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Datasheet for the decision of 29 April 2015

Case Number: T 2170/11 - 3.4.03

Application Number: 98900704.2

Publication Number: 1050908

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Language of the proceedings: EN

Title of invention:
INSULATING GATE TYPE BIPOLAR SEMICONDUCTOR DEVICE

Applicant:
MITSUBISHI DENKI KABUSHIKI KAISHA

Headword:

Relevant legal provisions:
EPC 1973 Art. 84, 111(1)
EPC Art. 123(2)

Keyword:
Amendments - added subject-matter (no)
Claims - clarity after amendment (yes)
Remittal to the department of first instance - (yes)

Decisions cited:

Catchword:

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Case Number: T 2170/11 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 29 April 2015

Appellant: (Applicant)	MITSUBISHI DENKI KABUSHIKI KAISHA 7-3, Marunouchi 2-chome Chiyoda-ku Tokyo 100-8310 (JP)
Representative:	Hofer, Dorothea Prüfer & Partner GbR Patentanwälte Sohnckestrasse 12 81479 München (DE)
Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 25 February 2011 refusing European patent application No. 98900704.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman R. Bekkering
Members: T. M. Häusser
T. Bokor

Summary of Facts and Submissions

I. The appeal concerns the decision of the examining division refusing the European patent application No. 98 900 704 for lack of clarity (Article 84 EPC) in relation to the main request pending at the time and added subject-matter (Article 123(2) EPC) in relation to the first and second auxiliary requests pending at the time.

II. At the oral proceedings before the board the appellant submitted the following request:

Setting aside the decision under appeal and grant of a patent on the basis of the following documents:

Description, pages 1, 1a, 1b, 2-8 as filed during the oral proceedings before the board,
Claims 1-7 of the new main request filed during the oral proceedings before the board,
Drawings: Sheets 1/13-13/13 as filed during the oral proceedings before the board.

III. The wording of independent claim 1 of the sole request is as follows (board's labelling "(i)"):

"1. An insulated-gate bipolar semiconductor device, comprising:

a semiconductor substrate (100) of an intrinsic characteristic or a first conductivity type;

a trench (7) provided at a first main surface of the semiconductor substrate (100);

a ladder-shaped emitter region (5) of the first conductivity type formed at a part of a first main surface of the semiconductor substrate (100) along the lengthwise direction of the trench (7);

a first impurity region (3) of a second conductivity type formed on a second main surface of the semiconductor substrate (100);

a second impurity region (4, 6) of the second conductivity type formed to surround the emitter region (5) of the first conductivity type as a base region;

a control conductor (9) formed in said trench (7) at a part of the second impurity region (4, 6) of the second conductivity type with an insulating film (8) therebetween;

an insulating layer (13) covering the first main surface of the semiconductor substrate (100) except for a contact hole region (A);

a first main electrode (11) provided in contact with both the emitter region (5) of the first conductivity type and the second impurity region (4, 6) of the second conductivity type in said contact hole region (A);

a second main electrode (10) provided in contact with the first impurity region (3) of the second conductivity type; and

a control electrode (G) connected to the control conductor (9), wherein

the first main electrode (11) runs in the lengthwise direction of the trench (7) and spans the portions between the cross-pieces of the ladder-shaped emitter region (5), such cross-pieces providing a direct electrical contact between the emitter region (5) and the first main electrode (11) and such portions between the cross-pieces being of the second conductivity type and having a high impurity concentration and serving to electrically connect the second impurity region (4, 6) to the first main electrode (11), and

regions (14, 15) to increase the specific resistance of portions of the emitter region (5) are

formed in the vicinity of a surface of the emitter region (5) between the cross-pieces and the trench (7) in order to form an emitter ballast resistance,

wherein the resistance of the emitter region (5) in a direction in parallel to the trench (7) is sufficiently lower than the resistance of the emitter region (5) in a direction perpendicular to the trench (7) in order to restrain unbalance in the element operation,

(i) so that the electric resistance between the first main electrode (11) and a part of the emitter region (5) of the first conductivity type that is close to the control conductor (9) has a prescribed value, which is independent from the distance of said part of the emitter region (5) close to the control conductor (9) to the emitter region (5) in direct electrical contact with the first main electrode (11)."

