

AO 120 (Rev. 08/10)

|                                                                                                                                                         |                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>TO:</b><br><b>Mail Stop 8</b><br><b>Director of the U.S. Patent and Trademark Office</b><br><b>P.O. Box 1450</b><br><b>Alexandria, VA 22313-1450</b> | <b>REPORT ON THE</b><br><b>FILING OR DETERMINATION OF AN</b><br><b>ACTION REGARDING A PATENT OR</b><br><b>TRADEMARK</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Austin Division on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.)

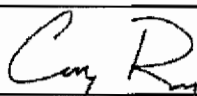
|                               |                                |                                                                   |
|-------------------------------|--------------------------------|-------------------------------------------------------------------|
| DOCKET NO.<br>1:23-cv-00369   | DATE FILED<br>3/31/2023        | U.S. DISTRICT COURT<br>Western District of Texas, Austin Division |
| PLAINTIFF<br>GREENTHREAD, LLC |                                | DEFENDANT<br>CIRRUS LOGIC, INC.                                   |
| PATENT OR<br>TRADEMARK NO.    | DATE OF PATENT<br>OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK                                     |
| 1 8,421,195                   | 4/16/2013                      | GREENTHREAD, LLC                                                  |
| 2 9,190,502                   | 11/17/2015                     | GREENTHREAD, LLC                                                  |
| 3 10,510,842                  | 12/17/2019                     | GREENTHREAD, LLC                                                  |
| 4 10,734,481                  | 8/4/2020                       | GREENTHREAD, LLC                                                  |
| 5 11,121,222                  | 9/14/2021                      | GREENTHREAD, LLC                                                  |

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

|                            |                                                                                                                                                               |                               |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| DATE INCLUDED              | INCLUDED BY<br><input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading |                               |
| PATENT OR<br>TRADEMARK NO. | DATE OF PATENT<br>OR TRADEMARK                                                                                                                                | HOLDER OF PATENT OR TRADEMARK |
| 1 11,316,014               | 4/26/2022                                                                                                                                                     | GREENTHREAD, LLC              |
| 2                          |                                                                                                                                                               |                               |
| 3                          |                                                                                                                                                               |                               |
| 4                          |                                                                                                                                                               |                               |
| 5                          |                                                                                                                                                               |                               |

In the above—entitled case, the following decision has been rendered or judgement issued:

|                    |
|--------------------|
| DECISION/JUDGEMENT |
|--------------------|

|                           |                                                                                                           |                    |
|---------------------------|-----------------------------------------------------------------------------------------------------------|--------------------|
| CLERK<br>PHILIP J. DEVLIN | (BY) DEPUTY CLERK<br> | DATE<br>04/04/2023 |
|---------------------------|-----------------------------------------------------------------------------------------------------------|--------------------|

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director  
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SONY GROUP CORPORATION,  
Petitioner,

v.

GREENTHREAD LLC  
Patent Owner.

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IPR2023-00324 (Patent No. 11,121,222 B2)  
IPR2023-00325 (Patent No. 11,316,014 B2)  
IPR2023-00375 (Patent No. 10,734,481 B2)  
IPR2023-00376 (Patent No. 10,510,842 B2)<sup>1</sup>

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Before GRACE KARAFFA OBERMANN, CHRISTOPHER L.  
CRUMBLEY, and CHRISTOPHER M. KAISER, *Administrative Patent  
Judges.*

*Per Curiam.*

DECISION  
Settlement Prior to Institution of Trial  
*37 C.F.R. § 42.74*

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<sup>1</sup> This Order addresses issues that are the same in the above-captioned proceedings. The parties are not authorized to use a multi-case caption.

IPR2023-00324 (Patent No. 11,121,222 B2)  
IPR2023-00325 (Patent No. 11,316,014 B2)  
IPR2023-00375 (Patent No. 10,734,481 B2)  
IPR2023-00376 (Patent No. 10,510,842 B2)

## I. INTRODUCTION

On May 3, 2023, after email authorization by the Board, Petitioner and Patent Owner (collectively “the Parties”) filed a Joint Motion to Terminate *Inter Partes* Review in the above-identified proceeding. Paper 8 (“Joint Motion”).<sup>2</sup> In support of the Joint Motion, the Parties filed copies of Confidential Settlement-Related Agreements (Exs. 2001, 2002 (“Settlement Agreements”)), as well as a Joint Request that Agreements be Treated as Business Confidential Information and be Kept Separate Pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74 (Paper 9 (“Joint Request”)).

## II. DISCUSSION

In the Joint Motion, “[t]he Parties jointly request that the Board terminate this *inter partes* review in its entirety.” Paper 8, 2. The Parties represent that the filed Settlement Agreements are true copies and “together form the complete agreement resolving the disputes in the *inter partes* review between the Parties” and that “[t]here are no other collateral agreements between the Parties made in connection with, or in contemplation of, the termination sought.” *Id.* at 1. The Parties further represent that the District Court proceedings between the Parties involving the above-identified patent at issue was dismissed on April 27, 2023. *Id.* at 2.

The Parties also filed a Joint Request that the Settlement Agreements be treated as business confidential information and be kept separate from the

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<sup>2</sup> For purposes of expediency, we cite to papers and exhibits filed in IPR2023-00324, unless otherwise noted. The Parties filed similar papers and exhibits in each of the above-identified proceedings.

IPR2023-00324 (Patent No. 11,121,222 B2)  
IPR2023-00325 (Patent No. 11,316,014 B2)  
IPR2023-00375 (Patent No. 10,734,481 B2)  
IPR2023-00376 (Patent No. 10,510,842 B2)

file of the patent involved in this *inter partes* proceeding. Paper 9, 1. As the filing party for confidential Exhibit 2001, Patent Owner represents that it “is not permitted to share certain portions . . . with any party other than the Board and its staff.” Paper 8, 1. Patent Owner further represents that “Exhibit 2001, to which Sony is not a party, is to be filed such that it is available to the Board and Patent Owner only” and that “the Parties are in agreement with this procedure.” *Id.*

This proceeding is in its preliminary phase. Petitioner filed its Petition on December 12, 2022, and Patent Owner has not filed a Preliminary Response, which was due May 12, 2023. Paper 5, 1; Ex. 3002, 1. Accordingly, we have not yet entered a decision on institution. In view of the early stage of the proceeding and the settlement between the Parties, we determine that good cause exists to terminate the proceeding with respect to the Parties.

After reviewing each of the Settlement Agreements, we find that the Settlement Agreements contain confidential business information regarding the terms of settlement. We determine that good cause exists to treat the Settlement Agreements as business confidential information pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) and kept separate from the files of the challenged patent.

The Parties further request that “the Board inform them if anyone seeks production of the agreements and afford them an opportunity to address whether such request is supported by good cause.” Paper 9, 1. We have no such procedure to serve upon the Parties a request for access to the Settlement Agreements, and, further, our regulations do not require us to do

IPR2023-00324 (Patent No. 11,121,222 B2)  
IPR2023-00325 (Patent No. 11,316,014 B2)  
IPR2023-00375 (Patent No. 10,734,481 B2)  
IPR2023-00376 (Patent No. 10,510,842 B2)

so. Therefore, we decline to issue an order regarding any request for access to the Settlement Agreements.

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

Accordingly, for the reasons discussed above, it is:

### III. ORDER

ORDERED that the Joint Motion to Terminate is *granted*;

FURTHER ORDERED that the Joint Request that Agreements be Treated as Business Confidential Information and be Kept Separate Pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74 is *granted*,

FURTHER ORDERED that Exhibits 2001 and 2002 shall remain business confidential information, and

FURTHER ORDERED that the Petition is *dismissed*.

IPR2023-00324 (Patent No. 11,121,222 B2)  
IPR2023-00325 (Patent No. 11,316,014 B2)  
IPR2023-00375 (Patent No. 10,734,481 B2)  
IPR2023-00376 (Patent No. 10,510,842 B2)

For PETITIONER:

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For PATENT OWNER:

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Arvind Jairam  
Stuart McCommas  
Archis “Neil” Ozarka  
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smccommas@mckoolsmith.com  
nozarkar@mckoolsmith.com

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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DELL TECHNOLOGIES INC. AND DELL INC.,  
Petitioner,

v.

GREENTHREAD LLC,  
Patent Owner.

