

**INFORMATION DISCLOSURE  
STATEMENT BY APPLICANT**  
( Not for submission under 37 CFR 1.99)

|                        |                |
|------------------------|----------------|
| Application Number     | 15590282       |
| Filing Date            | 2017-05-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2892           |
| Examiner Name          | ARORA, AJAY    |
| Attorney Docket Number | GRTD-33439     |

**CERTIFICATION STATEMENT**

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

**OR**

That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

**SIGNATURE**

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

|            |                                |                     |            |
|------------|--------------------------------|---------------------|------------|
| Signature  | /Keith D. Harden, Reg. #74472/ | Date (YYYY-MM-DD)   | 2017-08-09 |
| Name/Print | Keith D. Harden                | Registration Number | 74,472     |

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: RAO, G.R. Mohan  
Serial No.: 15/590,282  
Confirmation No.: 1032  
Filed: May 9, 2017  
Group: 2892  
Examiner: ARORA, Ajay  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT  
REGIONS

Mail Stop AMENDMENT  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

**AMENDMENT AND RESPONSE TO OFFICE ACTION**

This communication is responsive to the Examiner's Office Action dated July 17, 2018.  
Reconsideration is respectfully requested.

**Amendments to the Claims** are reflected in the listing of claims beginning on page 2 of this paper.

**Remarks/Arguments** begin on page 6 of this paper.

| <b>PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                         | Docket Number (Optional)<br><b>GRTD60-33439</b> |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
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| Application Number<br><b>15/590,282</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Filed<br><b>May 9, 2017</b>             |                                                 |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| For<br><b>SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                         |                                                 |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| Art Unit<br><b>2892</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Examiner<br><b>ARORA, Ajay</b>          |                                                 |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <p>This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.</p> <p>The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):</p> <table style="width: 100%; border-collapse: collapse;"><thead><tr><th></th><th style="text-align: center;"><u>Fee</u></th><th style="text-align: center;"><u>Small Entity Fee</u></th><th style="text-align: center;"><u>Micro Entity Fee</u></th><th></th></tr></thead><tbody><tr><td><input type="checkbox"/> One month (37 CFR 1.17(a)(1))</td><td style="text-align: center;">\$200</td><td style="text-align: center;">\$100</td><td style="text-align: center;">\$50</td><td>\$ _____</td></tr><tr><td><input type="checkbox"/> Two months (37 CFR 1.17(a)(2))</td><td style="text-align: center;">\$600</td><td style="text-align: center;">\$300</td><td style="text-align: center;">\$150</td><td>\$ _____</td></tr><tr><td><input checked="" type="checkbox"/> Three months (37 CFR 1.17(a)(3))</td><td style="text-align: center;">\$1,400</td><td style="text-align: center;">\$700</td><td style="text-align: center;">\$350</td><td>\$ <b>700</b></td></tr><tr><td><input type="checkbox"/> Four months (37 CFR 1.17(a)(4))</td><td style="text-align: center;">\$2,200</td><td style="text-align: center;">\$1,100</td><td style="text-align: center;">\$550</td><td>\$ _____</td></tr><tr><td><input type="checkbox"/> Five months (37 CFR 1.17(a)(5))</td><td style="text-align: center;">\$3,000</td><td style="text-align: center;">\$1,500</td><td style="text-align: center;">\$750</td><td>\$ _____</td></tr></tbody></table> <p><input checked="" type="checkbox"/> Applicant asserts small entity status. See 37 CFR 1.27.</p> <p><input type="checkbox"/> Applicant certifies micro entity status. See 37 CFR 1.29.<br/>Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.</p> <p><input type="checkbox"/> A check in the amount of the fee is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The Director has already been authorized to charge fees in this application to a Deposit Account.</p> <p><input checked="" type="checkbox"/> The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to<br/>Deposit Account Number <u>500208</u>.</p> <p><input checked="" type="checkbox"/> Payment made via EFS-Web.</p> <p><b>WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.</b></p> <p>I am the</p> <p><input type="checkbox"/> applicant.</p> <p><input checked="" type="checkbox"/> attorney or agent of record. Registration number <u>30646</u>.</p> <p><input type="checkbox"/> attorney or agent acting under 37 CFR 1.34. Registration number _____.</p> <table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; padding: 5px;"><u>/Gregory M. Howison, Reg. #30646/</u><br/>Signature</td><td style="width: 50%; padding: 5px;"><u>January 16, 2019</u><br/>Date</td></tr><tr><td style="padding: 5px;"><u>Gregory M. Howison</u><br/>Typed or printed name</td><td style="padding: 5px;"><u>972-628-3600</u><br/>Telephone Number</td></tr></table> <p><b>NOTE:</b> This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.</p> |                                         |                                                 |                         | <u>Fee</u>    | <u>Small Entity Fee</u> | <u>Micro Entity Fee</u> |  | <input type="checkbox"/> One month (37 CFR 1.17(a)(1)) | \$200 | \$100 | \$50 | \$ _____ | <input type="checkbox"/> Two months (37 CFR 1.17(a)(2)) | \$600 | \$300 | \$150 | \$ _____ | <input checked="" type="checkbox"/> Three months (37 CFR 1.17(a)(3)) | \$1,400 | \$700 | \$350 | \$ <b>700</b> | <input type="checkbox"/> Four months (37 CFR 1.17(a)(4)) | \$2,200 | \$1,100 | \$550 | \$ _____ | <input type="checkbox"/> Five months (37 CFR 1.17(a)(5)) | \$3,000 | \$1,500 | \$750 | \$ _____ | <u>/Gregory M. Howison, Reg. #30646/</u><br>Signature | <u>January 16, 2019</u><br>Date | <u>Gregory M. Howison</u><br>Typed or printed name | <u>972-628-3600</u><br>Telephone Number |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <u>Fee</u>                              | <u>Small Entity Fee</u>                         | <u>Micro Entity Fee</u> |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <input type="checkbox"/> One month (37 CFR 1.17(a)(1))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | \$200                                   | \$100                                           | \$50                    | \$ _____      |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <input type="checkbox"/> Two months (37 CFR 1.17(a)(2))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$600                                   | \$300                                           | \$150                   | \$ _____      |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <input checked="" type="checkbox"/> Three months (37 CFR 1.17(a)(3))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | \$1,400                                 | \$700                                           | \$350                   | \$ <b>700</b> |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <input type="checkbox"/> Four months (37 CFR 1.17(a)(4))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | \$2,200                                 | \$1,100                                         | \$550                   | \$ _____      |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <input type="checkbox"/> Five months (37 CFR 1.17(a)(5))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | \$3,000                                 | \$1,500                                         | \$750                   | \$ _____      |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <u>/Gregory M. Howison, Reg. #30646/</u><br>Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <u>January 16, 2019</u><br>Date         |                                                 |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |
| <u>Gregory M. Howison</u><br>Typed or printed name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <u>972-628-3600</u><br>Telephone Number |                                                 |                         |               |                         |                         |  |                                                        |       |       |      |          |                                                         |       |       |       |          |                                                                      |         |       |       |               |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                       |                                 |                                                    |                                         |

☒ \* Total of ONE forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

| Electronic Patent Application Fee Transmittal |          |                                                  |        |                      |
|-----------------------------------------------|----------|--------------------------------------------------|--------|----------------------|
| Application Number:                           |          | 15590282                                         |        |                      |
| Filing Date:                                  |          | 09-May-2017                                      |        |                      |
| Title of Invention:                           |          | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |        |                      |
| First Named Inventor/Applicant Name:          |          | G.R. MOHAN RAO                                   |        |                      |
| Filer:                                        |          | Gregory Michael Howison/Ashley Boyes             |        |                      |
| Attorney Docket Number:                       |          | GRTD-33439                                       |        |                      |
| Filed as Small Entity                         |          |                                                  |        |                      |
| Filing Fees for Utility under 35 USC 111(a)   |          |                                                  |        |                      |
| Description                                   | Fee Code | Quantity                                         | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                                  |        |                      |
| Pages:                                        |          |                                                  |        |                      |
| Claims:                                       |          |                                                  |        |                      |
| Miscellaneous-Filing:                         |          |                                                  |        |                      |
| Petition:                                     |          |                                                  |        |                      |
| Patent-Appeals-and-Interference:              |          |                                                  |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                                  |        |                      |
| Extension-of-Time:                            |          |                                                  |        |                      |

| Description                        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|------------------------------------|----------|----------|--------|----------------------|
| Extension - 3 months with \$0 paid | 2253     | 1        | 700    | 700                  |
| <b>Miscellaneous:</b>              |          |          |        |                      |
| <b>Total in USD (\$)</b>           |          |          |        | <b>700</b>           |

| Electronic Acknowledgement Receipt          |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 34876098                                         |
| <b>Application Number:</b>                  | 15590282                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 1032                                             |
| <b>Title of Invention:</b>                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |
| <b>First Named Inventor/Applicant Name:</b> | G.R. MOHAN RAO                                   |
| <b>Customer Number:</b>                     | 25883                                            |
| <b>Filer:</b>                               | Gregory Michael Howison                          |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD-33439                                       |
| <b>Receipt Date:</b>                        | 16-JAN-2019                                      |
| <b>Filing Date:</b>                         | 09-MAY-2017                                      |
| <b>Time Stamp:</b>                          | 18:21:33                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                                                                                                                                                                                                                                     |                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Submitted with Payment                                                                                                                                                                                                                              | yes                   |
| Payment Type                                                                                                                                                                                                                                        | CARD                  |
| Payment was successfully received in RAM                                                                                                                                                                                                            | \$700                 |
| RAM confirmation Number                                                                                                                                                                                                                             | 011719INTEFSW18243900 |
| Deposit Account                                                                                                                                                                                                                                     | 500208                |
| Authorized User                                                                                                                                                                                                                                     | Gregory Howison       |
| <p>The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:</p> <p>37 CFR 1.17 (Patent application and reexamination processing fees)</p> <p>37 CFR 1.21 (Miscellaneous fees and charges)</p> |                       |

|                              |                                                       |                       |                                          |                  |                  |
|------------------------------|-------------------------------------------------------|-----------------------|------------------------------------------|------------------|------------------|
|                              |                                                       |                       |                                          |                  |                  |
| File Listing:                |                                                       |                       |                                          |                  |                  |
| Document Number              | Document Description                                  | File Name             | File Size(Bytes)/ Message Digest         | Multi Part /.zip | Pages (if appl.) |
| 1                            |                                                       | GRT33439AMD011619.pdf | 122884                                   | yes              | 8                |
|                              |                                                       |                       | 1086404bf650a6a61e1a780c339a4e567c9126d6 |                  |                  |
|                              | Multipart Description/PDF files in .zip description   |                       |                                          |                  |                  |
|                              | Document Description                                  |                       | Start                                    | End              |                  |
|                              | Amendment/Req. Reconsideration-After Non-Final Reject |                       | 1                                        | 1                |                  |
|                              | Claims                                                |                       | 2                                        | 5                |                  |
|                              | Applicant Arguments/Remarks Made in an Amendment      |                       | 6                                        | 8                |                  |
| Warnings:                    |                                                       |                       |                                          |                  |                  |
| Information:                 |                                                       |                       |                                          |                  |                  |
| 2                            | Extension of Time                                     | GRT33439EXT011619.pdf | 126325                                   | no               | 1                |
|                              |                                                       |                       | 4af6f6b087cd12af850de4ab03510468d702267b |                  |                  |
| Warnings:                    |                                                       |                       |                                          |                  |                  |
| Information:                 |                                                       |                       |                                          |                  |                  |
| 3                            | Fee Worksheet (SB06)                                  | fee-info.pdf          | 30793                                    | no               | 2                |
|                              |                                                       |                       | 8f7a95b472d5d3f12ffc7028f0830d2c0c8ee30  |                  |                  |
| Warnings:                    |                                                       |                       |                                          |                  |                  |
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

**National Stage of an International Application under 35 U.S.C. 371**

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

**New International Application Filed with the USPTO as a Receiving Office**

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### **In the Claims**

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A semiconductor device, comprising:
  - a substrate of a first doping type at a first doping level having first and second surfaces;
  - a first active region disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and within which circuitry can be formed;
  - a second active region separate from the first active region disposed adjacent to the first active region and within which circuitry can be formed;
  - circuitry formed in at least one of the first active region or second active region;
  - and
  - at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first surface to the second surface of the substrate.
2. (Original) The semiconductor device of Claim 1, wherein the substrate is a p-type substrate.
3. (Original) The semiconductor device of Claim 1, wherein the substrate is an n-type substrate.
4. (Original) The semiconductor device of Claim 1, wherein the substrate has epitaxial silicon on top of a nonepitaxial substrate.
5. (Original) The semiconductor device of Claim 1, wherein the first active region and second active region contain p-channel and n-channel devices.
6. (Original) The semiconductor device of Claim 1, wherein the first active region and second active region contain either p-channel or n-channel devices.