IV. The appellant (applicant) argued essentially as follows:

(a) Amendments

The claims were based on original claims 1, 2, 4, 5, 6, and 7, the original description (page 4, lines 7-8, 15-17, and 32; page 6, lines 9-10, 12, 16-23, and 33; page 7, lines 3-9, 15-16, and 20-21; page 8, lines 4-8 and 9-16) and on the original drawings (Figures 1-3, 5-10, and 19-21).

(b) Clarity

The matter for which protection was sought was clearly defined in the amended claims. The description was brought into conformity with these claims and provided support for the claims.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments

2.1 In the decision under appeal the examining division held that the respective claim 1 of the first and second auxiliary requests then on file contained subject-matter extending beyond the content of the application as filed as these claims did not contain the feature relating to the electrical resistance between the first main electrode and a part of the emitter region that is close to the control conductor having a prescribed value (see feature (i) under point III. above). Since present claim 1 contains that feature, the objection is no longer relevant.

2.2 Claim 1 is based on original claims 1-3 (see the corrected translation of these claims filed with the letter dated 21 May 2010) and on the description and drawings as originally filed (see Figures 5-10 and 19-21 and the corrected translation of the description filed with the letter dated 21 May 2010, page 4, lines 6-17; page 4, line 27 - page 5, line 7; page 6, lines 7-10 and 14-23; page 6, line 32 - page 7, line 13).

Dependent claims 2-5 and 7 are based on original claims 4, 5, the two alternatives in original claim 6 and original claim 7, respectively. Dependent claim 6 is based on the description as originally filed (see the corrected translation of the description filed with the letter dated 21 May 2010, page 8, lines 9-16).

The description has been brought into conformity with the amended claims without extending beyond the content of the application as filed and supplemented with an indication of the relevant content of the prior art.

Accordingly, the board is satisfied that the amendments comply with the requirements of Article 123(2) EPC.

3. Clarity and support in the description

3.1 In the decision under appeal the examining division held that claim 1 of the main request then on file was not clear. In that claim it was specified that the electric resistance between the first main electrode and a part of the emitter region that was close to the control conductor had a prescribed value, which was independent "from the distance of the emitter region (5) of the first conductivity type in direct contact with the first main electrode (11)". Since one end point of the specified distance was not indicated in the claim, it was not unambiguously apparent which portions of the emitter were intended to have the claimed prescribed value.

However, in present claim 1 it is specified that the prescribed value is independent from the distance of said part of the emitter region close to the control conductor to the emitter region in direct electrical contact with the first main electrode. The second end point of the claimed distance is therefore indicated in present claim 1. Furthermore, as the emitter regions in direct electrical contact with the first main electrode are all connected to the first main electrode and thus have the same potential, the stated independence of the prescribed value of the resistance holds for all these emitter regions.

3.2 Furthermore, the matter for which protection is sought is defined in claim 1 mainly in terms of structural features, namely the trench with a control conductor, the ladder-shaped emitter region, first and second impurity regions, the first main electrode running in the lengthwise direction of the trench, regions to increase the specific resistance of portions of the emitter region in the vicinity of the surface of the emitter region between the cross-pieces of the ladder-shaped emitter region and the trench, the resistance of the emitter region in a direction in parallel to the trench being sufficiently lower than the resistance of the emitter region perpendicular to the trench.

Feature (i) of claim 1, which is formulated as a result to be achieved, namely that the prescribed value of the resistance is independent from the distance of the part of the emitter region close to the control conductor to the emitter region in direct electrical contact with the first main electrode, is considered to put constraints on these structural features, in particular on the regions to increase the specific resistance of portions of the emitter region and on the resistance of the emitter region in parallel and perpendicular to the trench.

3.3 Claim 1 is therefore considered to be clear.

Furthermore, dependent claims 2 to 7 are considered to define in a clear manner the specific embodiments of the invention.

3.4 The description has been brought into conformity with the amended claims and is considered to provide adequate support for these claims.

3.5 Accordingly, the board is satisfied that the claims comply with the requirements of Article 84 EPC 1973.

4. Remittal to the department of first instance

In the decision under appeal only the requirements of Articles 84 and 123(2) EPC were dealt with. The other requirements of the Convention were not discussed. In order to allow for the examination of these other requirements in two instances, remittal of the case to the department of first instance under Article 111(1) EPC 1973 is deemed appropriate.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for further prosecution.

The Registrar: The Chairman:

S. Sánchez Chiquero R. Bekkering

Decision electronically authenticated