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**Datasheet for the decision
of 12 March 2024**

Case Number: T 2896/19 - 3.4.03

Application Number: 12762112.6

Publication Number: 2754177

IPC: H01L29/06, H01L29/78,
H01L29/739, H01L29/04,
H01L29/16

Language of the proceedings: EN

Title of invention:

HIGH CURRENT DENSITY POWER MODULE COMPRISING TRANSISTORS WITH
IMPROVED LAYOUT

Applicant:

Wolfspeed, Inc.

Headword:

Wide bandgap transistors

Relevant legal provisions:

RPBA 2020 Art. 13(1), 13(2), 25(2)
RPBA Art. 12(4) (2007)

Keyword:

Amendment after Article 15(1) RPBA communication - exceptional circumstances (no) - taken into account (no)

Amendment to appeal case - amendment detrimental to procedural economy (yes)

Late-filed request - submitted with the statement of grounds of appeal - admitted (no) - request could have been filed in first instance proceedings (yes)

Decisions cited:

Catchword:



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Case Number: T 2896/19 - 3.4.03

D E C I S I O N
of Technical Board of Appeal 3.4.03
of 12 March 2024

Appellant: Wolfspeed, Inc.
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Durham, NC 27703 (US)

Representative: Boulton Wade Tennant LLP
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Decision under appeal: **Decision of the Examining Division of the
European Patent Office posted on 31 July 2019
refusing European patent application No.
12762112.6 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman T. Häusser
Members: M. Stenger
T. Bokor

Summary of Facts and Submissions

- I. The appeal concerns the decision of the examining division to refuse European application no. 12 762 112. In the contested decision, the examining division set out that the application did not comply with the requirements of Articles 123(2) and 84 EPC. In addition, further comments were provided with respect to Articles 54 and 84 EPC referring to documents D5, D6 and D2 as well as to trivial features. During the examination phase, objections with respect to Article 56 EPC were also made by the examining division.
- II. At the end of the oral proceedings before the board the appellant requested that the decision to refuse the application be set aside and a patent be granted on the basis of the main request or the first auxiliary request, both filed with the letter dated 12 February 2024, or conditional on the non-admittance of the main and first auxiliary requests, on the basis of the second auxiliary request, the claims of which were filed with the grounds of appeal.
- III. Claim 1 of the main request has the following wording (labeling (a), (b), ... added by the board):
- (a) *A power module comprising*
 - (b) *a housing (H1) with an interior chamber;*
 - (c) *a plurality of switch modules (SM1-SM4) mounted within the interior chamber and comprising a plurality of transistors (Q1-Q4) and a plurality of diodes (D1-D4) interconnected to facilitate switching power to a load*
 - (d) *wherein at least two of the plurality of transistors (100) each comprises:*

- (e) a drift layer (114, 214, 314) having a first conductivity type;
- (f) a well region (118, 218, 318) having a second conductivity type that is opposite the first conductivity type;
- (g) a source region (120A, 120B, 220, 320) in the well region, the source region having the first conductivity type and defining a channel region in the well region, wherein the source region comprises a lateral source region adjacent to the channel region and a plurality of source contact regions extending away from the lateral source region opposite the channel region;
- (h) a body contact region (122, 222, 322) having the second conductivity type between at least two of the plurality of source contact regions and in contact with the well region,
- (i) wherein the body contact region comprises a plurality of body contact regions that are interspersed between the plurality of source contact regions;
- (j) a source ohmic contact (134, 234, 334) that overlaps at least one of the source contact regions (120A, 120B, 220, 320) and the body contact region (122, 222, 322), and that does not overlap the lateral source region (120A),
- (k) wherein the source ohmic contact (134, 234, 334) overlaps the at least one source contact region in a source contact area and the source ohmic contact overlaps the body contact region in a body contact region area;
- (l) wherein a ratio of a minimum dimension $n1$ of the source contact area to a minimum dimension $w1$ of the well region is greater than 0.2;
- (m) wherein the drift layer comprises a wide bandgap semiconductor material.

- IV. Claim 1 of the first auxiliary request differs from claim 1 of the main request in that the following additional feature (c') is added after feature (c) (labeling (c') added by the board):

(c') , wherein at least one of the plurality of switch modules supports a current density of at least 10 amperes per cm²,

- V. Claim 1 of the second auxiliary request differs from claim 1 of the main request in that it does not comprise features (i), (k), (l) and (m), in that features (d), (e), (h) and (j) are replaced by features (d'), (e'), (h') and (j') and in that it comprises, at its end feature (n) as follows (labeling (d'), (e'), ... added by the board):

(d') wherein at least one of the plurality of switch modules and at least two of the plurality of transistors (100) comprises:

(e') a drift layer (114, 214, 314) being doped with a dopant of a first conductivity type;

(h') a contact region (122, 222, 322) having the second conductivity type between at least two of the plurality of source contact regions and in contact with the well region;

(j') a first ohmic contact (134, 234, 334) that overlaps the source region (120A, 120B, 220, 320) and overlaps the contact region (122, 222, 322); and

(n) a second contact region (132, 232, 332) that overlaps the source region (120A, 120B, 220, 320) and the well region (118, 218, 318).

