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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 14/90

D E C I S I O N
of 13 March 1991
correcting errors in the decision
of the Technical Board of Appeal 3.4.1
of 25 February 1991

Appellant : (Proprietor of the patent)
NEC Corporation
33-1, Shiba 5-chome, Minato-ku
Tokyo 108 (JP)

Representative :
Glawe, Delfs, Moll & Partner
Patentanwälte
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Respondent : (Opponent)
Robert Bosch GmbH
Postfach 10 60 50
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Representative :

Decision under appeal :
Decision of the Opposition Division of the European Patent Office dated 27 October 1989 revoking European patent No. 0 066 263 pursuant to Article 102(1) EPC.

Composition of the Board :

Chairman : G.D. Paterson
Members : H. Reich
U. Himmler

In application of Rule 89 EPC the front page of the Decision in the Appeal Case T 14/90 - 3.4.1 is corrected by substitutions of "Appellant (Proprietor of the Patent)" for "Appellant (Opponent)"; "Respondent (Opponent)" for "Respondent (Proprietor of the Patent)"; "Decision of the Opposition Devision of the European Patent Office dated 27 October 1989 revoking European patent Nr. 0 066 263 persuant to Article 102(1) EPC" for "Decision of Opposition Division of the European Patent Office dated 27 October 1989 rejecting the opposition filed againt European patent No. 0 066 263 persuant to Article 102(2) EPC".

The Registrar: The Chairman:

P. Martorana G. Paterson

BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS | BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE | CHAMBRES DE RECOURS DE L'OFFICE EUROPEEN DES BREVETS

Publication in the Official Journal ~~Yes~~ / No

File Number: T 14/90-3.4.1

Application No.: 82 104 644.8

Publication No.: 0 066 263

Title of invention: Semiconductor device having two resistors

Classification: H01L 27/08

D E C I S I O N
of 25 February 1991

Applicant:

Proprietor of the patent: NEC Corporation

Opponent: Robert Bosch GmbH

Headword:

EPC Articles 54(2) and 56

Keyword: "Novelty after amendment; inventive step (yes)"

Headnote

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Summary of Facts and Submissions

I. The Appellant is owner of European patent No. 0 066 263.

II. This patent was opposed by the Respondent on the grounds mentioned in Article 100(a) EPC in view of the prior art, which can be derived from the European Search Report documents:

D11: US-A-4 161 742
D12: US-A-3 644 802
D13: US-A-3 771 095
D14: DE-A-2 021 489;

in view of a prior public use of monolithic integrated control stage unit (Steuerstufe) "CK32" contained in transistor ignition switching device (Transistorzünd-schaltgerät) type "0227 100 024" (TSZ8u) of Robert Bosch GmbH, evidenced by documents:

D1: Copy of layout drawing of "Steuerstufe für TSZ CK32";
D2: Electrical circuit diagram (Schaltbild) of "TSZ-Schaltgerät 0 227 100 023/...024";
D3: Copy of Purchase Agreement No. 1044/00526-00, dated 5 December 1979;
D4: Copies of the collective bills No. 006852, dated 30 November 1980 and No. 036049 dated 15 January 1981;
D5: List of components of "TSZ-Schaltgerät 0 227 100 023/024";
D6: Four original coloured layout drawings representing parts of document D1;
D7: Mercedes-Benz Service: "PKW-Typen mit Motor 102, Einführungsschrift für den Kundendienst" June 1980, pages 2, 128-130;

D8: D.E. Bergfried, U. Mayer, R. Schleupen and P. Werner: "Engine Management Systems in Hybrid Technology", SAE Technical Paper Series 860593, page 167;

D9: "VDI-Berichte", No. 687, 1988, pages 111-114;

and further evidenced by the testimonies of the witnesses Bernd Kalkhof and Gerhard Schöner, heard during oral proceedings before the Opposition Division on 18 July 1989 and by an inspection of a CK32 wafer via a microscope by the members of the Opposition Division and the Appellant during these oral proceedings.

And in view of document:

D10: DE-C-1 764 455.

III. The Opposition Division revoked the patent on the ground that the subject-matter of granted Claim 1 would not be new having regard to the prior public use of the integrated control stage unit "CK32".