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IPR2023-00506 (Patent No. 10,510,842 B2)  
IPR2023-00507 (Patent No. 10,734,481 B2)  
IPR2023-00509 (Patent No. 11,121,222 B2)  
IPR2023-00510 (Patent No. 11,316,014 B2)<sup>1</sup>

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Before CHRISTOPHER L. CRUMBLEY, CHRISTOPHER M. KAISER,  
and KRISTI L. R. SAWERT, *Administrative Patent Judges*.

*Per Curiam.*

DECISION  
Settlement Prior to Institution of Trial  
*37 C.F.R. § 42.74*

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<sup>1</sup> This Order addresses issues that are the same in the above-captioned proceedings. The parties are not authorized to use a multi-case caption.

IPR2023-00506 (Patent No. 10,510,842 B2)  
IPR2023-00507 (Patent No. 10,734,481 B2)  
IPR2023-00509 (Patent No. 11,121,222 B2)  
IPR2023-00510 (Patent No. 11,316,014 B2)

## I. INTRODUCTION

On May 2, 2023, after email authorization by the Board, Petitioner and Patent Owner (collectively “the Parties”) filed a Joint Motion to Terminate *Inter Partes* Review in the above-identified proceeding. Paper 9 (“Joint Motion”).<sup>2</sup> In support of the Joint Motion, the Parties filed copies of Confidential Settlement-Related Agreements (Exs. 2001, 2002 (“Settlement Agreements”)), as well as a Joint Request to Keep Separate Pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) (Paper 10 (“Joint Request”)).

## II. DISCUSSION

In the Joint Motion, “[t]he Parties jointly request that the Board terminate this *inter partes* review of the Patent-in-Suit, Case No. IPR2023-00506, in its entirety.” Paper 9, 2. The Parties represent that the filed Settlement Agreements are true copies and “together form the complete agreement resolving the disputes in the *inter partes* review between the Parties” and that “[t]here are no other collateral agreements between the Parties made in connection with, or in contemplation of, the termination sought.” *Id.* at 1. The Parties further represent that a “joint motion to dismiss the lawsuit between” the Parties “involving the Patent-in-Suit was filed on April 24, 2023.” *Id.* at 2.

The Parties also filed a Joint Request that the Settlement Agreements be treated as business confidential information and be kept separate from the file of the patent involved in this *inter partes* proceeding and the files of this

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<sup>2</sup> For purposes of expediency, we cite to papers and exhibits filed in IPR2023-00506, unless otherwise noted. The Parties filed similar papers and exhibits in each of the above-identified proceedings.

IPR2023-00506 (Patent No. 10,510,842 B2)  
IPR2023-00507 (Patent No. 10,734,481 B2)  
IPR2023-00509 (Patent No. 11,121,222 B2)  
IPR2023-00510 (Patent No. 11,316,014 B2)

proceeding. Paper 10, 1. As the filing party for confidential Exhibit 2001, Patent Owner represents that it “is not permitted to share certain portions . . . with any party other than the Board and its staff.” Paper 9, 1. Patent Owner further represents that “Exhibit 2001, to which Dell is not a party, is to be filed such that it is available to the Board and Patent Owner only” and that “the Parties are in agreement with this procedure.” *Id.*

This proceeding is in its preliminary phase. Petitioner filed its Petition on January 27, 2022, and Patent Owner has not filed a Preliminary Response. Paper 9, 2. Accordingly, we have not yet entered a decision on institution. In view of the early stage of the proceeding and the settlement between the Parties, we determine that good cause exists to terminate the proceeding with respect to the Parties.

After reviewing each of the Settlement Agreements, we find that the Settlement Agreements contain confidential business information regarding the terms of settlement. We determine that good cause exists to treat the Settlement Agreements as business confidential information pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) and kept separate from the files of the challenged patent. On the other hand, as to the Parties’ request that the Board keep the Settlement Agreements “separate from the files of this proceeding,” Paper 10, 1, our regulations do not require us to do so. Therefore, we decline to issue an order to keep the Settlement Agreements separate from the file of this *inter partes* proceeding.

The Parties further request that “the Board inform them if anyone seeks production of the agreements and afford them an opportunity to address whether such request is supported by good cause.” Paper 10, 1. We

IPR2023-00506 (Patent No. 10,510,842 B2)  
IPR2023-00507 (Patent No. 10,734,481 B2)  
IPR2023-00509 (Patent No. 11,121,222 B2)  
IPR2023-00510 (Patent No. 11,316,014 B2)

have no such procedure to serve upon the Parties a request for access to the Settlement Agreements, and, further, our regulations do not require us to do so. Therefore, we decline to issue an order regarding any request for access to the Settlement Agreements.

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

Accordingly, for the reasons discussed above, it is:

### III. ORDER

ORDERED that the Joint Motion to Terminate is *granted*;

FURTHER ORDERED that the Joint Request to Keep Separate Pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c) is *granted-in-part* and *denied-in-part*,

FURTHER ORDERED that Exhibits 2001 and 2002 shall remain business confidential information, and

FURTHER ORDERED that the Petition is *dismissed*.

IPR2023-00506 (Patent No. 10,510,842 B2)  
IPR2023-00507 (Patent No. 10,734,481 B2)  
IPR2023-00509 (Patent No. 11,121,222 B2)  
IPR2023-00510 (Patent No. 11,316,014 B2)

FOR PETITIONER:

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lauren.griffin@alston.com

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Arvind Jairam  
Archis Ozarkar  
Nicholas Matich  
Stuart McCommas  
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nozarkar@mckoolsmith.com  
nmatich@mckoolsmith.com  
smccommas@mckoolsmith.com

AO 120 (Rev. 08/10)

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|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>TO: Mail Stop 8</b><br><b>Director of the U.S. Patent and Trademark Office</b><br><b>P.O. Box 1450</b><br><b>Alexandria, VA 22313-1450</b> | <b>REPORT ON THE</b><br><b>FILING OR DETERMINATION OF AN</b><br><b>ACTION REGARDING A PATENT OR</b><br><b>TRADEMARK</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Western District of Texas, Waco Division on the following

☐ Trademarks or ☒ Patents. ( ☐ the patent action involves 35 U.S.C. § 292.);

|                               |                                |                                                                        |
|-------------------------------|--------------------------------|------------------------------------------------------------------------|
| DOCKET NO.<br>6:22-cv-00105   | DATE FILED<br>1/27/2022        | U.S. DISTRICT COURT<br>Western District of Texas, Waco Division        |
| PLAINTIFF<br>GREENTHREAD, LLC |                                | DEFENDANT<br>INTEL CORPORATION, DELL INC., AND DELL TECHNOLOGIES INC., |
| PATENT OR<br>TRADEMARK NO.    | DATE OF PATENT<br>OR TRADEMARK | HOLDER OF PATENT OR TRADEMARK                                          |
| 1 8,421,195                   | 4/16/2013                      | GREENTHREAD, LLC                                                       |
| 2 9,190,502                   | 11/17/2015                     | GREENTHREAD, LLC                                                       |
| 3 10,510,842                  | 12/17/2019                     | GREENTHREAD, LLC                                                       |
| 4 10,734,481                  | 8/4/2020                       | GREENTHREAD, LLC                                                       |
| 5 11,121,222                  | 9/14/2021                      | GREENTHREAD, LLC                                                       |

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

|                            |                                                                                                                                                                          |                               |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| DATE INCLUDED              | INCLUDED BY<br><input checked="" type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading |                               |
| PATENT OR<br>TRADEMARK NO. | DATE OF PATENT<br>OR TRADEMARK                                                                                                                                           | HOLDER OF PATENT OR TRADEMARK |
| 1 11,316,014               | 4/26/2022                                                                                                                                                                | GREENTHREAD, LLC              |
| 2                          |                                                                                                                                                                          |                               |
| 3                          |                                                                                                                                                                          |                               |
| 4                          |                                                                                                                                                                          |                               |
| 5                          |                                                                                                                                                                          |                               |

In the above—entitled case, the following decision has been rendered or judgement issued:

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| DECISION/JUDGEMENT |
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|       |                   |      |
|-------|-------------------|------|
| CLERK | (BY) DEPUTY CLERK | DATE |
|-------|-------------------|------|

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director  
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

| APPLICATION NO. | ISSUE DATE | PATENT NO. | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|------------|------------|---------------------|------------------|
| 17/371,839      | 04/26/2022 | 11316014   | GRTD60-35314        | 2197             |

25883 7590 04/06/2022  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380

## ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

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 Application Assistance Unit (AAU) of the Office of Patents Stakeholder Experience (OPSE), Stakeholder Support Division (SSD) at (571)-272-4200.