7. (Original) The semiconductor device of Claim 1, wherein the first active region and second active region are each separated by at least one isolation region.
8. (Original) The semiconductor device of Claim 1, wherein the graded dopant is fabricated with an ion implantation process.
9. (Currently Amended) A semiconductor device, comprising:
- a substrate of a first doping type at a first doping level having first and second surfaces;
  - a first active region disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and within which circuitry can be formed in the surface thereof;
  - a second active region separate from the first active region disposed adjacent to the first active region and within which circuitry can be formed in the surface thereof;
  - circuitry formed in at least one of the first active region or second active region;
  - and
  - at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the surface to the substrate.
10. (Original) The semiconductor device of Claim 9, wherein the substrate is a p-type substrate.
11. (Original) The semiconductor device of Claim 9, wherein the substrate is an n-type substrate.
12. (Original) The semiconductor device of Claim 9, wherein the substrate has epitaxial silicon on top of a nonepitaxial substrate.
13. (Original) The semiconductor device of Claim 9, wherein the first active region and second active region contain p-channel and n-channel devices.

14. (Original) The semiconductor device of Claim 9, wherein the first active region and second active region contain either p-channel or n-channel devices.
15. (Original) The semiconductor device of Claim 9, wherein the first active region and second active region are each separated by at least one isolation region.
16. (Original) The semiconductor device of Claim 9, wherein the graded dopant is fabricated with an ion implantation process.
17. (New) The semiconductor device of Claim 1, wherein the circuitry includes active devices.
18. (New) The semiconductor device of Claim 9, wherein the circuitry includes active devices.

## **REMARKS**

Applicant has carefully reviewed the Office Action dated July 17, 2018. Applicant has amended Claims 1 and 9 and added new Claims 17 and 18 to more clearly point out the present inventive concept. Reconsideration and favorable action is respectfully requested.

Claims 1 – 16 stand rejected under 35 USC §103(a) as being anticipated by *Hong*. This rejection is respectfully traversed with respect to the claims as currently presented.

A basic misunderstanding between how the claims are drafted and how the Examiner is interpreted them is with respect to the term “active region.” This will be discussed in detail.

With respect to the *Hong* reference, the primary figure, Figure 4D is reproduced as follows:

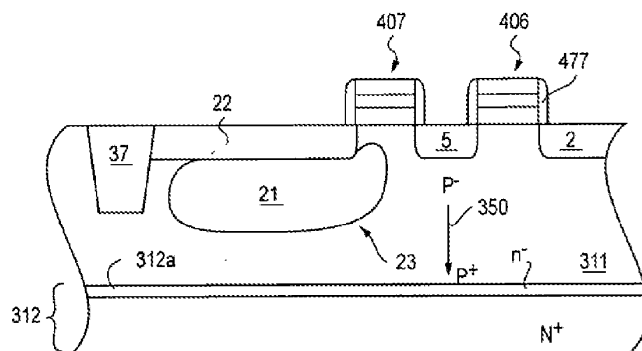


**FIG. 4D**

This Figure depicts the final construction at formation of the various doped regions. The description of this construction is as follows for the Examiner's convenience:

As shown in FIG. 4D, the n-type region 21 is formed from a point adjacent the transfer gate stack 407 and extending in the epitaxial layer 311 between the gate stack 407 and the isolation region 37. The region 21 forms a photosensitive charge accumulating region for collecting photo-generated charge.

The doped surface layer 22 for the photo-conversion device 23 is implanted and formed as a highly doped p-type surface layer. A p-type dopant, such as boron, indium, or any other suitable p-type dopant, may be used to form the p-type surface layer 22. The p-type surface layer 22 may be formed by known techniques. For example, layer 22 may be formed by implanting p-type ions through openings in a layer of photoresist. Alternatively, layer 22 may be formed by a gas source plasma doping process, or by diffusing a p-type dopant into the epitaxial layer 311 from an in-situ doped layer or a doped oxide layer deposited over the area where layer 22 is to be formed.

The floating diffusion region 5 and source/drain region 2 are implanted by known methods, as also shown in FIG. 4D. The floating diffusion region 5 and source/drain region 2 are formed as n-type regions. Any suitable n-type dopant, such as phosphorus, arsenic, or antimony, may be used. The floating diffusion region 5 is formed on the side of the transfer gate stack 407 opposite the n-type photodiode region 21. The source/drain region 2 is formed on a side of the reset gate stack 406 opposite the floating diffusion region 5.

Conventional processing methods can be used to form other structures of the pixel cell 300. For example, insulating, shielding, and metallization layers to connect gate lines, and other connections to the pixel cell 300 may be formed. Also, the entire surface may be covered with a passivation layer (not shown) of, for example, silicon dioxide, borosilicate glass (BSG), phosphosilicate glass (PSG), or borophosphosilicate glass (BPSG), which is CMP planarized and etched to provide contact holes, which are then metallized to provide contacts. Conventional layers of conductors and insulators may also be used to interconnect the structures and to connect pixel 300 to peripheral circuitry. (¶¶ 0038-0041).

From this description, it can be clearly seen that the region 2 is a source/drain region and it is formed similarly with the region 5 referred to as floating diffusion region. Both of the stacks 407 and 406 are referred to as “gate stacks.” These are basically the gates of the transistors. Underneath the transistor gates is formed a channel region. The region 22 is referred to merely as a P-type surface layer. The doping range of this layer is not set forth. However, the structure formed by the region 22, region 21 and the region 311 forms a P-N-P photodiode. Thus, the question is-what is an active region?

The Examiner has referred to the first active region as the region 311, but has referred to the regions 21, 22, 5 and 2 as “wells.” There is no support for such a construction, as the term “wells” in semiconductor technology is typically referred to as a region formed in a substrate within which active components are formed. The Examiner has referred to the second active region as being that defined by the source/drain region 2 or the regions 2 or 5 or 22 of the pixel

cell. Applicant has amended the claims to define the “active regions” as regions within which circuitry can be formed. The operation of the structure as set forth in ¶ 0007 as follows:

In the CMOS pixel cell 10 depicted in FIGS. 1 and 2, electrons are generated by light incident on the photo-conversion device 23 and are stored in the n-type photodiode region 21. These charges are transferred to the floating diffusion region 5 by the transfer transistor 17 when the transfer transistor 17 is activated. The source follower transistor 19 produces an output signal based on the transferred charges applied to its gate. A maximum output signal is proportional to the number of electrons extracted from the n-type photodiode region 21.

Thus, the trapped charges are stored in the region 21, and all the region 22 does is provide a contact with one side of the channel under the transfer transistor/stack 17 to allow charge to be transferred from the photodiode region 21 to the floating diffusion region 5 when transfer transistor/stack 17 is activated and the underlying channel is conductive. Thus, there is provided an active region 311 within which two transistors are formed with the transistor gate stacks 407 and 406 and their associated source/drain regions. The actual source for the transistor stack 407 is the N-type region 21 which is connected to the channel underlying the gate stack 407 by the P-type region 22. There are no active devices formed within the region 22 or the region 5 or the region 2 within which circuitry (active devices) can be formed - the active devices are formed only within the active region 311.

Applicant believes that *Hong* does not anticipate or obviate Claims 1 – 16, as currently presented, and therefore respectfully requests withdrawal of the 35 USC §103(a) rejection with respect thereto.

Applicant has now made an earnest attempt in order to place this case in condition for allowance. For the reasons stated above, Applicant respectfully requests full allowance of the claims as amended.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at [kharden@munckwilson.com](mailto:kharden@munckwilson.com).

Recognizing that Internet communications are not secure, Applicant hereby authorizes

the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application by video conferencing, instant messaging, or electronic mail. Applicant understands that a copy of these communications will be made of record in the application file.

Please charge any additional fees or deficiencies in fees or credit any overpayment to Deposit Account No. 20-0780/GRTD-33439.

Respectfully submitted,  
MUNCK WILSON MANDALA, LLP  
Attorneys for Applicant

/Gregory M. Howison, Reg. #30646/

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January 16, 2019

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|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------|--------------------|---------------------------|---------------------|---------------------------------------|--|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                               |                                                                                          |                                                                                                                                                                                                                               |                                    | Application or Docket Number<br>15/590,282 |                    | Filing Date<br>05/09/2017 |                     | <input type="checkbox"/> To be Mailed |  |  |
| ENTITY: <input type="checkbox"/> LARGE <input checked="" type="checkbox"/> SMALL <input type="checkbox"/> MICRO                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
| <b>APPLICATION AS FILED - PART I</b>                                                                                            |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         |                                            |                    |                           |                     |                                       |  |  |
| FOR                                                                                                                             |                                                                                          | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)                                  |                    | FEE (\$)                  |                     |                                       |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                             |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                    |                           |                     |                                       |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                            |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                    |                           |                     |                                       |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                       |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                    |                           |                     |                                       |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                |                                                                                          | minus 20 =                                                                                                                                                                                                                    | *                                  | x \$40 =                                   |                    |                           |                     |                                       |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                          |                                                                                          | minus 3 =                                                                                                                                                                                                                     | *                                  | x \$210 =                                  |                    |                           |                     |                                       |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))                                                                  |                                                                                          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                                            |                    |                           |                     |                                       |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                      |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                       |                                                                                          |                                                                                                                                                                                                                               |                                    | TOTAL                                      |                    |                           |                     |                                       |  |  |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                         |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                    |                           |                     |                                       |  |  |
| AMENDMENT                                                                                                                       | 01/16/2019                                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)          |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 18                                                                                                                                                                                                                          | Minus                              | ** 20                                      | = 0                | x \$ 50 =                 |                     | 0                                     |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                                                                                                                                                                                                                           | Minus                              | *** 3                                      | = 0                | x \$ 230 =                |                     | 0                                     |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE    |                           | 0                   |                                       |  |  |
| AMENDMENT                                                                                                                       |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                    |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)          |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | *                                                                                                                                                                                                                             | Minus                              | **                                         | =                  | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | *                                                                                                                                                                                                                             | Minus                              | ***                                        | =                  | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                    |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE    |                           |                     |                                       |  |  |
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| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 15/590,282                 | 05/09/2017  | G.R. MOHAN RAO       | GRTD-33439          | 1032             |
| 25883                      | 7590        | 05/16/2019           | EXAMINER            |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | ARORA, AJAY         |                  |
| P.O. Drawer 800889         |             |                      |                     |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | 2892                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
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## **DETAILED ACTION**

### ***Notice of Pre-AIA or AIA Status***

1. The present application is being examined under the pre-AIA first to invent provisions.

### ***Claim Objections***

2. Newly added claims 17 and 18 are objected to because of the following informalities: Each of claims 17 and 18 recite “the circuitry includes active devices” but their respective base claims (1 and 9) each recite “circuitry” that corresponds to “first active region” and also “circuitry” that corresponds to “second active region”. As such, it is not clear which of the two “circuitry” is being referred to in the recitation “the circuitry” of claims 17 and 18. For the purposes of this office action, it will be assumed that it can refer to any one of the circuitry. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

3. The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-18 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Hong (US 2007/0045682) of prior record, hereinafter Hong.

Regarding claims 1 and 17, Hong (refer to Figures 4A-4D and 5A-5C) teaches a semiconductor device, comprising:

a substrate (312 – see para 29) of a first doping type (i.e. parts 312 and 21 of the substrate have n-type doping, see para 29) at a first doping level having first and second surfaces;

a first active region (311, which includes wells such as 21, 22, 5, 2) disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type (i.e. p-type, see para 29) and within which circuitry (comprising pixel cell 300 described in para 28, including transistors corresponding to 407 or 406 – see para 32) can be formed, wherein (as recited in claim 17) the circuitry includes active devices (i.e. active devices corresponding to pixel described above);

a second active region (such as source/drain region 2, see para 40; or 2 or 5 or 22 of pixel cell formed in an adjacent region separated by shallow trench isolation 37 – see para 30) separate from the first active region disposed adjacent to the first active region and within which circuitry (note that circuitry is a very broad term and does not necessarily imply presence of active elements like transistors, and any device terminals such as source/drain read on “circuitry”; also see claim objection to claim 17 which as recited, does not require “active devices” in both “first active region” and “second active region”) can be formed;

circuitry (comprising pixel cell 300 described in para 28, including transistors corresponding to 407 or 406 – see para 32) formed in at least one of the first active region or second active region; and

at least a portion of at least one of the first and second active regions having at least one graded dopant concentration (350 – see para 24, last 3 sentences; also see Figure 5C and para 29) to aid carrier movement (para 26).