- VI. The appellant essentially argued that the main and the first auxiliary requests should be admitted into the proceedings because they were filed in reaction to new

objections of the board in its communication preparing the oral proceedings. The second auxiliary request should be admitted because the amendments it contained were filed at the earliest possible occasion, in reply to objections set out in the contested decision.

Reasons for the Decision

1. The appeal is admissible.

2. The invention

The application concerns a power module comprising switching modules with transistors for switching electrical power to a load, for example an H-bridge. The power devices referred to in the description are made with SiC (see paragraphs [3] and [4]).

In one embodiment, at least one of the switch modules supports a high current density (see paragraph [7]). In other embodiments, at least one transistor has particular structural properties (see paragraph [8]). The transistor may also have a high reverse blocking voltage (see paragraph [14]).

3. Main request and first auxiliary request

3.1 Submissions of the appellant

The appellant argued that the board had raised new objections in its communication under Article 15(1) RPBA.

In particular, the board had raised a new novelty objection with respect to the prior art shown in Figure 12 of the application. This had to be addressed even if the board qualified it as only a side remark.

Addressing it just by argument would not have been sufficient.

Moreover, the board had changed the inventive step objection with respect to D5/D6 in the contested decision to a novelty objection.

In addition, with respect to the objections relating to intermediate generalisation, the board had shifted the focus from paragraph [8] of the description as forming a possible basis for the amendments as set out in the contested decision to original claim 8.

The amendments in the main and the first auxiliary requests did not address these new or modified objections by changing the direction of the claimed subject-matter. Instead, they did so by specifying in the claims in more detail the general inventive concept of the application. This related to the difference in the influence of the sheet and contact resistance in wide and narrow bandgap semiconductors respectively, as set out, for example, in paragraphs [4], [12] and [79] to [82], and also reflected in the previous dependent claims by structural features.

3.2 Admittance under Article 13(2) RPBA

- 3.2.1 The main request and the first auxiliary request were filed after notification of a communication under Article 15(1) RPBA. These are amendments to the appeal case, and as such they shall, in principle, not be taken into account unless there are exceptional circumstances which have been justified with cogent reasons by the appellant (see Article 13(2) RPBA).

The board agrees that new objections raised for the first time by itself may in principle be considered as an exceptional circumstance under Article 13(2) RPBA.

In the present case, however, the board did not effectively raise such new objections, for the following reasons.

(a) Figure 12 of the application

The side remark made in section 7. of the board's communication reads "*As a side remark, the Board notes that, contrary to what the then applicant wrote in its letter dated 29 March 2019 (second paragraph under the heading 'Amended Claims'), neither claim 1 as underlying the contested decision nor present claim 1 recites two contact regions*". That is, the side remark points out the fact that the claims referred to are broader than alleged by the then applicant, in that they only recite one contact region.

In that respect, the board notes that the contact region(s) referred to in the remark relate(s) to what is referred to in the description as the "p+ contact regions 122" (paragraph [85] to [87] or "body contact regions" (paragraph [9]), corresponding to feature (i). The "second contact region (132, 232, 332)" mentioned in these claims (see feature (n) in claim 1 of the second auxiliary request) is effectively not a contact region, but a gate contact (see also paragraph [87]). The board also pointed out in its communication the use of inconsistent terminology (see section 5.4).

The last sentence of the side remark made in section 7. of the board's communication with respect to Figure 12 then reads "*It thus seems that present claim 1 is not even new in view of what is presented as prior art in the application (see figure 12)*". That is, the board considered that due to the breadth of the claims referred to, the novelty objection with respect to D5/D6 raised **before** the side remark and in the same

section of the board's communication was also valid for the prior art shown in the application itself.

Thus, the side remark made with respect to Figure 12 does not correspond to a new objection made for the first time by the board, contrary to the submission of the appellant. Instead, it rather emphasizes the previous comment made with respect to D5/D6.

(b) D5/D6

The comment made with respect to D5/D6 "*It thus appears that the subject-matter of claim 1 of the present request is not new in view of the disclosure of D5/D6, ...*" (first paragraph of section 7. of the board's communication) is preceded by the sentence "*The Board presently concurs with further comment of the Examining Division in section III.2 of the contested decision*". In the section of the contested decision referred to, the examining division held that "*... all the structural features of claim 1, i.e. all the features of claim 1 besides the claimed voltage, are disclosed by D5/D6*". In independent claim 1 of the second auxiliary request (on which the communication of the board is based), the feature concerning the claimed voltage "*and handles a voltage of greater than 12 kV*" has been removed. That is, the "*inventive step objection*" of the examining division with respect to D5/D6 referred to by the appellant is effectively the same as the board's novelty objection in the board's communication.