**INVENTOR(s)** (Please see PAIR WEB site <http://pair.uspto.gov> for additional inventors):

G.R. MOHAN RAO, ALLEN, TX;

**APPLICANT(s)** (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

GREENTHREAD, LLC, Dallas, TX;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit [SelectUSA.gov](http://SelectUSA.gov).

**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)

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.

25883 7590 03/23/2022  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

**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. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 17/371.839      | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |

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 | UNDISCOUNTED  | \$1200        | \$0.00              | \$0.00               | \$1200           | 06/23/2022 |

| EXAMINER    | ART UNIT | CLASS-SUBCLASS |
|-------------|----------|----------------|
| ARORA, AJAY | 2892     | 257-025000     |

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/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 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 Gregory M. Howison

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)

GREENTHREAD, LLC

DALLAS, TEXAS

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government4a. 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. 50-0208

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 /William G. Howison, Reg. #66850/Date March 23, 2022Typed or printed name William G. HowisonRegistration No. 66,850

## Electronic Patent Application Fee Transmittal

|                                                       |                                                  |                 |               |                             |
|-------------------------------------------------------|--------------------------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                            | 17371839                                         |                 |               |                             |
| <b>Filing Date:</b>                                   | 09-Jul-2021                                      |                 |               |                             |
| <b>Title of Invention:</b>                            | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>           | G.R. MOHAN RAO                                   |                 |               |                             |
| <b>Filer:</b>                                         | William G. Howison/Anna Nguyen                   |                 |               |                             |
| <b>Attorney Docket Number:</b>                        | GRTD60-35314                                     |                 |               |                             |
| Filed as Large Entity                                 |                                                  |                 |               |                             |
| <b>Filing Fees for    Utility under 35 USC 111(a)</b> |                                                  |                 |               |                             |
| <b>Description</b>                                    | <b>Fee Code</b>                                  | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                  |                                                  |                 |               |                             |
| <b>Pages:</b>                                         |                                                  |                 |               |                             |
| <b>Claims:</b>                                        |                                                  |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                          |                                                  |                 |               |                             |
| <b>Petition:</b>                                      |                                                  |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>               |                                                  |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>              |                                                  |                 |               |                             |

| Description                            | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|----------------------------------------|----------|----------|--------|----------------------|
| PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL | 1504     | 1        | 0      | 0                    |
| UTILITY APPL ISSUE FEE                 | 1501     | 1        | 1200   | 1200                 |
| Extension-of-Time:                     |          |          |        |                      |
| Miscellaneous:                         |          |          |        |                      |
| Total in USD (\$)                      |          |          |        | 1200                 |

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 45300225                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>                               | William G. Howison                               |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 23-MAR-2022                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 15:40:43                                         |
| <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 | \$ 1200          |
| RAM confirmation Number                  | E20223MF45452092 |
| Deposit Account                          | 500208           |
| Authorized User                          | William Howison  |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)  
37 CFR 1.21 (Miscellaneous fees and charges)

### File Listing:

| Document Number | Document Description        | File Name                       | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------|---------------------------------|------------------------------------------|------------------|------------------|
| 1               | Issue Fee Payment (PTO-85B) | GRT35314IssueFeeTransmittal.pdf | 1231571                                  | no               | 1                |
|                 |                             |                                 | c23ddc1d6949e077a00bd27b1dc82df75f150ea8 |                  |                  |

### Warnings:

### Information:

|   |                      |              |                                          |    |   |
|---|----------------------|--------------|------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 40395                                    | no | 2 |
|   |                      |              | 591f9a252b7a02f743b3047422b0137efc393983 |    |   |

### Warnings:

### Information:

|                                     |         |
|-------------------------------------|---------|
| <b>Total Files Size (in bytes):</b> | 1271966 |
|-------------------------------------|---------|

**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.**

#### New Applications Under 35 U.S.C. 111

**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

**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.**



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
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## NOTICE OF ALLOWANCE AND FEE(S) DUE

25883 7590 03/23/2022  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

EXAMINER

ARORA, AJAY

ART UNIT

PAPER NUMBER

2892

DATE MAILED: 03/23/2022

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 17/371,839      | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |

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 | UNDISCOUNTED  | \$1200        | \$0.00              | \$0.00               | \$1200           | 06/23/2022 |

**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. 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)

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.

25883 7590 03/23/2022  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380

## 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. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 17/371.839      | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |

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 | UNDISCOUNTED  | \$1200        | \$0.00              | \$0.00               | \$1200           | 06/23/2022 |

| EXAMINER    | ART UNIT | CLASS-SUBCLASS |
|-------------|----------|----------------|
| ARORA, AJAY | 2892     | 257-025000     |

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/AIA/122 or PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/AIA/47 or PTO/SB/47; Rev 03-02 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,

1 \_\_\_\_\_

(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.

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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| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 17/371,839                 | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |
| 25883                      | 7590        | 03/23/2022           | EXAMINER            |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | ARORA, AJAY         |                  |
| P.O. Drawer 800889         |             |                      | ART UNIT            |                  |
| DALLAS, TX 75380           |             |                      | PAPER NUMBER        |                  |
|                            |             |                      | 2892                |                  |
| DATE MAILED: 03/23/2022    |             |                      |                     |                  |

## 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) 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>17/371,839 | <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 3/4/2022.  
☐ 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 1-30. 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.

### **Reasons for Allowance**

2. Claims 1-30 are allowed. The following is an examiner's statement of reasons for allowance:

Claims 1-20 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 "at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface towards the area of the substrate where there are no active regions" (see last 5 lines).

The closest reference is Hong (US 2007/0045682), hereinafter Hong. More specifically, regarding claim 17, Hong (refer to Figures 4A-4D and 5A-5C) teaches An electronic system, the system 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) of a first doping type and a first doping level having a surface;

a first region (311, which includes wells such as 21, 22, 5, 2) disposed adjacent the first surface,

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 region disposed adjacent to the first active region and within which transistors (406, 407) may be formed;

at least a portion of at least one of the first and second 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).

However, the first region is not an “active” region and the structure does not show that the graded dopant region is to “aid carrier movement from the surface to the area of the substrate where there are no active regions”. Further, it is not obvious to modify Hong as changing first region and second region as above would change the intended function of the device.

Similarly, claims 21-30 are allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of base claim 21 that requires “at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface to the area of the substrate where there are no active regions” (see last 5 lines). Again, the closest reference is Hong.

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***

3. 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 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 published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197

Application/Control Number: 17/371,839  
Art Unit: 2892

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(toll-free). If you would like assistance from a USPTO Customer Service

Representative, 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>17/371,839 | <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><br>(Assistant Examiner) _____ (Date) _____                                              |  | <b>Total Claims Allowed:</b><br>30 |                         |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892<br>(Primary Examiner) _____ (Date) 08 March 2022 |  | O.G. Print Claim(s)<br>1           | O.G. Print Figure<br>5b |

|                                                                                                                  |                                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>17/371,839 | <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>                      |   |    |      |
| H01L29/10                           | / | 29 | / 10 |

|                    |   |  |  |
|--------------------|---|--|--|
| <b>NON-CLAIMED</b> |   |  |  |
| /                  | / |  |  |

|                                   |                 |
|-----------------------------------|-----------------|
| <b>US ORIGINAL CLASSIFICATION</b> |                 |
| <b>CLASS</b>                      | <b>SUBCLASS</b> |
| 257                               | 25              |