Hong does not specifically state that the aiding of carrier movement is “from the first surface to the second surface of the substrate”. However, Hong teaches that although a p-n-p photodiode is shown formed in Figure 4D, other photodiode types may be formed (para 42); and that gradients different from those shown in examples of Figure 5A-5C may be used (para 24, especially last sentence). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Hong so that the aiding of carrier movement is “from the first surface to the second surface of the substrate”. The ordinary artisan would have been motivated to modify Hong for at least the purpose of using a gradient suitable for a photo-conversion device (23 of Figure 4D, see para 26) in which at least a part that collects carriers is aided by the gradient, for example as case where said part is formed in or extends into the substrate, or when vertical devices are formed.

Regarding claims 2-3, Hong (refer to Figures 4A-4D and 5A-5C) teaches that the substrate (312) may be a p-type substrate (para 42), as recited in claim 2; or may be an n-type substrate (see Figure 4D), as recited in claim 3.

Regarding claim 4, Hong (refer to Figures 4A-4D and 5A-5C) teaches that the substrate (312) has epitaxial silicon on top of a nonepitaxial substrate (para 19 describes that the term “substrate” includes silicon-on-insulator, which includes epitaxial silicon on top of a nonepitaxial substrate).

Regarding claims 5-6, Hong (refer to Figures 4A-4D and 5A-5C) teaches that the first active region and second active region may contain contain p-channel or n-channel devices (see Figure 4D and para 42) and further teaches that different configuration of device(s) are possible (para 42-43). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Hong so that the first active region and second active region “contain p-channel and n-channel devices” (as recited in claim 5); or “contain either p-channel or n-channel devices. The ordinary artisan would have been motivated to modify Hong for at least the purpose of Motivation: at least for the purpose of forming image sensors where either p-channel device or n-channel devices are used; or a combination of such devices is used to design the circuit for maximum electrical efficiency for the given design requirements.

Regarding claim 7, Hong (refer to Figures 4A-4D and 5A-5C) teaches that the first active region and second active region may each separated by at least one isolation region (37, as explained for claim 1).

Regarding claim 8, it is a product claim but recites a method of steps therein; i.e. the graded dopant is “fabricated with an ion implantation process”. Therefore, the claim amounts to a product by process claim. *“Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the*

*product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.*

Claim 9 is substantially similar to claim 1 – instead of the limitation “from the first surface to the second surface of the substrate” of claim 1, claim 9 instead recites “from the surface to the substrate”. As such, the rejection of claim 1 also applies to claim 9.

Regarding claims 10-16 and 18, respectively, they are substantially similar to claims 2-8 and 17, respectively, and hence the rejections are substantially similar.

### ***Response to Arguments***

5. Applicant's arguments filed 1/16/2019 have been fully considered but they are not persuasive. On pages 5-7 of applicant's response, applicant attempts to answer “Thus, the question is what is an active region ?” (especially see page 6 of applicant's response, 2<sup>nd</sup> last paragraph, last sentence). Applicant argues that claims now define “active region” as one where “active components” such as “transistors” are formed (page 6, last paragraph and page 7 of applicant's response). However, base claim 1 does not provide such a recitation – only that “circuitry” (which is a much broader term) can be formed in the active region. New claims 17 and 18 do not require all recited active regions (two are recited in each of claims 1 and 9) must include “active devices”. Whereas the substrate (first active region) comprises the pixel structure and comprises active devices, the “second active region” only comprises part of an active device

(source/drain), which reads on “circuitry” but not on “circuitry” that “includes active devices”. However, that is not what is recited in the claims. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e. “second active region” also comprises “circuitry” that “includes active devices”) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

### ***Conclusion***

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on 9 AM - 5 PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on 5712721708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AJAY ARORA/  
Primary Examiner, Art Unit 2892



|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

|                        |             |                 |
|------------------------|-------------|-----------------|
| <b>CPC - Searched*</b> |             |                 |
| <b>Symbol</b>          | <b>Date</b> | <b>Examiner</b> |
| H01L 29/1095           | 6/25/2018   | AKA             |

|                                         |             |                 |
|-----------------------------------------|-------------|-----------------|
| <b>CPC Combination Sets - Searched*</b> |             |                 |
| <b>Symbol</b>                           | <b>Date</b> | <b>Examiner</b> |
|                                         |             |                 |

|                                      |                 |             |                 |
|--------------------------------------|-----------------|-------------|-----------------|
| <b>US Classification - Searched*</b> |                 |             |                 |
| <b>Class</b>                         | <b>Subclass</b> | <b>Date</b> | <b>Examiner</b> |
| 257                                  | 655             | 6/25/2018   | AKA             |

\* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

|                                                   |             |                 |
|---------------------------------------------------|-------------|-----------------|
| <b>Search Notes</b>                               |             |                 |
| <b>Search Notes</b>                               | <b>Date</b> | <b>Examiner</b> |
| Inventor search                                   | 6/25/2018   | AKA             |
| Assignee search                                   | 6/25/2018   | AKA             |
| All references for parent applications considered | 6/25/2018   | AKA             |
| EAST search history report                        | 6/25/2018   | AKA             |
| Revised EAST search history report                | 05/13/2019  | AKA             |

|                            |                              |             |                 |
|----------------------------|------------------------------|-------------|-----------------|
| <b>Interference Search</b> |                              |             |                 |
| <b>US Class/CPC Symbol</b> | <b>US Subclass/CPC Group</b> | <b>Date</b> | <b>Examiner</b> |
|                            |                              |             |                 |

|                                         |  |
|-----------------------------------------|--|
| /A.K.A./ Primary Examiner.Art Unit 2892 |  |
|-----------------------------------------|--|

## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                                                                                 | DBs                                                                  | Default Operator | Plurals | Time Stamp          |
|-------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------|---------|---------------------|
| L1    | 24   | ((("GREENTHREAD") near3 ("LLC"))).AS,AANM.                                                                                                                   | US-PGPUB;<br>USPAT; USOCR;<br>FPRS; EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2019/05/13<br>10:42 |
| L2    | 24   | ((("RAO") near3 ("G.R") near3 ("MOHAN"))).INV.                                                                                                               | US-PGPUB;<br>USPAT; USOCR;<br>FPRS; EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2019/05/13<br>10:42 |
| L3    | 41   | L1 L2                                                                                                                                                        | US-PGPUB;<br>USPAT; USOCR;<br>FPRS; EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2019/05/13<br>10:42 |
| L4    | 8    | (substrate and (first near3 (dop\$3 impurity)) and (second near3 (dop\$3 impurity)) and (active near2 circuit\$2) and (grad\$4 with (dop\$3 impurity))).clm. | US-PGPUB;<br>USPAT; USOCR;<br>FPRS; EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2019/05/13<br>10:44 |

5/13/2019 11:29:27 AM

C:\Users\aarora\Documents\EAST\Workspaces\15590282.wsp

| <b>PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                | Docket Number (Optional)<br><b>GRTD.01.01.DV5</b> |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
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| Application Number<br><b>15/590,282</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Filed<br><b>May 9, 2017</b>    |                                                   |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| For<br><b>SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |                                                   |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| Art Unit<br><b>2892</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Examiner<br><b>ARORA, Ajay</b> |                                                   |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <p>This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.</p> <p>The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 15%; text-align: center;"><u>Fee</u></th> <th style="width: 15%; text-align: center;"><u>Small Entity Fee</u></th> <th style="width: 15%; text-align: center;"><u>Micro Entity Fee</u></th> <th style="width: 25%;"></th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1))</td> <td style="text-align: center;">\$200</td> <td style="text-align: center;">\$100</td> <td style="text-align: center;">\$50</td> <td style="text-align: right;">\$ <u>100</u></td> </tr> <tr> <td><input type="checkbox"/> Two months (37 CFR 1.17(a)(2))</td> <td style="text-align: center;">\$600</td> <td style="text-align: center;">\$300</td> <td style="text-align: center;">\$150</td> <td style="text-align: right;">\$ _____</td> </tr> <tr> <td><input type="checkbox"/> Three months (37 CFR 1.17(a)(3))</td> <td style="text-align: center;">\$1,400</td> <td style="text-align: center;">\$700</td> <td style="text-align: center;">\$350</td> <td style="text-align: right;">\$ _____</td> </tr> <tr> <td><input type="checkbox"/> Four months (37 CFR 1.17(a)(4))</td> <td style="text-align: center;">\$2,200</td> <td style="text-align: center;">\$1,100</td> <td style="text-align: center;">\$550</td> <td style="text-align: right;">\$ _____</td> </tr> <tr> <td><input type="checkbox"/> Five months (37 CFR 1.17(a)(5))</td> <td style="text-align: center;">\$3,000</td> <td style="text-align: center;">\$1,500</td> <td style="text-align: center;">\$750</td> <td style="text-align: right;">\$ _____</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> Applicant asserts small entity status. See 37 CFR 1.27.</p> <p><input type="checkbox"/> Applicant certifies micro entity status. See 37 CFR 1.29.<br/>Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.</p> <p><input type="checkbox"/> A check in the amount of the fee is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The Director has already been authorized to charge fees in this application to a Deposit Account.</p> <p><input type="checkbox"/> The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to<br/>Deposit Account Number _____.</p> <p><input checked="" type="checkbox"/> Payment made via EFS-Web.</p> <p><b>WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.</b></p> <p>I am the</p> <p><input type="checkbox"/> applicant.</p> <p><input checked="" type="checkbox"/> attorney or agent of record. Registration number <u>44,962</u></p> <p><input type="checkbox"/> attorney or agent acting under 37 CFR 1.34. Registration number _____.</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <p style="text-align: center;">_____<br/>Signature</p> <p><b>Bill R. Naifeh</b><br/>_____<br/>Typed or printed name</p> </div> <div style="width: 45%;"> <p style="text-align: center;">_____<br/>Date</p> <p><b>September 16, 2019</b><br/>_____<br/>Telephone Number</p> </div> </div> <p><b>NOTE:</b> This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.</p> |                                |                                                   |                         | <u>Fee</u>    | <u>Small Entity Fee</u> | <u>Micro Entity Fee</u> |  | <input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1)) | \$200 | \$100 | \$50 | \$ <u>100</u> | <input type="checkbox"/> Two months (37 CFR 1.17(a)(2)) | \$600 | \$300 | \$150 | \$ _____ | <input type="checkbox"/> Three months (37 CFR 1.17(a)(3)) | \$1,400 | \$700 | \$350 | \$ _____ | <input type="checkbox"/> Four months (37 CFR 1.17(a)(4)) | \$2,200 | \$1,100 | \$550 | \$ _____ | <input type="checkbox"/> Five months (37 CFR 1.17(a)(5)) | \$3,000 | \$1,500 | \$750 | \$ _____ |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <u>Fee</u>                     | <u>Small Entity Fee</u>                           | <u>Micro Entity Fee</u> |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | \$200                          | \$100                                             | \$50                    | \$ <u>100</u> |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <input type="checkbox"/> Two months (37 CFR 1.17(a)(2))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | \$600                          | \$300                                             | \$150                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <input type="checkbox"/> Three months (37 CFR 1.17(a)(3))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | \$1,400                        | \$700                                             | \$350                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <input type="checkbox"/> Four months (37 CFR 1.17(a)(4))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | \$2,200                        | \$1,100                                           | \$550                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |
| <input type="checkbox"/> Five months (37 CFR 1.17(a)(5))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | \$3,000                        | \$1,500                                           | \$750                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |

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| <input type="checkbox"/> * Total of _____ forms are submitted. |
|----------------------------------------------------------------|