In addition, the board notes that the contested decision also explicitly mentions that D5/D6 discloses "*all the structural features of claim 1, has also the performance claimed in claims 1 and 4-9, in which case*

the subject-matter of these claims would have to be regarded as being not novel (Art.54(1) and (2) EPC)".

For these reasons, the comment on lack of novelty with respect to D5/D6 in section 7. of the board's communication cannot be considered as a new objection raised for the first time by the board, contrary to the submission of the appellant.

(c) Change of focus from paragraph [8] to original claim 8

In section II.2.3 of the decision, the examining division set out that claim 1 represented an unallowable intermediate generalisation of the embodiment described in paragraph [8] (page 5, second paragraph).

It further set out that the arguments put forward with reference to paragraph [8] also applied to claims 8 and 21 as originally filed and that original claims 8 to 10 indicated that at least two transistors comprised the additional features mentioned therein (as compared to at least one transistor as defined in claim 1, see page 5, third paragraph of the contested decision). Amended claim 1 thus also represented an impermissible intermediate generalisation with respect to (original) claims 8-10, 21, 39 and 42 (page 5, fourth paragraph).

In other words, the examining division set out that claim 1 represented an intermediate generalisation not only with respect to paragraph [8] but also with respect to original claim 8. The board therefore does not see that the examining division may have focused on any one of these two objections more than on the other, contrary to the submission of the appellant.

In section 5.4 of its communication, the board expressed its preliminary opinion that "*the terminology used in present claim 1 is not consistent with the one used in original claim 8 (and/or the rest of the original application)*". This objection thus not only referred to original claim 8, but to the original application as a whole, which includes paragraph [8].

In the same section of its communication, the board further indicated that according to original claim 8, the source ohmic contact did not overlap the lateral source region. This objection only referred to original claim 8 and not to original paragraph [8], in line with the submission of the appellant. The reason therefore, however, is that paragraph [8] does not comprise the feature of original claim 8 that the source ohmic contact "does not overlap the lateral source region". Its absence in claim 1 as filed with the grounds for appeal could therefore not represent an intermediate generalisation with respect to paragraph [8], but only with respect to original claim 8.

In sum, the examining division did not focus only on any of paragraph [8] and original claim 8 when setting out that claim 1 represented an intermediate generalisation. In a similar manner, the board did not focus on any of these parts of the original application in section 5.4 of its communication, either, but just appropriately commented on both of the two objections set out by the division, considering the amendments made to claim 1 as filed with the grounds for appeal. Contrary to the submission of the appellant, the board therefore does not see any shift of the focus in respect of the objection of the impermissible intermediate generalisation.

3.2.2 Admittance under Article 13(1) RPBA

Irrespective of the above, amendments to a party's appeal case after it has filed its grounds of appeal may be admitted only at the discretion of the board (Article 13(1) RPBA). When exercising its discretion, the board shall take into account, *inter alia*, the criteria set out in Article 12 RPBA, paragraphs 4 to 6, for instance, whether they should have been submitted in the first instance proceedings, and procedural economy.

(a) Procedural economy

In the present case, none of the independent claims of the claim sets discussed during the examination phase comprised the structural features described/defined in combination in any of paragraph [8] and original claim 8, let alone features (i), (k), (l) and (m) stemming from original claims 22, 24 and 30.

Instead, the independent claims submitted after entry into the European phase, but before the start of the examination, the independent claims filed in reply to the first communication under Article 94(3) EPC and the independent claims submitted in reply to the summons to oral proceedings before the examining division all comprised at least one of the features 1) and 2) that at least one of the switch modules

1) supported a current density of at least 10 amperes per cm²

and/or

2) handled a minimum voltage (of 10 or 12 kV), in line with what is set out in the published application in paragraphs [7] and [14].

The independent claims of the main request and the first auxiliary request, on the other hand, do not comprise any of features 1) and 2), but instead comprise the features described/defined in combination in paragraph [8] and claim 8, and additionally structural features (i), (k), (l) and (m).

That is, with respect to the claim sets discussed during the examination phase, the claim sets of the main request and the first independent request represent a change of general direction from features 1) and 2) relating to performance parameters of the power module to the structural features comprised in original claims 8, 21, 22, 24 and 30, contrary to the submission of the appellant.

Discussing claims with such a different direction for the first time at this late stage of the proceedings would be clearly detrimental to procedural economy.