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

|                                                 |               |                              |                   |
|-------------------------------------------------|---------------|------------------------------|-------------------|
| NONE                                            |               | <b>Total Claims Allowed:</b> |                   |
| (Assistant Examiner)                            | (Date)        | 30                           |                   |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892 | 08 March 2022 | O.G. Print Claim(s)          | O.G. Print Figure |
| (Primary Examiner)                              | (Date)        | 1                            | 5b                |

|                                                                                                                  |                                              |                                                                   |
|------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Issue Classification</b><br> | <b>Application/Control No.</b><br>17/371,839 | <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 checked="" 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        |       | 10       |       | 19       |       | 28       |       |          |       |          |       |          |       |          |
|        | 2        |       | 11       |       | 20       |       | 29       |       |          |       |          |       |          |       |          |
|        | 3        |       | 12       |       | 21       |       | 30       |       |          |       |          |       |          |       |          |
|        | 4        |       | 13       |       | 22       |       |          |       |          |       |          |       |          |       |          |
|        | 5        |       | 14       |       | 23       |       |          |       |          |       |          |       |          |       |          |
|        | 6        |       | 15       |       | 24       |       |          |       |          |       |          |       |          |       |          |
|        | 7        |       | 16       |       | 25       |       |          |       |          |       |          |       |          |       |          |
|        | 8        |       | 17       |       | 26       |       |          |       |          |       |          |       |          |       |          |
|        | 9        |       | 18       |       | 27       |       |          |       |          |       |          |       |          |       |          |

|                                                                                                  |  |                                    |                         |
|--------------------------------------------------------------------------------------------------|--|------------------------------------|-------------------------|
| NONE<br><br>(Assistant Examiner) _____ (Date) _____                                              |  | <b>Total Claims Allowed:</b><br>30 |                         |
| /AJAY ARORA/<br>Primary Examiner, Art Unit 2892<br>(Primary Examiner) _____ (Date) 08 March 2022 |  | O.G. Print Claim(s)<br>1           | O.G. Print Figure<br>5b |

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <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 - Searched* |            |          |
|-----------------|------------|----------|
| Symbol          | Date       | Examiner |
| H01L 29/1095    | 10/23/2021 | AKA      |

| CPC Combination Sets - Searched* |      |          |
|----------------------------------|------|----------|
| Symbol                           | Date | Examiner |
|                                  |      |          |

| US Classification - Searched* |          |            |          |
|-------------------------------|----------|------------|----------|
| Class                         | Subclass | Date       | Examiner |
| 257                           | 25       | 10/23/2021 | AKA      |

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

| Search Notes                                                                                                    |            |          |
|-----------------------------------------------------------------------------------------------------------------|------------|----------|
| Search Notes                                                                                                    | Date       | Examiner |
| Inventor search                                                                                                 | 10/23/2021 | AKA      |
| Assignee search                                                                                                 | 10/23/2021 | AKA      |
| References for all parent applications (10/934,915; 11/622,496; 15/590,282; 16/717950 and 16/947294) considered | 10/23/2021 | AKA      |
| .clm. interference search                                                                                       | 10/23/2021 | AKA      |
| EAST search history report                                                                                      | 10/23/2021 | AKA      |
| Revised EAST search history report                                                                              | 02/23/2022 | AKA      |
| Revised EAST search history report                                                                              | 03/08/2022 | aka      |

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

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

| Interference Search |                       |            |          |
|---------------------|-----------------------|------------|----------|
| US Class/CPC Symbol | US Subclass/CPC Group | Date       | Examiner |
| H01L                | 29/1095               | 10/23/2021 | AKA      |
| 257                 | 25                    | 10/23/2021 | AKA      |

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

|                                                                                                                    |                                              |                                                                   |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <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>Rejected</b> | - | <b>Cancelled</b>  | N | <b>Non-Elected</b>  | A | <b>Appeal</b>   |
| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

| CLAIMS                                                                                                                                                                                                  |          |            |            |            |  |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|------------|------------|--|--|--|--|--|--|
| <input checked="" type="checkbox"/> Claims renumbered in the same order as presented by applicant <input type="checkbox"/> CPA <input checked="" type="checkbox"/> T.D. <input type="checkbox"/> R.1.47 |          |            |            |            |  |  |  |  |  |  |
| CLAIM                                                                                                                                                                                                   |          | DATE       |            |            |  |  |  |  |  |  |
| Final                                                                                                                                                                                                   | Original | 10/23/2021 | 02/23/2022 | 03/08/2022 |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 1        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 2        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 3        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 4        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 5        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 6        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 7        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 8        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 9        | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 10       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 11       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 12       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 13       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 14       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 15       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 16       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 17       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 18       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 19       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 20       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 21       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 22       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 23       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 24       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 25       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 26       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 27       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 28       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 29       | ✓          | ✓          | =          |  |  |  |  |  |  |
|                                                                                                                                                                                                         | 30       | ✓          | ✓          | =          |  |  |  |  |  |  |

OK TO ENTER: /A.A/

GRTD60-35314

PATENT

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

In re application of: G. R. Mohan Rao  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2892  
Examiner: Ajay Arora  
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 February 28, 2022. 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 7 of this paper.

# PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits  | Search Query                                                                                                                                                                                                                                       | DBs                                                        | Default Operator | Plurals | British Equivalents | Time Stamp          |
|-------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|------------------|---------|---------------------|---------------------|
| L1    | 0     | 17/371,839                                                                                                                                                                                                                                         | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | OFF     | OFF                 | 2021/10/23 10:17 AM |
| L2    | 31    | ((("GREENTHREAD") near3 ("LLC"))).AS,AANM.                                                                                                                                                                                                         | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | ON      | ON                  | 2021/10/23 10:18 AM |
| L3    | 29    | ((("RAO") near3 ("G.R") near3 ("MOHAN"))).INV.                                                                                                                                                                                                     | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | ON      | ON                  | 2021/10/23 10:19 AM |
| L4    | 30065 | H01L29/1095.cpc.                                                                                                                                                                                                                                   | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | OFF     | OFF                 | 2021/10/23 10:19 AM |
| L5    | 669   | (257/25).CCLS.                                                                                                                                                                                                                                     | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | OFF     | OFF                 | 2021/10/23 10:19 AM |
| L6    | 56    | ("20010028097" "20020195656" "20030183856" "20070045682" "20080142899" "20140034997" "20170243876" "4160985" "4684971" "4688063" "4907058" "4994887" "5835402" "6025237" "6384431" "6465862").PN.                                                  | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | ON      | ON                  | 2021/10/23 10:20 AM |
| L7    | 29    | ("5448087" "5888857" "20030030488" "6720622" "20030026126" "5973575" "5262345" "20040027753").PN.                                                                                                                                                  | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | OFF     | OFF                 | 2021/10/23 10:20 AM |
| L8    | 12    | (US-20040027753-\$ or US-20030030488-\$ or US-20140034997-\$ or US-20060049464-\$ or US-20030026126-\$ or US-20070181927-\$ or US-20070045682-\$).did. or (US-5973575-\$ or US-5262345-\$ or US-5448087-\$ or US-6720622-\$ or US-5888857-\$).did. | (US-PGPUB; USPAT)                                          | OR               | ON      | ON                  | 2021/10/23 10:21 AM |
| L9    | 47    | ("20020056883" "20020084430" "20020102783" "20030042511" "4160                                                                                                                                                                                     | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;          | OR               | OFF     | OFF                 | 2021/10/23 10:22 AM |

|     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                            |    |     |     |                        |
|-----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|-----|------------------------|
| L10 | 118 | 985 "5637898 "5517052 "4481522 "6831292 "20020093281 "5029277 "20060113592 "20020134419").PN.<br>("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.                                                                                                                                                                                                                                                                                                             | IBM_TDB)<br><br>(US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>10:23 AM |
| L11 | 255 | ("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 "20070045682 "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 "20120048462").PN. | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)                 | OR | OFF | OFF | 2021/10/23<br>10:58 AM |
| L12 | 271 | ("20020102783 "20020134419 "20070045682" "6310366" "RE37441" "20020084430" "4001864" "4866000" "5480816" "5517052" "5797999" "5973575" "6754093" "7064385" "20120048462").PN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT;                          | OR | OFF | OFF | 2021/10/23<br>10:59 AM |

