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**Datasheet for the decision  
of 17 May 2022**

**Case Number:** T 0309/16 - 3.4.01

**Application Number:** 07716253.5

**Publication Number:** 1974223

**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 II / ALLEGRO MICROSYSTEMS

**Relevant legal provisions:**

EPC Art. 56, 111(1)

**Keyword:**

Inventive step - (no)

Appeal decision - remittal to the department of first instance  
(no)



**Beschwerdekammern**

**Boards of Appeal**

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Case Number: T 0309/16 - 3.4.01

**D E C I S I O N**  
**of Technical Board of Appeal 3.4.01**  
**of 17 May 2022**

**Appellant:** Micronas GmbH  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
15 December 2015 concerning maintenance of the  
European Patent No. 1974223 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 and requested oral proceedings if none of its substantive requests could be allowed on the basis of the written submissions. The proprietor also argued that none of the 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 gave its preliminary view that B2 should be considered in the appeal proceedings 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 the combined teaching of

D1: DE 10 2004 021 862 A1, and

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 opponent's final formulation of its request, at the end of oral proceedings, was that the decision under appeal be set aside and the patent revoked.
- VII. The proprietor's final formulation of its requests was 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 documents B1, B2, or B3 were admitted into the proceedings.
- VIII. Claim 1 of the main request (as maintained in the decision under appeal, reference signs omitted) 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 second  
substrate is coupled to the lead frame such*

*that the second surface of the second substrate is above the lead frame 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;*  
*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, characterized in that 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 and remittal*

1. Documents B1 to B3 were submitted under the regime of the rules of Procedure of the Boards of appeal 2007. The proprietor argued that none of them should be considered in the appeal proceedings, since there was no gap in the reasoning of the impugned decision to be filled; and because they would create a new case.

2. The Board is not convinced by this argument. B2 is an appropriate reaction to the impugned decision, point 21 of the reasons, in which it was held that the skilled person would not replace one of two sensor elements of the same type by differently-specified sensor elements for obtaining different operation ranges. B2 addresses this point. It does not pursue a new case but develops the opponent's previous line of argument. For these reasons, the Board decides to admit B2 and, having regard to Article 111 EPC, not to remit the case to the Opposition Division.

*Main request, inventive step*

3. D1 relates to sensing electrical current. The sensor disclosed in D1 measures the current indirectly by monitoring the magnetic field generated by it. The sensor is in the form of an integrated circuit having a lead frame L12 (Fig. 2) and first and second substrates. Each substrate has a surface directed towards the lead frame, and an opposing surface on which a respective magnetic field sensing element IC1', IC2' is provided. The substrates, together with the magnetic field sensing elements, are magnetic field sensor chips IC1, IC2. The sensor chips are not necessarily identical. They may be identical, when the second sensor chip IC2 is provided with the same signal processing circuitry as the first sensor IC2.
4. The configuration disclosed in D1 may be used for different set-ups, e.g. for differential measurement (description, paragraph [0029] and point 1 in [0030]), for absolute measurement (in which only one sensor is used) [0031], or to provide redundancy in the senses that the first sensor chip IC1 processes the signals of



both sensor elements IC1', IC2' or that both sensor chips process the signals of both sensor elements [0039].

5. D1 also addresses the scalability of a sensor [0033]. The skilled reader would understand that a current sensor having two magnetic field sensor elements, IC1' and IC2', may have a sensitivity different from that of another current sensor having a pair of identical field sensor elements, depending on the dimensions of the current-carrying conductor.
6. The integrated circuit according to claim 1 differs from that of D1 in that the first and second magnetic field sensing elements have different sensitivities to the magnetic field, and 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.
7. The proprietor defined the technical problem, when starting out from D1, as being to enhance the range of a magnetic field sensor device. This is in line with paragraph 38 of the patent specification, in which it is set out that magnetic field sensors with different ranges can operate together over a greater span of sensed electrical currents.
8. There are some doubts that a wider bandwidth is actually achieved without features that define some relationship between the ranges. However, providing sensors with different ranges is an essential prerequisite for solving this problem. Therefore, the Board accepts the proprietor's formulation of the

problem as it reflects the basic idea underlying the patent.

9. In seeking a solution to this problem, the skilled person would consider B2, which discloses a magnetic field current sensor aiming at a wide dynamic range and a high accuracy (page 1, lines 24 to 28). B2 discloses a magnetic field sensor composed of two different groups of sensing elements, namely Hall elements which are for measuring relatively strong magnetic fields, and magnetoresistive sensors for measuring weak magnetic fields (page 2, lines 1 to 8).
  
10. The proprietor argued that D1 disclosed two magnetic field sensors arranged on a lead frame only as an unfinished, intermediate product. A person skilled in the art would not have considered modifying the intermediate product before including it in a final product. Further, a modification that replaced one of the two identical sensor elements by a different type of sensor, so that the two have different sensitivities, would be contrary to the objective of D1, which was to provide a sensor having identical sensor elements as a final product. D2 was directed to a sensor as an end product, with two different sensor elements. Therefore, the person skilled in the art would have had no reason to consider B2 in combination with D1.
  
11. The Board does not agree. The integrated circuit of claim 1 is not an end product for performing a specific measurement task, but is only defined by general structural features concerning the arrangement of substrates and sensor elements on a lead frame and a functional definition of the sensor elements and operating areas as being different from one another.

The problem to be solved is of a general nature. Thus, a person skilled in the art would not have been deterred from considering two documents, each disclosing a complete and concrete solution to the problem of magnetic field measurement.

12. In order to obtain a large dynamic range, the skilled person would have considered providing the sensor as described in D1 with sensor elements from different groups with different sensitivities configured to detect a magnetic field in different operating ranges. The skilled person would thereby have obtained an integrated circuit as in claim 1.
13. The circuit of claim 1 of the main request does 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 the use of exactly these materials for the two substrates in an integrated circuit was not proposed in the prior art. This combination of materials made it possible to produce a highly sensitive sensor element exclusively in GaAs and a less sensitive sensor element together with the electronic circuit component, cost-effectively, in Si technology.
16. The Board does not agree. A reduction in cost is not associated solely with the choice of substrate materials. Regardless of this, the Board is not aware

of any specific technical problem that is solved solely by the choice of substrate materials Si and GaAs. These materials are, therefore, merely an arbitrary selection from a range of well-known substrate materials. The choice of these materials would, therefore, have been obvious.

17. Therefore, and for the 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. Claims 1 of auxiliary requests 1 and 1A are broader than claim 1 of auxiliary request 3. Therefore, the reasons why auxiliary request 3 lacks an inventive step also apply to them.

**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