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Patent Application Fee Transmittal |          |                                                  |        |                      |
|-----------------------------------------------|----------|--------------------------------------------------|--------|----------------------|
| Application Number:                           |          | 15590282                                         |        |                      |
| Filing Date:                                  |          | 09-May-2017                                      |        |                      |
| Title of Invention:                           |          | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |        |                      |
| First Named Inventor/Applicant Name:          |          | G.R. MOHAN RAO                                   |        |                      |
| Filer:                                        |          | Bill Naifeh                                      |        |                      |
| Attorney Docket Number:                       |          | GRTD60-33439                                     |        |                      |
| Filed as Small Entity                         |          |                                                  |        |                      |
| Filing Fees for Utility under 35 USC 111(a)   |          |                                                  |        |                      |
| Description                                   | Fee Code | Quantity                                         | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                                  |        |                      |
| Pages:                                        |          |                                                  |        |                      |
| Claims:                                       |          |                                                  |        |                      |
| Miscellaneous-Filing:                         |          |                                                  |        |                      |
| Petition:                                     |          |                                                  |        |                      |
| Patent-Appeals-and-Interference:              |          |                                                  |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                                  |        |                      |
| Extension-of-Time:                            |          |                                                  |        |                      |

| Description                       | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------|----------|----------|--------|----------------------|
| Extension - 1 month with \$0 paid | 2251     | 1        | 100    | 100                  |
| <b>Miscellaneous:</b>             |          |          |        |                      |
| <b>Total in USD (\$)</b>          |          |          |        | <b>100</b>           |

| Electronic Acknowledgement Receipt          |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 37180277                                         |
| <b>Application Number:</b>                  | 15590282                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 1032                                             |
| <b>Title of Invention:</b>                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |
| <b>First Named Inventor/Applicant Name:</b> | G.R. MOHAN RAO                                   |
| <b>Customer Number:</b>                     | 25883                                            |
| <b>Filer:</b>                               | Bill Naifeh                                      |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD60-33439                                     |
| <b>Receipt Date:</b>                        | 16-SEP-2019                                      |
| <b>Filing Date:</b>                         | 09-MAY-2017                                      |
| <b>Time Stamp:</b>                          | 19:29:40                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                                                                                                |                  |
|----------------------------------------------------------------------------------------------------------------|------------------|
| Submitted with Payment                                                                                         | yes              |
| Payment Type                                                                                                   | CARD             |
| Payment was successfully received in RAM                                                                       | \$100            |
| RAM confirmation Number                                                                                        | E20199FJ30410404 |
| Deposit Account                                                                                                |                  |
| Authorized User                                                                                                |                  |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: |                  |

| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                  |                      |                                          |                  |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------------------|------------------------------------------|------------------|------------------|
| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Document Description                             | File Name            | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Extension of Time                                | ExtensionRequest.pdf | 152335                                   | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |                      | 442ca22dd5ac62df3553d41c394a4b8663ca833  |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  |                      |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |                      |                                          |                  |                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Applicant Arguments/Remarks Made in an Amendment | Response.pdf         | 165286                                   | no               | 9                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |                      | f962fc39a9491f02b7e03d60b4ea88f6bdf2c2fc |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  |                      |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |                      |                                          |                  |                  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Fee Worksheet (SB06)                             | fee-info.pdf         | 30615                                    | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                  |                      | 9c2364ed444b7cfa6c82d9f3f4373753206046d9 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  |                      |                                          |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |                      |                                          |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                  |                      | 348236                                   |                  |                  |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                                  |                      |                                          |                  |                  |

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: RAO, G.R. Mohan  
Serial No.: 15/590,282  
Confirmation No.: 1032  
Filed: May 9, 2017  
Group: 2892  
Examiner: ARORA, Ajay  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT  
REGIONS

Mail Stop AMENDMENT  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

**AMENDMENT AFTER FINAL AND RESPONSE TO OFFICE ACTION**

This communication is responsive to the Examiner's Office Action dated May 16, 2019.  
Reconsideration is respectfully requested.

**Amendments to the Claims** are reflected in the listing of claims beginning on page 2 of this paper.

**Remarks/Arguments** begin on page 5 of this paper.

### **In the Claims**

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A semiconductor device, comprising:
  - a substrate of a first doping type at a first doping level having first and second surfaces;
  - a first active region disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and within which ~~circuitry~~ transistors can be formed;
  - a second active region separate from the first active region disposed adjacent to the first active region and within which transistors ~~circuitry~~ can be formed;
  - ~~circuitry~~ transistors formed in at least one of the first active region or second active region; and
  - at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first surface to the second surface of the substrate.
2. (Original) The semiconductor device of Claim 1, wherein the substrate is a p-type substrate.
3. (Original) The semiconductor device of Claim 1, wherein the substrate is an n-type substrate.
4. (Original) The semiconductor device of Claim 1, wherein the substrate has epitaxial silicon on top of a nonepitaxial substrate.
5. (Currently Amended) The semiconductor device of Claim 1, wherein the first active region and second active region contain one of either p-channel and n-channel devices.

6. (Currently amended) The semiconductor device of Claim 1, wherein the first active region and second active region contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has a graded dopant.
7. (Original) The semiconductor device of Claim 1, wherein the first active region and second active region are each separated by at least one isolation region.
8. (Original) The semiconductor device of Claim 1, wherein the graded dopant is fabricated with an ion implantation process.
9. (Currently Amended) A semiconductor device, comprising:
- a substrate of a first doping type at a first doping level having first and second surfaces;
  - a first active region disposed adjacent the first surface of the substrate with a second doping type opposite in conductivity to the first doping type and within which ~~circuitry~~ transistors can be formed in the surface thereof;
  - a second active region separate from the first active region disposed adjacent to the first active region and within which ~~circuitry~~ transistors can be formed in the surface thereof;
  - ~~circuitry~~ transistors formed in at least one of the first active region or second active region; and
  - at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the surface to the substrate.
10. (Original) The semiconductor device of Claim 9, wherein the substrate is a p-type substrate.
11. (Original) The semiconductor device of Claim 9, wherein the substrate is an n-type substrate.

12. (Original) The semiconductor device of Claim 9, wherein the substrate has epitaxial silicon on top of a nonepitaxial substrate.
13. (Currently Amended) The semiconductor device of Claim 9, wherein the first active region and second active region contain at least one of either p-channel and n-channel devices.
14. (Currently amended) The semiconductor device of Claim 9, wherein the first active region and second active region contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has a graded dopant.
15. (Original) The semiconductor device of Claim 9, wherein the first active region and second active region are each separated by at least one isolation region.
16. (Original) The semiconductor device of Claim 9, wherein the graded dopant is fabricated with an ion implantation process.
17. (Cancelled)
18. (Cancelled)
19. (New) The semiconductor device of Claim 1, wherein the first and second active regions are formed adjacent the first surface of the substrate.
20. (New) The semiconductor device of Claim 1, wherein the transistors which can be formed in the first and second active regions are CMOS transistors requiring a source, a drain, a gate and a channel region.

## **REMARKS**

Applicant has carefully reviewed the Office Action dated July 17, 2018. Applicant has amended claims 1, 5, 6, 9, 13, and 14, cancelled claims 17 and 18, and added new claims 19 and 20. Reconsideration and favorable action is respectfully requested.

Claims 1 – 16 stand rejected under 35 USC §103(a) as being anticipated by *Hong*. This rejection is respectfully traversed with respect to the claims as currently presented.

A basic misunderstanding between how the claims are drafted and how the Examiner is interpreting them is with respect to the term “active region.” This will be discussed in detail.

With respect to the *Hong* reference, the primary figure, Figure 4D is reproduced as follows:

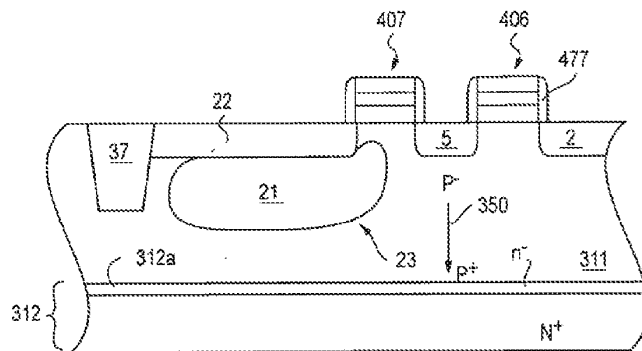


**FIG. 4D**

This figure depicts the final construction at formation of the various doped regions. The description of this construction is as follows for the Examiner's convenience:

As shown in FIG. 4D, the n-type region 21 is formed from a point adjacent the transfer gate stack 407 and extending in the epitaxial layer 311 between the gate stack 407 and the isolation region 37. The region 21 forms a photosensitive charge accumulating region for collecting photo-generated charge.

The doped surface layer 22 for the photo-conversion device 23 is implanted and formed as a highly doped p-type surface layer. A p-type dopant, such as boron, indium, or any other suitable p-type dopant, may be used to form the p-type surface layer 22. The p-type surface layer 22 may be formed by known techniques. For example, layer 22 may be formed by implanting p-type ions through openings in a layer of photoresist. Alternatively, layer 22 may be formed by a gas source plasma doping process, or by diffusing a p-type dopant into the epitaxial layer 311 from an in-situ doped layer or a doped oxide layer deposited over the area where layer 22 is to be formed.

The floating diffusion region 5 and source/drain region 2 are implanted by known methods, as also shown in FIG. 4D. The floating diffusion region 5 and source/drain region 2 are formed as n-type regions. Any suitable n-type dopant, such as phosphorus, arsenic, or antimony, may be used. The floating diffusion region 5 is formed on the side of the transfer gate stack 407 opposite the n-type photodiode region 21. The source/drain region 2 is formed on a side of the reset gate stack 406 opposite the floating diffusion region 5.

Conventional processing methods can be used to form other structures of the pixel cell 300. For example, insulating, shielding, and metallization layers to connect gate lines, and other connections to the pixel cell 300 may be formed. Also, the entire surface may be covered with a passivation layer (not shown) of, for example, silicon dioxide, borosilicate glass (BSG), phosphosilicate glass (PSG), or borophosphosilicate glass (BPSG), which is CMP planarized and etched to provide contact holes, which are then metallized to provide contacts. Conventional layers of conductors and insulators may also be used to interconnect the structures and to connect pixel 300 to peripheral circuitry. (¶¶ 0038-0041).

From this description, it can be clearly seen that the region 2 is a source/drain region and it is formed similarly with the region 5 referred to as a floating diffusion region. Both of the stacks 407 and 406 are referred to as “gate stacks.” These are basically the gates of the transistors. Underneath the transistor gates is formed a channel region. The region 22 is referred to merely as a P-type surface layer. The doping range of this layer is not set forth. However, the structure formed by the region 22, region 21 and the region 311 forms a P-N-P photodiode. Thus, the question is - what is an active region?

The Examiner has referred to the first active region as the region 311, but has referred to the regions 21, 22, 5 and 2 as “wells.” As discussed in the prior Response, there is no support for such a construction, as the term “wells” in semiconductor technology typically refers to a region formed in a substrate within which active components are formed. The Examiner has referred to

the second active region as being that defined by the source/drain region 2 or the regions 2 or 5 or 22 of the pixel cell. Applicant had previously amended the claims to define the “active regions” as regions within which transistors can be formed and the current amendments set forth that “circuitry” is now “transistors” formed in at least one of the active regions. This is a clear distinction, as a well 2 or 5 cannot have a transistor formed therein. The operation of the structure in Hong is set forth in ¶ 0007 as follows:

In the CMOS pixel cell 10 depicted in FIGS. 1 and 2, electrons are generated by light incident on the photo-conversion device 23 and are stored in the n-type photodiode region 21. These charges are transferred to the floating diffusion region 5 by the transfer transistor 17 when the transfer transistor 17 is activated. The source follower transistor 19 produces an output signal based on the transferred charges applied to its gate. A maximum output signal is proportional to the number of electrons extracted from the n-type photodiode region 21.

Thus, as discussed in the previous Response, the trapped charges are stored in the region 21, and all the region 22 does is provide a contact with one side of the channel under the transfer transistor/stack 17 to allow charge to be transferred from the photodiode region 21 to the floating diffusion region 5 when transfer transistor/stack 17 is activated and the underlying channel is conductive. Thus, there is provided only a “single” active region 311 within which two transistors are formed with the transistor gate stacks 407 and 406 and their associated source/drain regions. The actual source for the transistor stack 407 is the N-type region 21 which is connected to the channel underlying the gate stack 407 by the P-type region 22. There are no transistors formed within the region 22 or the region 5 or the region 2 - the transistors are formed only within the “single” active region 311.

With respect to claims 5 and 6 requiring transistors to be formed of a specific conductivity type, the Examiner referred to Hong as follows on Page 5 of the current Office Action:

Regarding claims 5-6, Hong (refer to Figures 4A-40 and 5A-5C) teaches that the first active region and second active region may contain contain [sic] p-channel or n-channel devices (see Figure 40 and para 42) and further teaches that different configuration of device(s) are possible (para 42-43). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Hong so

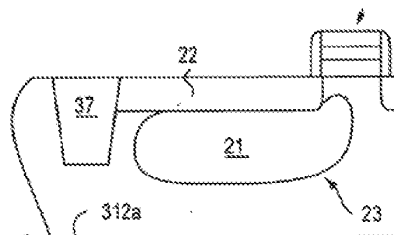
that the first active region and second active region "contain p-channel and n-channel devices" (as recited in claim 5); or "contain either p-channel or n-channel devices. The ordinary artisan would have been motivated to modify Hong for at least the purpose of Motivation: at least for the purpose of forming image sensors where either p-channel device or n-channel devices are used; or a combination of such devices is used to design the circuit for maximum electrical efficiency for the given design requirements.