|     |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                     |    |     |     |                        |
|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|-----|-----|------------------------|
|     |     | "20040027753" "20120<br>048462" "4160985" "43<br>47654" "5213988" "557<br>5862" "8164124" "2013<br>0001661" "5329144" "5<br>496746" "5569612" "56<br>37898" "5973575" "621<br>1028" "6683343" "6696<br>314" "6713813" "67540<br>93" "7064385" "200300<br>30488" "20070045682" "<br>"4481522" "6753202" "2<br>0020056883" "2002008<br>4430" "20020093281" "<br>20030026126" "200300<br>42511" "4001864" "513<br>0262" "5262345" "5448<br>087" "6472715" "66705<br>44" "6720622" "678071<br>3" "6921946" "1051084<br>2" "20010040622" "200<br>20074585" "6465862" "<br>6747883" "7233044" "7<br>307327" "20030030488<br>" "20040063288" "2006<br>0113592" "2015020031<br>4" "4866000" "5029277"<br> "5480816" "5517052" "<br>5797999" "6452086" "6<br>706550" "6737722" "68<br>31292" "6878603" "711<br>5925" "9190502" "9647<br>070" "5888857" "67441<br>17" "6756616" "693321<br>5" "7504692" "8421195"<br>) .PN. | IBM_TDB)                                                            |    |     |     |                        |
| L13 | 316 | ("20020102783" "20020<br>134419" "20070045682<br>" "6310366" "RE37441"<br>"4907058" "200400277<br>53" "20080142899" "20<br>120048462" "4160985" "<br>"4347654" "5213988" "5<br>575862" "8164124" "20<br>010028097" "4994887" "<br>"6025237" "201300016<br>61" "5329144" "549674<br>6" "5569612" "5637898"<br> "5973575" "6211028" "<br>6683343" "6696314" "6<br>713813" "6754093" "70<br>64385" "20140034997" "<br>"10734481" "4481522" "6<br>753202" "2002019565<br>6" "20030183856" "200<br>20056883" "200200844<br>30" "20020093281" "20<br>030026126" "20030042                                                                                                                                                                                                                                                                                                                                               | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:00 AM |

|     |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                     |    |     |     |                        |
|-----|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|-----|-----|------------------------|
|     |       | 511 "4001864 "51302<br>62 "5262345 "544808<br>7 "6472715 "6670544"<br> "6720622 "6780713 "6921946 "2017024387<br>6 "5835402 "2007004<br>5682 "10510842 "200<br>10040622 "200200745<br>85 "20030183856 "46<br>84971 "6465862 "674<br>7883 "7233044 "7307<br>327 "4688063 "20030<br>030488 "20040063288<br> "20060113592 "2015<br>0200314 "4866000 "5<br>029277 "5480816 "55<br>17052 "5797999 "645<br>2086 "6706550 "6737<br>722 "6831292 "68786<br>03 "7115925 "919050<br>2 "9647070 "2008014<br>2899 "6384431 "5888<br>857 "6744117 "67566<br>16 "6933215 "750469<br>2 "8421195").PN. |                                                                     |    |     |     |                        |
| L14 | 319   | L7 L9 L10 L11 L12 L13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:01 AM |
| L15 | 10    | L3 and drift                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:02 AM |
| L16 | 14    | L2 and drift                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:02 AM |
| L17 | 574   | (source drain<br>source/drain) and drift<br>and ((gradient graded)<br>near2 concentration<br>near2 dop\$3) and well                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:03 AM |
| L18 | 25930 | H01L27/11521.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:03 AM |
| L19 | 14669 | H01L27/11524.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:04 AM |
| L20 | 29711 | H01L27/14643.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:04 AM |
| L21 | 11836 | H01L29/36.cpc.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (US-PGPUB; USPAT;                                                   | OR | ON  | ON  | 2021/10/23             |

|     |       |                                                                                                                                                                                 |                                                                     |    |     |     |                                    |
|-----|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|----|-----|-----|------------------------------------|
| L22 | 13097 | H01L29/7395.cpc.                                                                                                                                                                | USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB)                      | OR | ON  | ON  | 11:04 AM<br>2021/10/23<br>11:04 AM |
| L23 | 18    | L4 and L18 and L21                                                                                                                                                              | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:08 AM             |
| L24 | 18    | L4 and L18 and L20                                                                                                                                                              | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:10 AM             |
| L25 | 18    | L4 and L19 and L20                                                                                                                                                              | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:10 AM             |
| L26 | 66    | L4 and L19 and L21                                                                                                                                                              | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | ON  | ON  | 2021/10/23<br>11:10 AM             |
| L27 | 2     | ((source drain<br>"source/drain" active)<br>and drift and ((gradient<br>graded) near2<br>concentration near2<br>dop\$3) and well and<br>((no near2 active)<br>(inactive))).clm. | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:11 AM             |
| L28 | 32    | ((source drain<br>"source/drain" active)<br>and drift and ((gradient<br>graded) near2<br>concentration near2<br>dop\$3) and well and<br>((no near2 active)<br>(inactive)))      | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>11:13 AM             |
| L30 | 574   | (source drain<br>source/drain) and drift<br>and ((gradient graded)<br>near2 concentration<br>near2 dop\$3) and well                                                             | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>03:37 PM             |
| L31 | 574   | L30                                                                                                                                                                             | (US-PGPUB; USPAT;<br>USOCR; FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2021/10/23<br>03:37 PM             |
| L32 | 1     | ("9647070").PN.                                                                                                                                                                 | (US-PGPUB; USPAT)                                                   | OR | OFF | OFF | 2021/10/23<br>04:21 PM             |
| L33 | 1     | ("6384431").PN.                                                                                                                                                                 | (US-PGPUB; USPAT)                                                   | OR | OFF | OFF | 2021/10/23<br>04:21 PM             |
| L34 | 3     | 16/947,294                                                                                                                                                                      | (US-PGPUB; USPAT;<br>USOCR; FIT (AU, AP,                            | OR | ON  | ON  | 2022/02/23<br>11:02 PM             |

|     |     |                                                                                                                          |                                                                                                                                                                                                                                                                                                                       |    |     |     |                        |
|-----|-----|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----|-----|------------------------|
| L35 | 544 | (source drain<br>source\$1drain) AND<br>drift AND ((gradient<br>graded) near2<br>concentration near2<br>dop\$3) AND well | AT, BE, BG, BR, BY,<br>CA, CH, CN, CS, CU,<br>CZ, DD, DE, DK, EA,<br>EE, EP, ES, FI, FR, GB,<br>HR, HU, ID, IE, IL, IS,<br>IT, JP, KR, LT, LU, LV,<br>MA, OA, RU, SU, WO,<br>MC, MD, MY, NL, NO,<br>NZ, PH, PL, PT, RO,<br>RS, SE, SG, SI, SK,<br>TH, TN, TR, TW, UA,<br>VN); FPRS; EPO;<br>JPO; DERWENT;<br>IBM_TDB) | OR | OFF | OFF | 2022/02/23<br>11:22 PM |
| L36 | 1   | "11121222"                                                                                                               | (USPAT)                                                                                                                                                                                                                                                                                                               | OR | ON  | ON  | 2022/03/08<br>09:28 PM |

## PE2E SEARCH - Search History (Interference)

| Ref # | Hits | Search Query                                                                                                                                                               | DBs               | Default Operator | Plurals | British Equivalents | Time Stamp             |
|-------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------|---------|---------------------|------------------------|
| N29   | 31   | ((source drain<br>"source/drain" active)<br>and drift and ((gradient<br>graded) near2<br>concentration near2<br>dop\$3) and well and<br>((no near2 active)<br>(inactive))) | (US-PGPUB; USPAT) | OR               | OFF     | OFF                 | 2021/10/23<br>11:12 AM |

## Bibliographic Data

Application No: 17/371,839

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. |
|-----------------------|-------|----------------|---------------------|
| 07/09/2021            | 257   | 2892           | GRTD60-35314        |
| <b>RULE</b>           |       |                |                     |

