a large dynamic range and high accuracy (page 1, lines 24 to 28) , wherein the magnetic field sensor is formed from two different groups of sensor elements, namely Hall elements for measuring relatively strong magnetic fields and magnetoresistive sensors for weak fields (page 2, lines 1 to 8). The skilled person would have considered the circuit described in B2 as a sensor application of a module as described in D20.
  
11. The proprietor argued that D20 was not concerned with magnetic field sensing and that there would have been no incentive for the skilled person to use the stacking technique it described to realise magnetic field sensors.
  
12. The Board does not agree. The integrated circuit of claim 1 is limited by no more than a juxtaposition of, on the one hand, the arrangement of the substrates on the lead frame and of sensors on either side of one substrate and, on the other hand, features defining the function of sensor elements and distinct operating ranges without synergistic interaction. On the basis of D20, the skilled person would, therefore, have had no reason to consider only sensor applications for the detection of certain physical quantities. Rather, the skilled person would have considered a wide range of sensor applications for the detection of physical quantities as potential applications. Amongst these,

the skilled person would have considered the magnetic field current sensor described in B2.

13. The circuit of claim 1 does, therefore, not involve an inventive step (Article 56 EPC).

*Auxiliary request 3, inventive step*

14. According to claim 1, the integrated circuit comprises a combination of two substrates, one of which is silicon and the other of which is GaAs.
15. The proprietor argued that it was not known, from the prior art, to use these materials for the two substrates in an integrated circuit having magnetic field sensors. This choice of materials allowed a highly sensitive sensing element to be produced in GaAs and a less sensitive sensing element together with the electronic circuit element to be produced cost-effectively in Si technology.
16. The selection of these materials does not provide any particular technical effect. It is not apparent that the selection of substrate materials is directly associated with costs. There is no discernible relationship between the sensitivity of a magnetic field sensor and the substrate material, as the type of magnetic field sensor and, hence, its interaction with the substrate remains undefined. Thus, the selection is merely an arbitrary one from a group of materials commonly known as semiconductor substrate materials.
17. Therefore, and for these reasons given above for the main request, the integrated circuit of claim 1 of

auxiliary request 3 does not involve an inventive step (Article 56 EPC).

*Auxiliary requests 1 and 1A, inventive step*

18. Claim 1 of auxiliary requests 1 and 1A is broader in scope than that of auxiliary request 3. Therefore, the reasons for lack of inventive step of auxiliary request 3 equally apply to auxiliary requests 1 and 1A.

**Order**

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

The decision under appeal is set aside.  
The patent is revoked.

The Registrar:

The Chair:



H. Jenney

P. Scriven

Decision electronically authenticated