The Examiner is relying on Paragraphs [0042] and [0043] for support, which paragraphs state as follows:

[0042] While the above embodiments are described in connection with the formation of p-n-p-type photodiodes the invention is not limited to these embodiments. The invention also has applicability to other types of photo-conversion devices, such as a photodiode formed from n-p or n-p-n regions in a substrate, a photogate, or a photoconductor. If an n-p-n-type photodiode is formed the dopant and conductivity types of all structures would change accordingly. Specifically, the substrate 312 would be p-type and the epitaxial layer 311 would be n-type.

[0043] Although the above embodiments are described in connection with a 4T pixel cell 300, the configuration of pixel cell 300 is only exemplary and the invention may also be incorporated into other pixel circuits having different numbers of transistors. Without being limiting, such a circuit may include a three-transistor (3T) pixel cell, a five-transistor (5T) pixel cell, a six-transistor (6T) pixel cell, or a seven-transistor pixel cell (7T). A 3T cell often omits the transfer transistor, and may have a reset transistor adjacent to a photodiode. The 5T, 6T, and 7T pixel cells differ from the 4T pixel cell by the addition of one, two, or three transistors, respectively, such as a shutter transistor, a CMOS photogate transistor, and an anti-blooming transistor. Further, while the above embodiments are described in connection with a CMOS pixel cell 300 the invention is also applicable to pixel cells in a charge coupled device (CCD) image sensor.

This describes nothing more that the different switch transistors that can be utilized for the transistor gate stacks 406 and 407. The structure:



only sets forth a structure with an N-Type region 21 and a heavily doped P-Type region 22 disposed adjacent to and above. This is a diode construction and there is no discussion in Hong that a transistor of any type can or could be formed in the active region 21.

Applicant believes that *Hong* does not anticipate or obviate pending claims 1 – 16, 19, and 20 as currently presented, and therefore respectfully requests withdrawal of the 35 USC §103(a) rejection with respect thereto. Applicant has now made an earnest attempt in order to place this case in condition for allowance. For the reasons stated above, Applicant respectfully requests full allowance of the claims as amended.

If any issues arise, or if the Examiner has any suggestions for expediting allowance of this Application, the Applicant respectfully invites the Examiner to contact the undersigned at the telephone number indicated below or at [tim@naifeh.com](mailto:tim@naifeh.com).

Recognizing that Internet communications are not secure, Applicant hereby authorizes the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application by video conferencing, instant messaging, or electronic mail. Applicant understands that a copy of these communications will be made of record in the application file.

Respectfully submitted,  
Attorneys for Applicant

/Bill R. Naifeh, Reg. No. 44,962/

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AMENDMENT AND RESPONSE  
SN: 15/590,282  
Atty. Dkt. No. GRTD.01.01.DV5

Page 9 of 9

|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------|-------------------|---------------------------|---------------------|---------------------------------------|--|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                               |                                                                                          |                                                                                                                                                                                                                               |                                    | Application or Docket Number<br>15/590,282 |                   | Filing Date<br>05/09/2017 |                     | <input type="checkbox"/> To be Mailed |  |  |
| ENTITY: <input type="checkbox"/> LARGE <input checked="" type="checkbox"/> SMALL <input type="checkbox"/> MICRO                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
| <b>APPLICATION AS FILED - PART I</b>                                                                                            |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         |                                            |                   |                           |                     |                                       |  |  |
| FOR                                                                                                                             |                                                                                          | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)                                  |                   | FEE (\$)                  |                     |                                       |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                             |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                   |                           |                     |                                       |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                            |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                   |                           |                     |                                       |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                       |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                   |                           |                     |                                       |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                |                                                                                          | minus 20 =                                                                                                                                                                                                                    | *                                  | x \$40 =                                   |                   |                           |                     |                                       |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                          |                                                                                          | minus 3 =                                                                                                                                                                                                                     | *                                  | x \$210 =                                  |                   |                           |                     |                                       |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))                                                                  |                                                                                          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                                            |                   |                           |                     |                                       |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                      |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                       |                                                                                          |                                                                                                                                                                                                                               |                                    | TOTAL                                      |                   |                           |                     |                                       |  |  |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                         |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                   |                           |                     |                                       |  |  |
| AMENDMENT                                                                                                                       | 09/16/2019                                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)         |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 18                                                                                                                                                                                                                          | Minus                              | ** 20                                      | = 0               | x \$ 50 =                 |                     | 0                                     |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                                                                                                                                                                                                                           | Minus                              | *** 3                                      | = 0               | x \$ 230 =                |                     | 0                                     |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE   |                           | 0                   |                                       |  |  |
| AMENDMENT                                                                                                                       |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                   |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)         |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | *                                                                                                                                                                                                                             | Minus                              | **                                         | =                 | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | *                                                                                                                                                                                                                             | Minus                              | ***                                        | =                 | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE   |                           |                     |                                       |  |  |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.                                           |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | LIE               |                           |                     |                                       |  |  |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".                                       |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | /RENEE D HAWKINS/ |                           |                     |                                       |  |  |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                   |                           |                     |                                       |  |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------|------------------------|---------------------------|---------------------|---------------------------------------|--|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                               |                                                                                          |                                                                                                                                                                                                                               |                                    | Application or Docket Number<br>15/590,282 |                        | Filing Date<br>05/09/2017 |                     | <input type="checkbox"/> To be Mailed |  |  |
| ENTITY: <input type="checkbox"/> LARGE <input checked="" type="checkbox"/> SMALL <input type="checkbox"/> MICRO                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
| <b>APPLICATION AS FILED - PART I</b>                                                                                            |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         |                                            |                        |                           |                     |                                       |  |  |
| FOR                                                                                                                             |                                                                                          | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)                                  |                        | FEE (\$)                  |                     |                                       |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                             |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                        |                           |                     |                                       |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                            |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                        |                           |                     |                                       |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                       |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                        |                           |                     |                                       |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(i))                                                                                                |                                                                                          | minus 20 =                                                                                                                                                                                                                    | *                                  | x \$40 =                                   |                        |                           |                     |                                       |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                          |                                                                                          | minus 3 =                                                                                                                                                                                                                     | *                                  | x \$210 =                                  |                        |                           |                     |                                       |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))                                                                  |                                                                                          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                                            |                        |                           |                     |                                       |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                      |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                       |                                                                                          |                                                                                                                                                                                                                               |                                    | TOTAL                                      |                        |                           |                     |                                       |  |  |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                         |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                        |                           |                     |                                       |  |  |
| AMENDMENT                                                                                                                       | 09/16/2019                                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)              |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 18                                                                                                                                                                                                                          | Minus                              | ** 20                                      | = 0                    | x \$ 50 =                 |                     | 0                                     |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                                                                                                                                                                                                                           | Minus                              | *** 3                                      | = 0                    | x \$ 230 =                |                     | 0                                     |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE        |                           | 0                   |                                       |  |  |
| AMENDMENT                                                                                                                       |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                        |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)              |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | *                                                                                                                                                                                                                             | Minus                              | **                                         | =                      | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | *                                                                                                                                                                                                                             | Minus                              | ***                                        | =                      | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE        |                           |                     |                                       |  |  |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.                                           |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | LIE                    |                           |                     |                                       |  |  |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".                                       |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | /TAMMY D MCBETH BROWN/ |                           |                     |                                       |  |  |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                        |                           |                     |                                       |  |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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|                            |             |                      |                     |                  |
|----------------------------|-------------|----------------------|---------------------|------------------|
| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 15/590,282                 | 05/09/2017  | G.R. MOHAN RAO       | GRTD60-33439        | 1032             |
| 25883                      | 7590        | 09/27/2019           | EXAMINER            |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | ARORA, AJAY         |                  |
| P.O. Drawer 800889         |             |                      |                     |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | 2892                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                            |             |                      | 09/27/2019          | ELECTRONIC       |

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

IPdocketing@munckwilson.com  
admin@dalpat.com  
eofficeaction@apcoll.com

|                                                                       |                                      |                                        |                                |
|-----------------------------------------------------------------------|--------------------------------------|----------------------------------------|--------------------------------|
| <b>Advisory Action</b><br><b>Before the Filing of an Appeal Brief</b> | <b>Application No.</b><br>15/590,282 | <b>Applicant(s)</b><br>RAO, G.R. MOHAN |                                |
|                                                                       | <b>Examiner</b><br>AJAY ARORA        | <b>Art Unit</b><br>2892                | <b>AIA (FITF) Status</b><br>No |

**--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

THE REPLY FILED 16 September 2019 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

**NO NOTICE OF APPEAL FILED**

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☒ The period for reply expires 4 months from the mailing date of the final rejection.

b) ☐ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.

c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires \_\_\_\_\_ months from the mailing date of the prior Advisory Action or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

*Examiner Note:* If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANTS FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**NOTICE OF APPEAL**

2. ☐ The Notice of Appeal was filed on \_\_\_\_\_. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37CFR 41.37(a).

**AMENDMENTS**

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because

a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);

b) ☐ They raise the issue of new matter (see NOTE below);

c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

NOTE: See Continuation Sheet (See 37CFR 1.116 and 41.33(a)).

4. ☐ The amendments are not in compliance with 37CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).

5. ☐ Applicants reply has overcome the following rejection(s): \_\_\_\_\_

6. ☐ Newly proposed or amended claim(s) \_\_\_\_\_ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

7. ☐ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

**AFFIDAVIT OR OTHER EVIDENCE**

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_

9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).

10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).

11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

**REQUEST FOR RECONSIDERATION/OTHER**

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because:  
See Continuation Sheet.

13. ☐ Note the attached Information Disclosure Statement(s). (PTO/SB/08) Paper No(s). \_\_\_\_\_

14. ☐ Other: \_\_\_\_\_

**STATUS OF CLAIMS**

15. The status of the claim(s) is (or will be) as follows:

Claim(s) allowed: \_\_\_\_\_.

Claim(s) objected to: \_\_\_\_\_.

Claim(s) rejected: 1-18.

Claim(s) withdrawn from consideration: \_\_\_\_\_.

|                                                 |  |
|-------------------------------------------------|--|
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892 |  |
|-------------------------------------------------|--|

Continuation of 3. NOTE: The new limitation that requires previously recited "circuitry" to more specifically be "transistors" raises new issues that would require further consideration and/or search

Continuation of REQUEST FOR RECONSIDERATION/OTHER 12. The request for reconsideration has been considered but does NOT place the application in condition for allowance because: Applicant's arguments are based on the currently proposed amendments, which are not being entered. As explained in the response to arguments on page 6 of office action of 5/16/2019, the base claim 1 did not previously provide a recitation that active region necessarily needed to have transistors - just circuitry. The proposed amendment (from "circuitry" to "transistor") does overcome the current rejection of record but given the change in scope of the claim at this stage, the amendment is not being entered at this after final stage and will require further consideration and/or search.

DO NOT ENTER: /A.A/

GRTD.01.01.DV5

PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: RAO, G.R. Mohan  
Serial No.: 15/590,282  
Confirmation No.: 1032  
Filed: May 9, 2017  
Group: 2892  
Examiner: ARORA, Ajay  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT  
REGIONS

Mail Stop AMENDMENT  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

**AMENDMENT AFTER FINAL AND RESPONSE TO OFFICE ACTION**

This communication is responsive to the Examiner's Office Action dated May 16, 2019.  
Reconsideration is respectfully requested.