### APPLICANTS

GREENTHREAD, LLC, Dallas, TX, UNITED STATES

### INVENTORS

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

### CONTINUING DATA

This application is a CON of 16947294 07/27/2020 PAT 11121222

16947294 is a CON of 16717950 12/17/2019 PAT 10734481

16717950 is a CON of 15590282 05/09/2017 PAT 10510842

15590282 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\*\*

07/22/2021

### STATE OR COUNTRY

UNITED STATES

### ADDRESS

MUNCK WILSON MANDALA L.L.P

P.O. Drawer 800889

DALLAS, TX 75380

UNITED STATES

### FILING FEE RECEIVED

\$7,160

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         |                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>Doc Code: DIST.E.FILE</b><br><b>Document Description: Electronic Terminal Disclaimer - Filed</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                         | PTO/SB/26<br>U.S. Patent and Trademark Office<br>Department of Commerce |
| Electronic Petition Request                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT</b> |                                                                         |
| Application Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 17371839                                                                                |                                                                         |
| Filing Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 09-Jul-2021                                                                             |                                                                         |
| First Named Inventor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | G.R. MOHAN RAO                                                                          |                                                                         |
| Attorney Docket Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GRTD60-35314                                                                            |                                                                         |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS                                        |                                                                         |
| <input checked="" type="checkbox"/> Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action<br><br><input checked="" type="checkbox"/> This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |                                                                         |
| Owner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Percent Interest                                                                        |                                                                         |
| GREENTHREAD, LLC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 100%                                                                                    |                                                                         |
| <p>The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)</p> <p>11121222</p> <p>as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.</p> <p>In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:</p> <ul style="list-style-type: none"> <li>- expires for failure to pay a maintenance fee;</li> <li>- is held unenforceable;</li> <li>- is found invalid by a court of competent jurisdiction;</li> <li>- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;</li> <li>- has all claims canceled by a reexamination certificate;</li> <li>- is reissued; or</li> <li>- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.</li> </ul> <p><input checked="" type="radio"/> Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.</p> |                                                                                         |                                                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <input type="radio"/> I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |
| Applicant claims the following fee status:<br><br><input type="radio"/> Small Entity<br><br><input type="radio"/> Micro Entity<br><br><input checked="" type="radio"/> Regular Undiscounted                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |
| I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.                                                                                                                                                             |                                   |
| THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES<br><br>I certify, in accordance with 37 CFR 1.4(d)(4) that I am:<br><br><input checked="" type="radio"/> An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application<br><br>Registration Number <u>30646</u><br><br><input type="radio"/> A sole inventor<br><br><input type="radio"/> A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application<br><br><input type="radio"/> A joint inventor; all of whom are signing this request |                                   |
| Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | /Gregory M. Howison, Reg. #30646/ |
| Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Gregory M. Howison                |

\*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).  
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

## Electronic Patent Application Fee Transmittal

|                                                    |                                                  |                 |               |                             |
|----------------------------------------------------|--------------------------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                         | 17371839                                         |                 |               |                             |
| <b>Filing Date:</b>                                | 09-Jul-2021                                      |                 |               |                             |
| <b>Title of Invention:</b>                         | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        | G.R. MOHAN RAO                                   |                 |               |                             |
| <b>Filer:</b>                                      | Gregory Michael Howison/Joselyn Rodriguez        |                 |               |                             |
| <b>Attorney Docket Number:</b>                     | GRTD60-35314                                     |                 |               |                             |
| Filed as Large Entity                              |                                                  |                 |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                                                  |                 |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b>                                  | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                                                  |                 |               |                             |
| STATUTORY OR TERMINAL DISCLAIMER                   | 1814                                             | 1               | 170           | 170                         |
| <b>Pages:</b>                                      |                                                  |                 |               |                             |
| <b>Claims:</b>                                     |                                                  |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                                                  |                 |               |                             |
| <b>Petition:</b>                                   |                                                  |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                                                  |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                                                  |                 |               |                             |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 170                  |

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 17371839

Filing Date: 09-Jul-2021

Applicant/Patent under Reexamination: RAO

Electronic Terminal Disclaimer filed on March 15, 2022

☒ APPROVED

**This patent is subject to a terminal disclaimer**

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 45218088                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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/Joselyn Rodriguez        |
| <b>Filer Authorized By:</b>                 | Gregory Michael Howison                          |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 15-MAR-2022                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 15:55:28                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                          |                   |
|------------------------------------------|-------------------|
| Submitted with Payment                   | yes               |
| Payment Type                             | DA                |
| Payment was successfully received in RAM | \$ 170            |
| RAM confirmation Number                  | E20223EF55242618  |
| Deposit Account                          | 500208            |
| Authorized User                          | Joselyn Rodriguez |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

| <b>File Listing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                        |                          |                                              |                  |                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------|----------------------------------------------|------------------|------------------|
| Document Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Document Description                   | File Name                | File Size(Bytes)/<br>Message Digest          | Multi Part /.zip | Pages (if appl.) |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Terminal Disclaimer-Filed (Electronic) | eTerminal-Disclaimer.pdf | 41407                                        | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                        |                          | ce154e2964899d218ef9dae5a3347ca4e03<br>ea568 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |                          |                                              |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                        |                          |                                              |                  |                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Fee Worksheet (SB06)                   | fee-info.pdf             | 38134                                        | no               | 2                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                        |                          | 3ae58ae3a199f0bc9bc08814725ee818db8<br>0dd20 |                  |                  |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                        |                          |                                              |                  |                  |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                        |                          |                                              |                  |                  |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                        |                          | 79541                                        |                  |                  |
| <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> |                                        |                          |                                              |                  |                  |

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|                                                                                                                                 |                                                                                          |                                                                                                                                                                                                                               |       |                                            |     |                           |  |                                       |  |                     |  |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------|-----|---------------------------|--|---------------------------------------|--|---------------------|--|
| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                               |                                                                                          |                                                                                                                                                                                                                               |       | Application or Docket Number<br>17/371,839 |     | Filing Date<br>07/09/2021 |  | <input type="checkbox"/> To be Mailed |  |                     |  |
| ENTITY: <input checked="" type="checkbox"/> LARGE <input 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), (i), 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 \$100 =                 |  |                                       |  |                     |  |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                          |                                                                                          | minus 3 = *                                                                                                                                                                                                                   |       |                                            |     | x \$480 =                 |  |                                       |  |                     |  |
| <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>                                                                                                                | 03/04/2022                                                                               | CLAIMS REMAINING AFTER AMENDMENT                                                                                                                                                                                              |       | HIGHEST NUMBER PREVIOUSLY PAID FOR         |     | PRESENT EXTRA             |  | RATE (\$)                             |  | ADDITIONAL FEE (\$) |  |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 30                                                                                                                                                                                                                          | Minus | ** 30                                      | = 0 |                           |  | x \$100 =                             |  | 0                   |  |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                                                                                                                                                                                                                           | Minus | *** 3                                      | = 0 |                           |  | x \$480 =                             |  | 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                   |  |
|                                                                                                                                 |                                                                                          | (Column 1)                                                                                                                                                                                                                    |       | (Column 2)                                 |     | (Column 3)                |  |                                       |  |                     |  |
| <b>AMENDMENT</b>                                                                                                                |                                                                                          | 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".                                       |                                                                                          |                                                                                                                                                                                                                               |       |                                            |     |                           |  | /THERESA D DAWKINS/                   |  |                     |  |
| *** 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.*

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

In re application of: G. R. Mohan Rao  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2892  
Examiner: Ajay Arora  
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 February 28, 2022. 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 7 of this paper.

## **In the Claims**

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

1. (Previously Presented) An electronic system, the system comprising:

at least one semiconductor device, the at least one semiconductor device including:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface with a second doping type  
opposite in conductivity to the first doping type and within which 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 can be formed;

transistors formed in at least one of the first active region or second active  
region;

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 and  
second active regions towards an area of the substrate where there are no active  
regions; and

at least one well region adjacent to the first or second active region  
containing at least one graded dopant region, the graded dopant region to aid carrier  
movement from the surface towards the area of the substrate where there are no  
active regions, wherein at least some of the transistors form digital logic of the  
semiconductor device.

2. (Previously Presented) The system of Claim 1, wherein the substrate of the at least one semiconductor device is a p-type substrate.

3. (Previously Presented) The system of Claim 1, wherein the substrate of the at least one semiconductor device has epitaxial silicon on top of a nonepitaxial substrate.

4. (Previously Presented) The system of Claim 1, wherein the first active region and second active region of the at least one semiconductor device contain digital logic formed by one of either p-channel and n-channel devices.
5. (Previously Presented) The system of Claim 1, wherein the first active region and second active region of the at least one semiconductor device contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has at least one graded dopant.
6. (Previously Presented) The system of Claim 1, wherein the first active region and second active region of the at least one semiconductor device are each separated by at least one isolation region.
7. (Previously Presented) The system of Claim 1, wherein the graded dopant is fabricated with an ion implantation process.
8. (Previously Presented) The system of Claim 1, wherein the first and second active regions of the at least one semiconductor device are formed adjacent the first surface of the substrate of the at least one semiconductor device.
9. (Previously Presented) The system of Claim 1, wherein dopants of the graded dopant concentration in the first active region or the second active region of the at least one semiconductor device are either p-type or n-type.
10. (Previously Presented) The system of Claim 1, wherein dopants of the graded dopant concentration in the first active region of the at least one semiconductor device are both p-type and n-type.
11. (Previously Presented) The system of Claim 1, wherein dopants of the graded dopant concentration in the second active region of the at least one semiconductor device are both p-type and n-type.