IV. An appeal against this decision was lodged by the Patentee, requesting in the grounds of appeal to maintain the patent in amended form on the basis of annexed new Claims 1 to 4, wherein amended Claim 1 combines granted Claims 1, 3 and 6.

Amended Claim 1 reads as follows:

"A semiconductor device comprising first and second strip-shaped resistors (R_1', R_3', R_2', R_4') which are formed respectively by first and second semiconductor regions (2; 5; 11, 12, 13, 14, 15, 16, 17) of one conductivity type, each region including a plurality of high resistivity portions (8, 9, 11, 15) which substantially determine the resistance value of the respective resistor and which have

the same width in both resistors, and at least one low resistivity portion (13, 14) interconnecting said high resistivity portions wherein the geometrical configuration of the first and second strip-shaped resistors are different from each other, the resistance values of the first and second resistors (R_1', R_2') have a predetermined resistance ratio to each other, and the ratio of the numbers (n, n') of the high resistivity portions (8, 9; 11, 15) in said first and second resistors (R_1', R_2'), respectively, is substantially the same as said resistance ratio

c h a r a c t e r i z e d in that

- each of said first and second semiconductor regions comprises a plurality of straight portions interconnected by bent portions,

- the numbers of straight portions in said first and second semiconductor regions are different to each other and their ratios different from said resistance ratio,

- in at least one of said first and second elongated semiconductor regions the number of high resistivity portions is different from the number of straight portions, and

- at least two of said high resistivity portions in said first resistor have different length."

Claims 2 to 4 are dependent on Claim 1.

V. In a communication pursuant to Article 110(2) EPC the Board expressed its provisional view that - on the basis of these new Claims 1 to 4 - the patent might be maintained in amended form and invited the Appellant to adapt the description and drawings of the granted patent to the subject-matter of these claims with regard to Rules 27(1)(c) and (d) EPC.

VI. The Respondent (Opponent) filed no observations within the periods fixed by the Board, either in answer to the grounds of appeal or in reply to the above communication of the Board.

VII. The Appellant (Patentee), in response to the communication of the Board, requested that the appealed decision be set aside and that the patent be maintained in amended form on the basis of the following documents:

Claims: 1 to 4, received 28 February 1990 with the grounds of appeal;

Description: Pages 2 and 6 to 9 according to EP-B1-0 066 263;
Pages 3 to 5 and 10 to 12 received 26 October 1990 with letter dated 26 October 1990;

Drawings: Figures 1 to 10 according to EP-B1-0 066 263;
Figures 11 to 14 received 26 October 1990 with letter dated 26 October 1990.

Auxiliarily he requested oral proceedings.

VIII. In support of his request, the Appellant argued essentially as follows:

All resistors in prior used control stage unit CK32 are composed of a plurality of unit resistance portions, each having the same size and resistance value, whereas in the present invention the high resistivity elements have different lengths, so that the resistance ratio of two resistors is in no way linked with the number of high resistivity portions contained in each resistor. The technical concept of the present invention would be based on the idea of creating additional high resistivity

portions not for the purpose of realising a particular resistance value of one resistor, but in order to make the ratio of the numbers of high resistivity portions of different lengths of two resistors equal to their resistance ratio for the reason of its precision achievable in the manufacturing process.

Reasons for the Decision

1. The appeal is admissible.

2. There is no formal objection under Articles 123(2) or (3) EPC to the current version of the claims, description and drawings. In particular, present Claim 1 comprises the subject-matter of Claims 1, 3 and 6 of the published patent specification, which are based on the originally disclosed embodiments according to Figures 5 and 6. Present Claims 2 to 4 are identical with granted Claims 2, 4 and 5 respectively.

3. Novelty

3.1 None of the prior art semiconductor devices relied on in the pending proceedings comprises the characteristics as claimed in the characterising part of Claim 1.

3.2 As can best be seen from document D1, prior used control stage unit CK32 which was not contested by the Appellant to have been made available to the public prior to the priority date of the present invention, diverges from the characterising features of Claim 1 by the following facts:

(a) In CK32 not "each" but only one "of said first and second semiconductor regions" (R202) is L-shaped and

thus "comprises a plurality of straight portions". Its straight portions are moreover not "interconnected by bent portions" but only by one bent portion. All resistors of CK32 representing the claimed "second semiconductor regions" are I-shaped and thus have only one straight portion.