**Amendments to the Claims** are reflected in the listing of claims beginning on page 2 of this paper.

**Remarks/Arguments** begin on page 5 of this paper.

Doc code: RCEX

PTO/SB/30EFS (02-18)

Doc description: Request for Continued Examination (RCE)

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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# **REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL** **(Submitted Only via EFS-Web)**

|                      |                |             |            |                               |              |          |      |
|----------------------|----------------|-------------|------------|-------------------------------|--------------|----------|------|
| Application Number   | 15590282       | Filing Date | 2017-05-09 | Docket Number (if applicable) | GRTD60-33439 | Art Unit | 2892 |
| First Named Inventor | G.R. Mohan Rao |             |            | Examiner Name                 | Arora, Ajay  |          |      |

**This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.**  
 Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at [WWW.USPTO.GOV](http://WWW.USPTO.GOV)

## **SUBMISSION REQUIRED UNDER 37 CFR 1.114**

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☒ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on \_\_\_\_\_

☐ Other \_\_\_\_\_

☐ Enclosed

☐ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other \_\_\_\_\_

## **MISCELLANEOUS**

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months \_\_\_\_\_.  
 (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other \_\_\_\_\_

## **FEES**

**The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No. \_\_\_\_\_

## **SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED**

☒ Patent Practitioner Signature

Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (02-18)

Approved for use through 11/30/2020. OMB 0651-0031

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

| Signature of Registered U.S. Patent Practitioner |                                |                     |            |
|--------------------------------------------------|--------------------------------|---------------------|------------|
| Signature                                        | Bill R. Naifeh, Reg No. 44962/ | Date (YYYY-MM-DD)   | 2019-10-09 |
| Name                                             | Bill R. Naifeh                 | Registration Number | 44962      |

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

## Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| <b>PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                         | Docket Number (Optional)<br><b>GRTD60-33439</b> |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
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| Application Number<br><b>15/590,282</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Filed<br><b>2017-05-09</b>              |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| For<br><b>SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| Art Unit<br><b>2892</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Examiner<br><b>Arora, Ajay</b>          |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <p>This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.</p> <p>The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):</p> <table style="width: 100%; border-collapse: collapse;"><thead><tr><th></th><th style="text-align: center;"><u>Fee</u></th><th style="text-align: center;"><u>Small Entity Fee</u></th><th style="text-align: center;"><u>Micro Entity Fee</u></th><th></th></tr></thead><tbody><tr><td><input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1))</td><td style="text-align: center;">\$200</td><td style="text-align: center;">\$100</td><td style="text-align: center;">\$50</td><td style="text-align: right;">\$ <u>100</u></td></tr><tr><td><input type="checkbox"/> Two months (37 CFR 1.17(a)(2))</td><td style="text-align: center;">\$600</td><td style="text-align: center;">\$300</td><td style="text-align: center;">\$150</td><td style="text-align: right;">\$ _____</td></tr><tr><td><input type="checkbox"/> Three months (37 CFR 1.17(a)(3))</td><td style="text-align: center;">\$1,400</td><td style="text-align: center;">\$700</td><td style="text-align: center;">\$350</td><td style="text-align: right;">\$ _____</td></tr><tr><td><input type="checkbox"/> Four months (37 CFR 1.17(a)(4))</td><td style="text-align: center;">\$2,200</td><td style="text-align: center;">\$1,100</td><td style="text-align: center;">\$550</td><td style="text-align: right;">\$ _____</td></tr><tr><td><input type="checkbox"/> Five months (37 CFR 1.17(a)(5))</td><td style="text-align: center;">\$3,000</td><td style="text-align: center;">\$1,500</td><td style="text-align: center;">\$750</td><td style="text-align: right;">\$ _____</td></tr></tbody></table> <p><input checked="" type="checkbox"/> Applicant asserts small entity status. See 37 CFR 1.27.</p> <p><input type="checkbox"/> Applicant certifies micro entity status. See 37 CFR 1.29.<br/>Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.</p> <p><input type="checkbox"/> A check in the amount of the fee is enclosed.</p> <p><input type="checkbox"/> Payment by credit card. Form PTO-2038 is attached.</p> <p><input type="checkbox"/> The Director has already been authorized to charge fees in this application to a Deposit Account.</p> <p><input type="checkbox"/> The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to<br/>Deposit Account Number _____.</p> <p><input checked="" type="checkbox"/> Payment made via EFS-Web.</p> <p><b>WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.</b></p> <p>I am the</p> <p><input type="checkbox"/> applicant.</p> <p><input type="checkbox"/> attorney or agent of record. Registration number _____.</p> <p><input checked="" type="checkbox"/> attorney or agent acting under 37 CFR 1.34. Registration number <u>44,962</u></p> <table style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; padding: 5px;"><u>/Bill R. Naifeh, Reg No. 44962/</u><br/>Signature</td><td style="width: 50%; padding: 5px;"><u>2019-10-09</u><br/>Date</td></tr><tr><td style="padding: 5px;"><u>Bill R. Naifeh</u><br/>Typed or printed name</td><td style="padding: 5px;"><u>972-726-9500</u><br/>Telephone Number</td></tr></table> <p><b>NOTE:</b> This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.</p> |                                         |                                                 |                         | <u>Fee</u>    | <u>Small Entity Fee</u> | <u>Micro Entity Fee</u> |  | <input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1)) | \$200 | \$100 | \$50 | \$ <u>100</u> | <input type="checkbox"/> Two months (37 CFR 1.17(a)(2)) | \$600 | \$300 | \$150 | \$ _____ | <input type="checkbox"/> Three months (37 CFR 1.17(a)(3)) | \$1,400 | \$700 | \$350 | \$ _____ | <input type="checkbox"/> Four months (37 CFR 1.17(a)(4)) | \$2,200 | \$1,100 | \$550 | \$ _____ | <input type="checkbox"/> Five months (37 CFR 1.17(a)(5)) | \$3,000 | \$1,500 | \$750 | \$ _____ | <u>/Bill R. Naifeh, Reg No. 44962/</u><br>Signature | <u>2019-10-09</u><br>Date | <u>Bill R. Naifeh</u><br>Typed or printed name | <u>972-726-9500</u><br>Telephone Number |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <u>Fee</u>                              | <u>Small Entity Fee</u>                         | <u>Micro Entity Fee</u> |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input checked="" type="checkbox"/> One month (37 CFR 1.17(a)(1))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | \$200                                   | \$100                                           | \$50                    | \$ <u>100</u> |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input type="checkbox"/> Two months (37 CFR 1.17(a)(2))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | \$600                                   | \$300                                           | \$150                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input type="checkbox"/> Three months (37 CFR 1.17(a)(3))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | \$1,400                                 | \$700                                           | \$350                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input type="checkbox"/> Four months (37 CFR 1.17(a)(4))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$2,200                                 | \$1,100                                         | \$550                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input type="checkbox"/> Five months (37 CFR 1.17(a)(5))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | \$3,000                                 | \$1,500                                         | \$750                   | \$ _____      |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <u>/Bill R. Naifeh, Reg No. 44962/</u><br>Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <u>2019-10-09</u><br>Date               |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <u>Bill R. Naifeh</u><br>Typed or printed name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u>972-726-9500</u><br>Telephone Number |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |
| <input checked="" type="checkbox"/> * Total of <u>1</u> forms are submitted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                         |                                                 |                         |               |                         |                         |  |                                                                   |       |       |      |               |                                                         |       |       |       |          |                                                           |         |       |       |          |                                                          |         |         |       |          |                                                          |         |         |       |          |                                                     |                           |                                                |                                         |

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

## Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

| Electronic Patent Application Fee Transmittal |          |                                                  |        |                      |
|-----------------------------------------------|----------|--------------------------------------------------|--------|----------------------|
| Application Number:                           |          | 15590282                                         |        |                      |
| Filing Date:                                  |          | 09-May-2017                                      |        |                      |
| Title of Invention:                           |          | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |        |                      |
| First Named Inventor/Applicant Name:          |          | G.R. MOHAN RAO                                   |        |                      |
| Filer:                                        |          | Bill Naifeh/April Reasoner                       |        |                      |
| Attorney Docket Number:                       |          | GRTD60-33439                                     |        |                      |
| Filed as Small Entity                         |          |                                                  |        |                      |
| Filing Fees for Utility under 35 USC 111(a)   |          |                                                  |        |                      |
| Description                                   | Fee Code | Quantity                                         | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                                  |        |                      |
| Pages:                                        |          |                                                  |        |                      |
| Claims:                                       |          |                                                  |        |                      |
| Miscellaneous-Filing:                         |          |                                                  |        |                      |
| Petition:                                     |          |                                                  |        |                      |
| Patent-Appeals-and-Interference:              |          |                                                  |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                                  |        |                      |
| Extension-of-Time:                            |          |                                                  |        |                      |

| Description                       | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|-----------------------------------|----------|----------|--------|----------------------|
| Extension - 1 month with \$0 paid | 2251     | 1        | 100    | 100                  |
| <b>Miscellaneous:</b>             |          |          |        |                      |
| RCE- 1ST REQUEST                  | 2801     | 1        | 650    | 650                  |
| <b>Total in USD (\$)</b>          |          |          |        | <b>750</b>           |

| Electronic Acknowledgement Receipt          |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 37412614                                         |
| <b>Application Number:</b>                  | 15590282                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 1032                                             |
| <b>Title of Invention:</b>                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |
| <b>First Named Inventor/Applicant Name:</b> | G.R. MOHAN RAO                                   |
| <b>Customer Number:</b>                     | 25883                                            |
| <b>Filer:</b>                               | Bill Naifeh/April Reasoner                       |
| <b>Filer Authorized By:</b>                 | Bill Naifeh                                      |
| <b>Attorney Docket Number:</b>              | GRTD60-33439                                     |
| <b>Receipt Date:</b>                        | 09-OCT-2019                                      |
| <b>Filing Date:</b>                         | 09-MAY-2017                                      |
| <b>Time Stamp:</b>                          | 16:36:06                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                                                                                                |                  |
|----------------------------------------------------------------------------------------------------------------|------------------|
| Submitted with Payment                                                                                         | yes              |
| Payment Type                                                                                                   | CARD             |
| Payment was successfully received in RAM                                                                       | \$750            |
| RAM confirmation Number                                                                                        | E201909G36330357 |
| Deposit Account                                                                                                |                  |
| Authorized User                                                                                                |                  |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: |                  |

| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                         |              |                                              |                  |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------|----------------------------------------------|------------------|------------------|
| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Document Description                    | File Name    | File Size(Bytes)/<br>Message Digest          | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Request for Continued Examination (RCE) | RCE.pdf      | 1349888                                      | no               | 3                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                         |              | f871f9926356e960b321b41248745e1df61e<br>a1dd |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                         |              |                                              |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                         |              |                                              |                  |                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Extension of Time                       | EOT.pdf      | 157589                                       | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                         |              | 6e7d72d3aa816684bb021eb6a4d4532d1c<br>318583 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                         |              |                                              |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                         |              |                                              |                  |                  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Fee Worksheet (SB06)                    | fee-info.pdf | 32401                                        | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                         |              | ad3a7a144a8b45e2e370d17c8b63a583351<br>82b81 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                         |              |                                              |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                         |              |                                              |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                         |              | 1539878                                      |                  |                  |
| <p><b>This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.</b></p> <p><b><u>New Applications Under 35 U.S.C. 111</u></b><br/> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p> |                                         |              |                                              |                  |                  |

|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|--------------------------------------------|-----------------|---------------------------|---------------------|---------------------------------------|--|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                               |                                                                                          |                                                                                                                                                                                                                               |                                    | Application or Docket Number<br>15/590,282 |                 | Filing Date<br>05/09/2017 |                     | <input type="checkbox"/> To be Mailed |  |  |
| ENTITY: <input type="checkbox"/> LARGE <input checked="" type="checkbox"/> SMALL <input type="checkbox"/> MICRO                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
| <b>APPLICATION AS FILED - PART I</b>                                                                                            |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         |                                            |                 |                           |                     |                                       |  |  |
| FOR                                                                                                                             |                                                                                          | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                       | RATE (\$)                                  |                 | FEE (\$)                  |                     |                                       |  |  |
| <input type="checkbox"/> BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                             |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                 |                           |                     |                                       |  |  |
| <input type="checkbox"/> SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                            |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                 |                           |                     |                                       |  |  |
| <input type="checkbox"/> EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                       |                                                                                          | N/A                                                                                                                                                                                                                           | N/A                                | N/A                                        |                 |                           |                     |                                       |  |  |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                                                                                |                                                                                          | minus 20 =                                                                                                                                                                                                                    | *                                  | x \$40 =                                   |                 |                           |                     |                                       |  |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                          |                                                                                          | minus 3 =                                                                                                                                                                                                                     | *                                  | x \$210 =                                  |                 |                           |                     |                                       |  |  |
| <input type="checkbox"/> APPLICATION SIZE FEE (37 CFR 1.16(s))                                                                  |                                                                                          | If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s). |                                    |                                            |                 |                           |                     |                                       |  |  |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                      |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                       |                                                                                          |                                                                                                                                                                                                                               |                                    | TOTAL                                      |                 |                           |                     |                                       |  |  |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                         |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                 |                           |                     |                                       |  |  |
| <b>AMENDMENT</b>                                                                                                                | 10/09/2019                                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)       |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 18                                                                                                                                                                                                                          | Minus                              | ** 20                                      | = 0             | x \$ 50 =                 |                     | 0                                     |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                                                                                                                                                                                                                           | Minus                              | *** 3                                      | = 0             | x \$ 230 =                |                     | 0                                     |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE |                           | 0                   |                                       |  |  |
| <b>AMENDMENT</b>                                                                                                                |                                                                                          | (Column 1)                                                                                                                                                                                                                    | (Column 2)                         | (Column 3)                                 |                 |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA                              | RATE (\$)       |                           | ADDITIONAL FEE (\$) |                                       |  |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | *                                                                                                                                                                                                                             | Minus                              | **                                         | =               | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | *                                                                                                                                                                                                                             | Minus                              | ***                                        | =               | x \$ 0 =                  |                     |                                       |  |  |
|                                                                                                                                 | <input type="checkbox"/> Application Size Fee (37 CFR 1.16(s))                           |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
| <input type="checkbox"/> FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | TOTAL ADD'L FEE |                           |                     |                                       |  |  |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.                                           |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | LIE             |                           |                     |                                       |  |  |
| ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".                                       |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            | /AMANDA N FORD/ |                           |                     |                                       |  |  |
| *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".                                        |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |
| The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1. |                                                                                          |                                                                                                                                                                                                                               |                                    |                                            |                 |                           |                     |                                       |  |  |