12. (Previously Presented) The system of Claim 1, wherein dopants of the graded dopant region in the well region of the at least one semiconductor device are both p-type and n-type.

13. (Previously Presented) The system of claim 1, wherein the transistors which can be formed in the first and second active regions of the at least one semiconductor device are CMOS digital logic transistors requiring at least a source, a drain, a gate and a channel.

14. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device is a dynamic random access memory (DRAM).

15. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device is a complementary metal oxide semiconductor (CMOS) with a nonepitaxial substrate.

16. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device is a flash memory.

17. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device comprises digital logic and capacitors.

18. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device is a central processing unit.

19. (Previously Presented) The system of Claim 1, wherein the at least one semiconductor device is an image sensor.

20. (Previously Presented) The system of Claim 1, wherein each of the first and second active regions of the at least one semiconductor device are in the lateral or vertical direction.

21. (Previously Presented) An electronic system, comprising:

at least one semiconductor device, the at least one semiconductor device including:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface of the substrate with a

second doping type opposite in conductivity to the first doping type and within

which 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 transistors can be formed in the surface thereof;

10 transistors formed in at least one of the first active region or second active region;

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 an area of the substrate where there are no active regions; and

15 at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface to the area of the substrate where there are no active regions, and wherein the graded dopant concentration is linear, quasilinear, error function, complementary error function, or any combination thereof.

22. (Previously Presented) The system of Claim 21, wherein the substrate of the at least one semiconductor device is an n-type substrate.

23. (Previously Presented) The system of Claim 21, wherein the substrate of the at least one semiconductor device is a p-type substrate.

24. (Previously Presented) The system of Claim 21, wherein the substrate of the at least one semiconductor device has epitaxial silicon on top of a nonepitaxial substrate.

25. (Previously Presented) The system of Claim 21, wherein the first active region and second active region of the at least one semiconductor device contain at least one of either p-channel and n-channel devices.

26. (Previously Presented) The system of Claim 21, wherein the first active region and second active region of the at least one semiconductor device contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has at least one graded dopant.

27. (Previously Presented) The system of Claim 21, wherein the first active region and second active region of the at least one semiconductor device are each separated by at least one isolation region.

28. (Previously Presented) The system of Claim 21, wherein dopants of the graded dopant concentration in the first active region or the second active region of the at least one semiconductor device are either p-type or n-type.

29. (Previously Presented) The system of Claim 21, wherein dopants of the graded dopant concentration in the first active region of the at least one semiconductor device are both p-type and n-type.

30. (Previously Presented) The system of Claim 21, wherein dopants of the graded dopant concentration in the second active region of the at least one semiconductor device are both p-type and n-type.

## **REMARKS**

Applicant has carefully reviewed the Office Action dated February 28, 2022. Reconsideration and favorable action is respectfully requested.

Claims 1-30 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-30 of U.S. Patent No. 11121222. A Terminal Disclaimer is submitted concurrently with this response with respect to U.S. Patent No. 11121222.

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 [whowison@munckwilson.com](mailto:whowison@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. 50-0208/GRTD60-35314.

Respectfully submitted,  
MUNCK WILSON MANDALA, LLP  
Attorneys for Applicant

/William G. Howison, Reg. #66850/

William G. Howison  
Registration No. 66,850

WGH/als

P.O. Drawer 800889  
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Tel: 972-628-3600  
Fax: 972-628-3616  
March 4, 2022

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 45143918                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>                               | William G. Howison                               |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 04-MAR-2022                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 12:32:31                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                        |    |
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| Document Number | Document Description | File Name       | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
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|                 |                      |                 | b7e71d2fc480d3afb876e1eed26332baeb2bb3e6 |                  |                  |

| Multipart Description/PDF files in .zip description |       |     |  |
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| Document Description                                | Start | End |  |
| Response After Final Action                         | 1     | 1   |  |
| Claims                                              | 2     | 6   |  |
| Applicant Arguments/Remarks Made in an Amendment    | 7     | 8   |  |

**Warnings:**

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**New Applications Under 35 U.S.C. 111**  
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**  
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.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                         |                                                                         |
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| <b>Doc Code: DIST.E.FILE</b><br><b>Document Description: Electronic Terminal Disclaimer - Filed</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                         | PTO/SB/26<br>U.S. Patent and Trademark Office<br>Department of Commerce |
| Electronic Petition Request                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>TERMINAL DISCLAIMER TO OBIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT</b> |                                                                         |
| Application Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 17371839                                                                                |                                                                         |
| Filing Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 09-Jul-2021                                                                             |                                                                         |
| First Named Inventor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | G.R. MOHAN RAO                                                                          |                                                                         |
| Attorney Docket Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | GRTD60-35314                                                                            |                                                                         |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS                                        |                                                                         |
| <input checked="" type="checkbox"/> Filing of terminal disclaimer does not obviate requirement for response under 37 CFR 1.111 to outstanding Office Action<br><br><input checked="" type="checkbox"/> This electronic Terminal Disclaimer is not being used for a Joint Research Agreement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                         |                                                                         |
| Owner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Percent Interest                                                                        |                                                                         |
| VERVAIN, LLC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 100%                                                                                    |                                                                         |
| <p>The owner(s) with percent interest listed above in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of prior patent number(s)</p> <p>11121222</p> <p>as the term of said prior patent is presently shortened by any terminal disclaimer. The owner hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the prior patent are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.</p> <p>In making the above disclaimer, the owner does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the prior patent, "as the term of said prior patent is presently shortened by any terminal disclaimer," in the event that said prior patent later:</p> <ul style="list-style-type: none"> <li>- expires for failure to pay a maintenance fee;</li> <li>- is held unenforceable;</li> <li>- is found invalid by a court of competent jurisdiction;</li> <li>- is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321;</li> <li>- has all claims canceled by a reexamination certificate;</li> <li>- is reissued; or</li> <li>- is in any manner terminated prior to the expiration of its full statutory term as presently shortened by any terminal disclaimer.</li> </ul> <p><input checked="" type="radio"/> Terminal disclaimer fee under 37 CFR 1.20(d) is included with Electronic Terminal Disclaimer request.</p> |                                                                                         |                                                                         |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| <input type="radio"/> I certify, in accordance with 37 CFR 1.4(d)(4), that the terminal disclaimer fee under 37 CFR 1.20(d) required for this terminal disclaimer has already been paid in the above-identified application.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |
| Applicant claims the following fee status:<br><br><input type="radio"/> Small Entity<br><br><input type="radio"/> Micro Entity<br><br><input checked="" type="radio"/> Regular Undiscounted                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |
| I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.                                                                                                                                                             |                                   |
| THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES<br><br>I certify, in accordance with 37 CFR 1.4(d)(4) that I am:<br><br><input checked="" type="radio"/> An attorney or agent registered to practice before the Patent and Trademark Office who is of record in this application<br><br>Registration Number <u>66850</u><br><br><input type="radio"/> A sole inventor<br><br><input type="radio"/> A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application<br><br><input type="radio"/> A joint inventor; all of whom are signing this request |                                   |
| Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | /William G. Howison, Reg. #66850/ |
| Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | William G. Howison                |

\*Statement under 37 CFR 3.73(b) is required if terminal disclaimer is signed by the assignee (owner).  
 Form PTO/SB/96 may be used for making this certification. See MPEP § 324.