(b) The ratio of straight portions in the first and second semiconductor regions of CK32 is thus 2:1. Comparison in CK32 of R202 with R611, R614, R279, R278 results in the **same** ratio of resistances (see the ratio of the identical high resistivity portions) and not in a "different" one as claimed.

(c) In all "first and second elongated semiconductor regions" of CK32 "the number of high resistivity portions is different from the number of straight portions" and not only in "at least one" as claimed.

(d) All high resistivity portions of CK32 have the same length.

3.3 In the semiconductor device disclosed in document D10 only one coherent semiconductor region (base region 12, 13) is provided, in which all necessary resistors of the device are formed; see column 6, lines 15-68 and Figure 2. The resistors disclosed in documents D11 to D14 include as well only high resistivity semiconductor portions, which are moreover not interconnected by "at least one low resistivity portion" in the semiconductor as claimed in Claim 1, but by metal contacts on top of the semiconductor body.

3.4 For the reasons given above, the subject-matter of Claim 1 is considered novel (Article 54(2) EPC).

4. Inventive step

4.1 Starting from the nearest prior art made available to the public by use of control stage unit CK32 in transistor ignition switching device TSZ-0 227 100 024 of the company Robert Bosch GmbH, the objective problem underlying the present invention is to enhance the freedom in the design of a semiconductor device in which a resistance ratio between resistors having different configurations can be precisely achieved despite variations of the effective resistor lengths due to the subdiffusion during annealing of implanted dopants beyond the limits of the implantation mask; see the description of the patent, page 3, lines 17-20, as well as Figures 1 and 2 with their corresponding description.

4.2 This problem is solved by the **combination** of all features claimed in Claim 1.

4.3 This solution is not obvious in view of the prior art on file, in particular not in view of unit CK32. As can best be seen from document D1, this prior art only teaches a skilled person to compose a desired resistance value by a series circuit of a corresponding number of high resistivity portions of identical resistivity, width and length. Only as a consequence of these identical basic resistor elements the condition claimed in the **preamble** of Claim 1 is fulfilled that "the ratio of the numbers (n, n') of the high resistivity portions in said first and second resistors, respectively, is substantially the same as said resistance ratio". In the Board's view it is not at all obvious for a skilled person to maintain this condition in a resistor design without identical basic elements, in particular wherein at least a part of the individual high resistivity portions have different lengths as claimed in the **characterising part** of Claim 1.

The Board is convinced that the normal capacities of a skilled person are surpassed in the following steps: decoupling the number of interfaces between low and high resistivity semiconductor portions to be provided from the number of resistor elements necessary to realise a predetermined resistance value, and recognising that the number of these interfaces has to be approximated to the predetermined resistance ratio of arbitrarily formed first and second resistors in order to compensate for variations of this ratio due to an subdiffusion beyond mask openings in the manufacturing process; see the description of the patent, equations (6) and (11).

4.4 No guidance to the above solution can be given by document D10, wherein all resistor regions are provided within the same homogeneously doped semiconductor volume.

In the devices disclosed in documents D11 to D14 the effective lengths of the resistivity portions are not limited by lower doped semiconductor zones but by metal contacts through contact windows in an insulating surface layer, which windows are provided within the interior of the surface regions of the resistivity portions. Due to the fact that a heat treatment does not change the relative positions of the contact windows, any variation of the lengths of the resistivity portions by diffusion has no influence on the effective resistor lengths. Hence, these prior art devices do not even hint at the technical problem of the present patent.

4.5 For these reasons, the Board finds that the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.

5. Hence it follows that amended Claim 1 is allowable.

6. Dependent Claims 2 to 4 concern particular embodiments of the semiconductor device according to Claim 1 and are therefore likewise allowable.

7. Under these circumstances, the Appellant's auxiliary request for oral proceedings may be disregarded for lack of legal grounds.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the first instance with the order to maintain the patent in amended form on the basis of the following documents:

Claims: 1 to 4, received on 28 February 1990;
Description: pages 2 and 6 to 9 according to EP-B1-0 066 263,
pages 3 to 5 and 10 to 12, received on 26 October 1990;
Drawings: Figures 1 to 10 according to EP-B1-0 066 263,
Figures 11 to 14, received on 26 October 1990.

The Registrar: The Chairman:

P. Martorana G.D. Paterson

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