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

*If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*



# UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

## NOTICE OF ALLOWANCE AND FEE(S) DUE

25883 7590 11/05/2019  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

EXAMINER

ARORA, AJAY

ART UNIT

PAPER NUMBER

2892

DATE MAILED: 11/05/2019

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 15/590,282      | 05/09/2017  | G.R. MOHAN RAO       | GRTD60-33439        | 1032             |

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$500         | \$0.00              | \$0.00               | \$500            | 02/05/2020 |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at [www.uspto.gov/PatentMaintenanceFees](http://www.uspto.gov/PatentMaintenanceFees).**

## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25883 7590 11/05/2019  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

### Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

|                         |
|-------------------------|
| (Typed or printed name) |
| (Signature)             |
| (Date)                  |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 15/590,282      | 05/09/2017  | G.R. MOHAN RAO       | GRTD60-33439        | 1032             |

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$500         | \$0.00              | \$0.00               | \$500            | 02/05/2020 |

| EXAMINER    | ART UNIT | CLASS-SUBCLASS |
|-------------|----------|----------------|
| ARORA, AJAY | 2892     | 257-655000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 \_\_\_\_\_  
2 \_\_\_\_\_  
3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☐ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☐ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. \_\_\_\_\_

5. Change in Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**NOTE:** This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature \_\_\_\_\_ Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_ Registration No. \_\_\_\_\_



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| 25883                      | 7590        | 11/05/2019           | EXAMINER            |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | ARORA, AJAY         |                  |
| P.O. Drawer 800889         |             |                      | ART UNIT            |                  |
| DALLAS, TX 75380           |             |                      | PAPER NUMBER        |                  |
|                            |             |                      | 2892                |                  |
| DATE MAILED: 11/05/2019    |             |                      |                     |                  |

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

## OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

### Privacy Act Statement

**The Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

|                               |                                      |                                        |                                |
|-------------------------------|--------------------------------------|----------------------------------------|--------------------------------|
| <b>Notice of Allowability</b> | <b>Application No.</b><br>15/590,282 | <b>Applicant(s)</b><br>RAO, G.R. MOHAN |                                |
|                               | <b>Examiner</b><br>AJAY ARORA        | <b>Art Unit</b><br>2892                | <b>AIA (FITF) Status</b><br>No |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 10/9/2019.  
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on \_\_\_\_\_.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on \_\_\_\_\_; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are 1-16 and 19-20. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see [http://www.uspto.gov/patents/init\\_events/pph/index.jsp](http://www.uspto.gov/patents/init_events/pph/index.jsp) or send an inquiry to [PPHfeedback@uspto.gov](mailto:PPHfeedback@uspto.gov).

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

**Certified copies:**

a) ☐ All      b) ☐ Some      \*c) ☐ None of the:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.

3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.  
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

**Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

|                                                                                                                   |                                                                                      |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)                                                  | 5. <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 2. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date _____.          | 6. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| 3. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material _____. | 7. <input type="checkbox"/> Other _____.                                             |
| 4. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date. _____.                           |                                                                                      |

|                                                 |  |
|-------------------------------------------------|--|
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892 |  |
|-------------------------------------------------|--|

## **DETAILED ACTION**

### ***Notice of Pre-AIA or AIA Status***

1. The present application is being examined under the pre-AIA first to invent provisions.

### ***Continued Examination Under 37 CFR 1.114***

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 9/16/2019 has been entered.

### **Reasons for Allowance**

3. Claims 1-16 and 19-20 are allowed. The following is an examiner's statement of reasons for allowance:
4. Claims 1-8 and 19-20 are allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of the base claim 1 that requires "a first active region" within which "transistors can be formed" (see lines 4-6) and "a second active region separate from the first active region" within which "transistors can be formed" (see lines 7-8) in conjunction with "at least one graded dopant

concentration to aid carrier movement from the first surface to the second surface of the substrate" (see last 3 lines of claim 1). Also see applicant's arguments presented on page 5, 4<sup>th</sup> paragraph to page 7, 3<sup>rd</sup> last paragraph of applicant's response of 9/16/2019, which are persuasive.

5. Similarly, claims 9-16 are allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of the base claim 9 that requires "a first active region" within which "transistors can be formed" (see lines 5-6 of claim 9) and "a second active region separate from the first active region" within which "transistors can be formed" (see lines 7-9 of claim 9) in conjunction with "at least one graded dopant concentration to aid carrier movement from the surface to the substrate" (see last 3 lines of claim 9).

6. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### ***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on 9 AM - 5 PM.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an

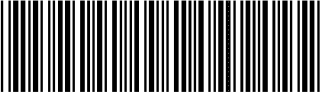
interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at <http://www.uspto.gov/interviewpractice>.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on 5712721708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AJAY ARORA/  
Primary Examiner, Art Unit 2892

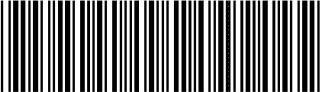


|                                                                                                                  |                                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                  | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

| CPC    |   |    |   |       |      |            |
|--------|---|----|---|-------|------|------------|
| Symbol |   |    |   |       | Type | Version    |
| H01L   | / | 29 | / | 1095  | F    | 2013-01-01 |
| H01L   | / | 27 | / | 11524 | I    | 2013-01-01 |
| H01L   | / | 27 | / | 14643 | I    | 2013-01-01 |
| H01L   | / | 27 | / | 11521 | I    | 2013-01-01 |
| H01L   | / | 29 | / | 7395  | I    | 2013-01-01 |
| H01L   | / | 29 | / | 36    | I    | 2013-01-01 |
| H01L   | / | 27 | / | 0214  | A    | 2013-01-01 |
| H01L   | / | 27 | / | 10844 | A    | 2013-01-01 |

| CPC Combination Sets |   |  |   |      |     |
|----------------------|---|--|---|------|-----|
| Symbol               |   |  |   | Type | Set |
|                      | / |  | / |      |     |

|                                                                       |  |                                    |                          |
|-----------------------------------------------------------------------|--|------------------------------------|--------------------------|
| NONE<br>(Assistant Examiner)                                          |  | <b>Total Claims Allowed:</b><br>18 |                          |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892<br>(Primary Examiner) |  | 28 October 2019<br>(Date)          | O.G. Print Claim(s)<br>1 |
|                                                                       |  |                                    | O.G. Print Figure<br>5B  |

|                                                                                                                  |                                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                  | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

|                                     |  |    |    |
|-------------------------------------|--|----|----|
| <b>INTERNATIONAL CLASSIFICATION</b> |  |    |    |
| <b>CLAIMED</b>                      |  |    |    |
| H01L                                |  | 21 | 02 |
| <b>NON-CLAIMED</b>                  |  |    |    |
|                                     |  |    |    |

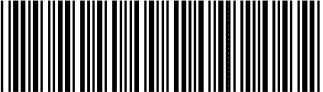
|                                   |                 |
|-----------------------------------|-----------------|
| <b>US ORIGINAL CLASSIFICATION</b> |                 |
| <b>CLASS</b>                      | <b>SUBCLASS</b> |
| 257                               | 655             |

|                            |                                          |  |  |  |  |  |
|----------------------------|------------------------------------------|--|--|--|--|--|
| <b>CROSS REFERENCES(S)</b> |                                          |  |  |  |  |  |
| <b>CLASS</b>               | <b>SUBCLASS (ONE SUBCLASS PER BLOCK)</b> |  |  |  |  |  |
|                            |                                          |  |  |  |  |  |

|                                                                       |                           |                              |                         |
|-----------------------------------------------------------------------|---------------------------|------------------------------|-------------------------|
| NONE                                                                  |                           | <b>Total Claims Allowed:</b> |                         |
| (Assistant Examiner)                                                  | (Date)                    | 18                           |                         |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892<br>(Primary Examiner) | 28 October 2019<br>(Date) | O.G. Print Claim(s)<br>1     | O.G. Print Figure<br>5B |

U.S. Patent and Trademark Office

Part of Paper No.: 20191028

|                                                                                                                  |                                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                  | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

|                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input type="checkbox"/> T.D. <input type="checkbox"/> R.1.47 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

| CLAIMS |          |       |          |       |          |       |          |       |          |       |          |       |          |       |          |
|--------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|-------|----------|
| Final  | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original | Final | Original |
| 1      | 1        | 10    | 10       | 17    | 19       |       |          |       |          |       |          |       |          |       |          |
| 2      | 2        | 11    | 11       | 18    | 20       |       |          |       |          |       |          |       |          |       |          |
| 3      | 3        | 12    | 12       |       |          |       |          |       |          |       |          |       |          |       |          |
| 4      | 4        | 13    | 13       |       |          |       |          |       |          |       |          |       |          |       |          |
| 5      | 5        | 14    | 14       |       |          |       |          |       |          |       |          |       |          |       |          |
| 6      | 6        | 15    | 15       |       |          |       |          |       |          |       |          |       |          |       |          |
| 7      | 7        | 16    | 16       |       |          |       |          |       |          |       |          |       |          |       |          |
| 8      | 8        | -     | 17       |       |          |       |          |       |          |       |          |       |          |       |          |
| 9      | 9        | -     | 18       |       |          |       |          |       |          |       |          |       |          |       |          |

|                                                                       |  |                                    |                         |
|-----------------------------------------------------------------------|--|------------------------------------|-------------------------|
| NONE<br><br>(Assistant Examiner) (Date)                               |  | <b>Total Claims Allowed:</b><br>18 |                         |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892<br>(Primary Examiner) |  | 28 October 2019<br>(Date)          |                         |
|                                                                       |  | O.G. Print Claim(s)<br>1           | O.G. Print Figure<br>5B |

U.S. Patent and Trademark Office

Part of Paper No.: 20191028

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

|                        |             |                 |
|------------------------|-------------|-----------------|
| <b>CPC - Searched*</b> |             |                 |
| <b>Symbol</b>          | <b>Date</b> | <b>Examiner</b> |
| H01L 29/1095           | 6/25/2018   | AKA             |

|                                         |             |                 |
|-----------------------------------------|-------------|-----------------|
| <b>CPC Combination Sets - Searched*</b> |             |                 |
| <b>Symbol</b>                           | <b>Date</b> | <b>Examiner</b> |
|                                         |             |                 |

|                                      |                 |             |                 |
|--------------------------------------|-----------------|-------------|-----------------|
| <b>US Classification - Searched*</b> |                 |             |                 |
| <b>Class</b>                         | <b>Subclass</b> | <b>Date</b> | <b>Examiner</b> |
| 257                                  | 655             | 6/25/2018   | AKA             |

\* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

|                                                   |             |                 |
|---------------------------------------------------|-------------|-----------------|
| <b>Search Notes</b>                               |             |                 |
| <b>Search Notes</b>                               | <b>Date</b> | <b>Examiner</b> |
| Inventor search                                   | 6/25/2018   | AKA             |
| Assignee search                                   | 6/25/2018   | AKA             |
| All references for parent applications considered | 6/25/2018   | AKA             |
| EAST search history report                        | 6/25/2018   | AKA             |
| Revised EAST search history report                | 05/13/2019  | AKA             |
| .clm. interference search                         | 10/28/2019  | AKA             |
| Revised EAST search history report                | 10/28/2019  | AKA             |

|                            |                              |             |                 |
|----------------------------|------------------------------|-------------|-----------------|
| <b>Interference Search</b> |                              |             |                 |
| <b>US Class/CPC Symbol</b> | <b>US Subclass/CPC Group</b> | <b>Date</b> | <b>Examiner</b> |
| H01L                       | 29/1095                      | 6/25/2018   | AKA             |
| 257                        | 655                          | 6/25/2018   | AKA             |

|                                         |  |
|-----------------------------------------|--|
| /A.K.A./ Primary Examiner.Art Unit 2892 |  |
|-----------------------------------------|--|