In that respect, the board notes that feature (i), which is based on original claim 22, features (k) and (l), which are based on original claim 24, and feature (m), which is based on original claim 30, were never claimed before in combination, not even at the search stage, because original claims 22, 24 and 30 all depended directly on original claim 21. The board can therefore not even be sure that the corresponding features were ever searched in combination.

(b) Requests should have been submitted in the examination proceedings

In addition, in the summons to oral proceedings, the examining division had set out in section 1.1 that claim 1 as then on file did not have a basis in original claims 8 and 9 because these comprised a

number of features that were inextricably linked to those put into claim 1. The examining division continued to set out that paragraph [8] could not be regarded as a valid basis for those features, either, listing the features that are disclosed in paragraph [8] in combination and which correspond essentially to the features of original claim 8.

In other words, prompted by section 1.1 of the summons to oral proceedings, the then applicant not only could, but indeed should have submitted, in the proceedings leading to the decision under appeal, a request comprising a claim 1 amended such that it included all the features listed in paragraph [8]/original claim 8 in order to overcome the objection with respect to Article 123(2) EPC as set out in that section of the summons to oral proceedings.

3.2.3 Conclusion

The board found no exceptional circumstances that would have justified under Article 13(2) RPBA to take into account the amendments submitted as main request and first auxiliary request.

In addition, the board found that these amendments filed for the first time during the appeal proceedings were detrimental to procedural economy and that these amendments should have been filed during the first instance examination proceedings.

Therefore, the board decided not to admit the main request and the first auxiliary request under Article 13(1) and (2) RPBA.

4. Second auxiliary request

4.1 Submissions of the appellant

The appellant submitted that the feature that at least one of the switch modules "handles a voltage of greater than 12 kV" was deleted in reaction to an objection raised for the first time in the contested decision and therefore at the earliest possible occasion.

The other amendments in claim 1 of the second auxiliary request were based on paragraph [8]. The second paragraph on page 5 of the contested decision suggested for the first time that paragraph [8] might provide a basis for the features introduced previously into claim 1. Therefore, the amendments that included the features disclosed in that paragraph were filed at the earliest possible occasion, directly in reaction to the contested decision, and with the grounds of appeal.

4.2 Admittance under Article 12(4) RPBA 2007

The limit of 12 kV in the feature that at least one of the switch modules "handles a voltage of greater than 12 kV" instead of the previously claimed limit of 10 kV was changed in reply to section 1.3 of the summons to oral proceedings. In this section, the examining division set out that a limit of 10 kV was not disclosed in the original application in that generality, but only in specific configurations. Thus, amending claim 1 by simply changing the limit from 10 kV to 12 kV did not take into account the reasons given by the examining division. The then applicant could therefore not be surprised that this amendment did not satisfy the requirements of Article 123(2) EPC, either.

Moreover, as explained above for the main request and the first auxiliary request (see section 3.2.2(b)

above), the examining division had already set out in section 1.1 of the summons to oral proceedings that claim 1 as filed with the reply to the first communication under Article 94(3) EPC did not have a basis in original claim 8 or paragraph [8], because features from this claim/this paragraph were missing in claim 1.

That is, the sentence "A possible basis could be par. 8 of the pamphlet" on page 5 of the contested decision may have been the first explicit suggestion for including the features listed in paragraph [8] in claim 1 expressed in positive terms, in line with the submission of the appellant.

However, section 1.1 of the summons to oral proceedings effectively comprises the same suggestion expressed in negative terms and thus, prompted thereby, the then applicant not only could but should have amended claim 1 already in the first instance proceedings, by including the corresponding features listed in paragraph [8]/original claim 8 in order to overcome the objection with respect to Article 123(2) EPC set out in section 1.1 of the summons to oral proceedings.

The earliest occasion for doing so would have been with its reply to the summons to oral proceedings, contrary to the submission of the appellant. However, in the claim set filed therewith, the corresponding features were not only not included in claim 1, but were even deleted from the previous claim set as a whole by deleting dependent claim 4.

The then applicant would have had a further opportunity to include these features in claim 1 during the oral proceedings before the examining division. However, it chose not to attend the oral proceedings, thereby also forfeiting this further opportunity.

The board thus concludes that the then appellant should have presented the request filed with the grounds of appeal already in the first instance proceedings, at the latest during the oral proceedings before the examining division. Accordingly, the board decides not to admit the second auxiliary request under Article 12(4) RPBA 2007, which applies to the second auxiliary request according to Article 25(2) RPBA.

5. Conclusion

None of the requests was admitted to the appeal proceedings. Thus, in the absence of any admissible and allowable requests, the appeal must fail.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



S. Sánchez Chiquero

T. Häusser

Decision electronically authenticated