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>15/590,282 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

|                                         |  |
|-----------------------------------------|--|
| /A.K.A./ Primary Examiner.Art Unit 2892 |  |
|-----------------------------------------|--|

## EAST Search History

## EAST Search History (Prior Art)

| Ref # | Hits  | Search Query                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DBs                                                                        | Default Operator | Plurals | Time Stamp          |
|-------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------|---------------------|
| L2    | 347   | (substrate and (first near3 (dop\$3 impurity)) and (second near3 (dop\$3 impurity)) and (transistor) and (grad\$4 with (dop\$3 impurity))).clm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2019/10/28<br>13:09 |
| L3    | 25310 | (grad\$4 with dop\$3)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2019/10/28<br>13:27 |
| L4    | 2624  | L3 and (substrate with surface with (first one) with (second other opposi\$3)) and transistor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2019/10/28<br>13:27 |
| S1    | 1     | 15/590,282                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2018/06/25<br>06:54 |
| S2    | 208   | ("20020102783"   "20030026126"   "20030030488"   "6211028"   "6310366"   "6753202"   "7115925"   "8164124"   "6878603"   "20020056883"   "20020093281"   "20150200314"   "4347654"   "5496746"   "6452086"   "6737722"   "6747883"   "6780713"   "20030042511"   "5029277"   "5888857"   "6670544"   "6706550"   "6713813"   "6921943"   "7504692"   "20040027753"   "4160985"   "5448087"   "6472715"   "6683343"   "6831292"   "7307327"   "5569612"   "5575862"   "5637898"   "6720622"   "6744117"   "20020134419"   "20060113592"   "20130001661"   "4481522"   "5262345"   "6756616"   "6933215"   "7233044"   "20010040622"   "20020074585"   "5130262"   "5213988"   "5329144"   "6465862"   "6696314"   "RE37441"   "20020084430"   "4001864"   "4866000"   "5480816"   "5517052"   "5797999"   "5973575"   "6754093"   "7064385").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2018/06/25<br>06:55 |

|    |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                            |    |     |                     |
|----|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| S3 | 22    | ((("GREENTHREAD") near3 ("LLC"))).AS,AANM.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>06:57 |
| S4 | 23    | ((("RAO") near3 ("G.R") near3 ("MOHAN"))).INV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>06:57 |
| S5 | 1112  | (257/655).CCLS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>06:57 |
| S6 | 19693 | h01129/1095.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>06:58 |
| S7 | 187   | ("20030030488"   "20020102783"  <br>"20030026126"   "20030030488"  <br>"6211028"   "6310366"   "6753202"  <br>"7115925"   "8164124"   "20020056883"  <br>"20020093281"   "20150200314"  <br>"4347654"   "5496746"   "6452086"  <br>"6737722"   "6747883"   "20030042511"  <br>"5029277"   "5888857"   "6670544"  <br>"6706550"   "6713813"   "6921943"  <br>"20040027753"   "4160985"   "5448087"  <br>"6472715"   "6683343"   "6831292"  <br>"7307327"   "5569612"   "5575862"  <br>"5637898"   "6720622"   "6744117"  <br>"20020134419"   "20060113592"  <br>"20130001661"   "4481522"   "5262345"  <br>"6756616"   "20010040622"  <br>"20020074585"   "5130262"   "5213988"  <br>"5329144"   "6465862"   "6696314"  <br>"RE37441"   "20020084430"   "4001864"  <br>"4866000"   "5480816"   "5517052"  <br>"5979799"   "5973575"   "6754093").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>06:59 |
| S8 | 10    | ("20010040622"   "20030030488"  <br>"4160985").PN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:00 |
| S9 | 27    | ("5448087"   "5888857"   "20030030488"<br>  "6720622"   "20030026126"   "5973575"<br>  "5262345"   "20040027753").PN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;            | OR | OFF | 2018/06/25<br>07:02 |

|     |       |                                                                                                                                                                                                                                                                                                                                                             |                                                                            |    |     |                     |
|-----|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |       |                                                                                                                                                                                                                                                                                                                                                             | IBM_TDB                                                                    |    |     |                     |
| S10 | 44    | ("20020056883"   "20020084430"   "20020102783"   "20030042511"   "4160985"   "5637898"   "5517052"   "4481522"   "6831292"   "20020093281"   "5029277"   "20060113592"   "20020134419").PN.                                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:03 |
| S11 | 92    | ("20020074585"   "5496746"   "6683343"   "6696314"   "6452086"   "6472715"   "6747883"   "5797999"   "6670544"   "20040063288"   "4347654"   "4866000"   "6744117"   "6754093"   "5213988"   "5569612"   "RE37441"   "4001864"   "6756616"   "5130262"   "5329144"   "6706550"   "6753202"   "5480816"   "6713813"   "6737722"   "5575862"   "6211028").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:04 |
| S12 | 189   | S7 S8 S9 S10 S11                                                                                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:05 |
| S13 | 21    | S2 NOT S12                                                                                                                                                                                                                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:06 |
| S14 | 22949 | (grad\$4 with dop\$3)                                                                                                                                                                                                                                                                                                                                       | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2018/06/25<br>07:09 |
| S15 | 3307  | S14 and (substrate with surface with (first one) with (second other opposi\$3))                                                                                                                                                                                                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2018/06/25<br>07:11 |
| S16 | 657   | S15 and (carrier with surface)                                                                                                                                                                                                                                                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2018/06/25<br>07:12 |
| S17 | 1     | S12 and S16                                                                                                                                                                                                                                                                                                                                                 | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2018/06/25<br>07:12 |
| S18 | 1     | ("20070045682").PN.                                                                                                                                                                                                                                                                                                                                         | US-PGPUB;                                                                  | OR | OFF | 2019/05/12          |

|     |    |                                                                                                                                                              |                                                                            |    |     |                     |
|-----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |    |                                                                                                                                                              | USPAT                                                                      |    |     | 23:27               |
| S19 | 24 | ((("GREENTHREAD") near3 ("LLC"))).AS,AANM.                                                                                                                   | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2019/05/13<br>10:42 |
| S20 | 24 | ((("RAO") near3 ("G.R") near3 ("MOHAN"))).INV.                                                                                                               | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2019/05/13<br>10:42 |
| S21 | 41 | S19 S20                                                                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2019/05/13<br>10:42 |
| S22 | 8  | (substrate and (first near3 (dop\$3 impurity)) and (second near3 (dop\$3 impurity)) and (active near2 circuit\$2) and (grad\$4 with (dop\$3 impurity))).clm. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS;<br>EPO; JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2019/05/13<br>10:44 |

10/ 28/ 2019 2:15:21 PM

C:\Users\aarora\Documents\EAST\Workspaces\15590282.wsp

## Bibliographic Data

Application No: 15/590,282

Foreign Priority claimed: ☐ Yes ☒ No

35 USC 119 (a-d) conditions met: ☐ Yes ☒ No ☐ Met After Allowance

Verified and Acknowledged:

/AJAY ARORA/

Examiner's Signature

Initials

Title:

SEMICONDUCTOR DEVICES WITH GRADED DOPANT  
REGIONS

---

| FILING or 371(c) DATE | CLASS | GROUP ART UNIT | ATTORNEY DOCKET NO. |
|-----------------------|-------|----------------|---------------------|
| 05/09/2017            | 257   | 2892           | GRTD60-33439        |
| RULE                  |       |                |                     |

### APPLICANTS

GREENTHREAD, LLC, DALLAS, TX, UNITED STATES

### INVENTORS

G.R. MOHAN RAO ALLEN, TX, UNITED STATES

### CONTINUING DATA

This application is a CON of 14931636 11/03/2015 PAT 9647070

14931636 is a CON of 14515584 10/16/2014 PAT 9190502

14515584 is a CON of 13854319 04/01/2013ABN

13854319 is a CON of 11622496 01/12/2007 PAT 8421195

11622496 is a DIV of 10934915 09/03/2004ABN

### FOREIGN APPLICATIONS

### IF REQUIRED, FOREIGN LICENSE GRANTED\*\*

05/16/2017

### \*\* SMALL ENTITY \*\*

### STATE OR COUNTRY

UNITED STATES

### ADDRESS

MUNCK WILSON MANDALA L.L.P

P.O. Drawer 800889

DALLAS, TX 75380

UNITED STATES

### FILING FEE RECEIVED

\$730

# **PART B - FEE(S) TRANSMITTAL**

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

**INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

25883 7590 11/05/2019  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

|                         |
|-------------------------|
| (Typed or printed name) |
| (Signature)             |
| (Date)                  |

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 15/590,282      | 05/09/2017  | G.R. MOHAN RAO       | GRTD60-33439        | 1032             |

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

| APPLN. TYPE    | ENTITY STATUS | ISSUE FEE DUE | PUBLICATION FEE DUE | PREV. PAID ISSUE FEE | TOTAL FEE(S) DUE | DATE DUE   |
|----------------|---------------|---------------|---------------------|----------------------|------------------|------------|
| nonprovisional | SMALL         | \$500         | \$0.00              | \$0.00               | \$500            | 02/05/2020 |

| EXAMINER    | ART UNIT | CLASS-SUBCLASS |
|-------------|----------|----------------|
| ARORA, AJAY | 2892     | 257-655000     |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Bill R. Naifeh

2 Timothy F. Bliss

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

GREENTHREAD, LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Dallas, Texas

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. Fees submitted: ☒ Issue Fee ☐ Publication Fee (if required) ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Method of Payment: (Please first reapply any previously paid fee shown above)

☒ Electronic Payment via EFS-Web ☐ Enclosed check ☐ Non-electronic payment by credit card (Attach form PTO-2038)

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. \_\_\_\_\_

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

**NOTE:** Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

**NOTE:** If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

**NOTE:** Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

**NOTE:** This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Bill R. Naifeh, Reg No. 44962/

Date 2019-11-08

Typed or printed name Bill R. Naifeh

Registration No. 44,962

| Electronic Patent Application Fee Transmittal |          |                                                  |        |                      |
|-----------------------------------------------|----------|--------------------------------------------------|--------|----------------------|
| Application Number:                           |          | 15590282                                         |        |                      |
| Filing Date:                                  |          | 09-May-2017                                      |        |                      |
| Title of Invention:                           |          | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |        |                      |
| First Named Inventor/Applicant Name:          |          | G.R. MOHAN RAO                                   |        |                      |
| Filer:                                        |          | Bill Naifeh/April Reasoner                       |        |                      |
| Attorney Docket Number:                       |          | GRTD60-33439                                     |        |                      |
| Filed as Small Entity                         |          |                                                  |        |                      |
| Filing Fees for Utility under 35 USC 111(a)   |          |                                                  |        |                      |
| Description                                   | Fee Code | Quantity                                         | Amount | Sub-Total in USD(\$) |
| Basic Filing:                                 |          |                                                  |        |                      |
| Pages:                                        |          |                                                  |        |                      |
| Claims:                                       |          |                                                  |        |                      |
| Miscellaneous-Filing:                         |          |                                                  |        |                      |
| Petition:                                     |          |                                                  |        |                      |
| Patent-Appeals-and-Interference:              |          |                                                  |        |                      |
| Post-Allowance-and-Post-Issuance:             |          |                                                  |        |                      |
| UTILITY APPL ISSUE FEE                        | 2501     | 1                                                | 500    | 500                  |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 500                  |

| Electronic Acknowledgement Receipt          |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 37702171                                         |
| <b>Application Number:</b>                  | 15590282                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 1032                                             |
| <b>Title of Invention:</b>                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |
| <b>First Named Inventor/Applicant Name:</b> | G.R. MOHAN RAO                                   |
| <b>Customer Number:</b>                     | 25883                                            |
| <b>Filer:</b>                               | Bill Naifeh/April Reasoner                       |
| <b>Filer Authorized By:</b>                 | Bill Naifeh                                      |
| <b>Attorney Docket Number:</b>              | GRTD60-33439                                     |
| <b>Receipt Date:</b>                        | 08-NOV-2019                                      |
| <b>Filing Date:</b>                         | 09-MAY-2017                                      |
| <b>Time Stamp:</b>                          | 15:54:44                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                                                                                                |                  |
|----------------------------------------------------------------------------------------------------------------|------------------|
| Submitted with Payment                                                                                         | yes              |
| Payment Type                                                                                                   | CARD             |
| Payment was successfully received in RAM                                                                       | \$ 500           |
| RAM confirmation Number                                                                                        | E2019A8F55144730 |
| Deposit Account                                                                                                |                  |
| Authorized User                                                                                                |                  |
| The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: |                  |