## Electronic Patent Application Fee Transmittal

|                                                    |                                                  |                 |               |                             |
|----------------------------------------------------|--------------------------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                         | 17371839                                         |                 |               |                             |
| <b>Filing Date:</b>                                | 09-Jul-2021                                      |                 |               |                             |
| <b>Title of Invention:</b>                         | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>        | G.R. MOHAN RAO                                   |                 |               |                             |
| <b>Filer:</b>                                      | William G. Howison                               |                 |               |                             |
| <b>Attorney Docket Number:</b>                     | GRTD60-35314                                     |                 |               |                             |
| Filed as Large Entity                              |                                                  |                 |               |                             |
| <b>Filing Fees for Utility under 35 USC 111(a)</b> |                                                  |                 |               |                             |
| <b>Description</b>                                 | <b>Fee Code</b>                                  | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                               |                                                  |                 |               |                             |
| STATUTORY OR TERMINAL DISCLAIMER                   | 1814                                             | 1               | 170           | 170                         |
| <b>Pages:</b>                                      |                                                  |                 |               |                             |
| <b>Claims:</b>                                     |                                                  |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                       |                                                  |                 |               |                             |
| <b>Petition:</b>                                   |                                                  |                 |               |                             |
| <b>Patent-Appeals-and-Interference:</b>            |                                                  |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>           |                                                  |                 |               |                             |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 170                  |

Doc Code: DISQ.E.FILE

Document Description: Electronic Terminal Disclaimer – Approved

Application No.: 17371839

Filing Date: 09-Jul-2021

Applicant/Patent under Reexamination: RAO

Electronic Terminal Disclaimer filed on March 4, 2022

☒ APPROVED

**This patent is subject to a terminal disclaimer**

☐ DISAPPROVED

Approved/Disapproved by: Electronic Terminal Disclaimer automatically approved by EFS-Web

U.S. Patent and Trademark Office

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 45143893                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>                               | William G. Howison                               |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 04-MAR-2022                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 12:30:37                                         |
| <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 | \$ 170           |
| RAM confirmation Number                  | E202234C30322647 |
| Deposit Account                          | 500208           |
| Authorized User                          | William Howison  |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)  
37 CFR 1.21 (Miscellaneous fees and charges)

### File Listing:

| Document Number | Document Description                   | File Name                | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------------------------|--------------------------|------------------------------------------|------------------|------------------|
| 1               | Terminal Disclaimer-Filed (Electronic) | eTerminal-Disclaimer.pdf | 41402                                    | no               | 2                |
|                 |                                        |                          | 4d991e41980f21eb9155bf9068f5448b37bf6f71 |                  |                  |

### Warnings:

### Information:

|   |                      |              |                                          |    |   |
|---|----------------------|--------------|------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 38019                                    | no | 2 |
|   |                      |              | 8ce81bc4d9c0cfb1086a96d9c0b9a84fc97e97bf |    |   |

### Warnings:

### Information:

|                                     |       |
|-------------------------------------|-------|
| <b>Total Files Size (in bytes):</b> | 79421 |
|-------------------------------------|-------|

**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.**

#### New Applications Under 35 U.S.C. 111

**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

**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.**



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**United States Patent and Trademark Office**  
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www.uspto.gov

| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------|-------------|----------------------|---------------------|------------------|
| 17/371,839                 | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |
| 25883                      | 7590        | 02/28/2022           |                     |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | EXAMINER            |                  |
| P.O. Drawer 800889         |             |                      | ARORA, AJAY         |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | 2892                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                            |             |                      | 02/28/2022          | 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@appcoll.com



## DETAILED ACTION

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

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

### ***Double Patenting***

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on nonstatutory double patenting provided the reference application or patent either is shown to be commonly owned with the examined application, or claims an invention made as a

result of activities undertaken within the scope of a joint research agreement. See MPEP § 717.02 for applications subject to examination under the first inventor to file provisions of the AIA as explained in MPEP § 2159. See MPEP § 2146 *et seq.* for applications not subject to examination under the first inventor to file provisions of the AIA. A terminal disclaimer must be signed in compliance with 37 CFR 1.321(b).

The USPTO Internet website contains terminal disclaimer forms which may be used. Please visit [www.uspto.gov/patent/patents-forms](http://www.uspto.gov/patent/patents-forms). The filing date of the application in which the form is filed determines what form (e.g., PTO/SB/25, PTO/SB/26, PTO/AIA/25, or PTO/AIA/26) should be used. A web-based eTerminal Disclaimer may be filled out completely online using web-screens. An eTerminal Disclaimer that meets all requirements is auto-processed and approved immediately upon submission. For more information about eTerminal Disclaimers, refer to [www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp](http://www.uspto.gov/patents/process/file/efs/guidance/eTD-info-I.jsp).

3. Claims 1-30 are rejected on the ground of nonstatutory double patenting as being unpatentable over claims 1-30 of U.S. Patent No. US 11121222. Although the claims at issue are not identical, they are not patentably distinct from each other because the claims of the current application are only different in that they claim "An electronic system, the system comprising at least one semiconductor device, the at least one semiconductor device including.." (see, for example, base claims 1 and 21) compared to claims 1-30 of U.S. Patent No. 11121222 (see for example, base claims 1 and 21), which claims a specific type of electronic system that comprises at least one semiconductor device; i.e. a VLSI semiconductor device. Thus, claims 1-30 of the

current application are broader in scope compared to the corresponding claims 1-30 of U.S. Patent No. 11121222, as explained above, but are otherwise similar.

### ***Art Based Rejection***

4. No art based rejection has been provided, as the prior art does not teach or suggest the features of claims 1-30. The closest prior art is Hong (US 2007/0045682), hereinafter Hong, especially see Figures 4A-4D and 5A-5C and para 26-32 (as also explained in Notice of Allowance of 8/11/2021 for parent application 16/947,294).

### ***Conclusion***

5. 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.

6. 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 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 published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center, visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AJAY ARORA/  
Primary Examiner, Art Unit 2892

|                                                                                                          |                                              |                                                                   |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Search Notes</b><br> | <b>Application/Control No.</b><br>17/371,839 | <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 - Searched* |            |          |
|-----------------|------------|----------|
| Symbol          | Date       | Examiner |
| H01L 29/1095    | 10/23/2021 | AKA      |

| CPC Combination Sets - Searched* |      |          |
|----------------------------------|------|----------|
| Symbol                           | Date | Examiner |
|                                  |      |          |

| US Classification - Searched* |          |            |          |
|-------------------------------|----------|------------|----------|
| Class                         | Subclass | Date       | Examiner |
| 257                           | 25       | 10/23/2021 | AKA      |

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

| Search Notes                                                                                                      |            |          |
|-------------------------------------------------------------------------------------------------------------------|------------|----------|
| Search Notes                                                                                                      | Date       | Examiner |
| Inventor search                                                                                                   | 10/23/2021 | AKA      |
| Assignee search                                                                                                   | 10/23/2021 | AKA      |
| References for all parent applications (10/934,915; 11/622,496; 15/590,282; 16/717,950 and 16/947,294) considered | 10/23/2021 | AKA      |
| .clm. interference search                                                                                         | 10/23/2021 | AKA      |
| EAST search history report                                                                                        | 10/23/2021 | AKA      |
| Revised EAST search history report                                                                                | 02/23/2022 | AKA      |

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

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

| Interference Search |                       |            |          |
|---------------------|-----------------------|------------|----------|
| US Class/CPC Symbol | US Subclass/CPC Group | Date       | Examiner |
| H01L                | 29/1095               | 10/23/2021 | AKA      |
| 257                 | 25                    | 10/23/2021 | AKA      |

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

|                                                                                                                    |                                              |                                                                   |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <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>Rejected</b> | - | <b>Cancelled</b>  | N | <b>Non-Elected</b>  | A | <b>Appeal</b>   |
| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

| CLAIMS                                                                                                                                                                            |          |            |            |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|------------|--|--|--|--|--|--|--|
| <input 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 |          |            |            |  |  |  |  |  |  |  |
| CLAIM                                                                                                                                                                             |          | DATE       |            |  |  |  |  |  |  |  |
| Final                                                                                                                                                                             | Original | 10/23/2021 | 02/23/2022 |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 1        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 2        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 3        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 4        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 5        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 6        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 7        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 8        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 9        | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 10       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 11       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 12       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 13       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 14       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 15       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 16       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 17       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 18       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 19       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 20       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 21       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 22       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 23       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 24       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 25       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 26       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 27       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 28       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 29       | ✓          | ✓          |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 30       | ✓          | ✓          |  |  |  |  |  |  |  |

## PE2E SEARCH - Search History (Prior Art)

| Ref # | Hits | Search Query                                                                                              | DBs                                                                                                                                                                                                                                                                                                                  | Default Operator | Plurals | British Equivalents | Time Stamp          |
|-------|------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------|---------------------|---------------------|
| L34   | 3    | 16/947,294                                                                                                | (US-PGPUB; USPAT; USOCR; FIT (AU, AP, AT, BE, BG, BR, BY, CA, CH, CN, CS, CU, CZ, DD, DE, DK, EA, EE, EP, ES, FI, FR, GB, HR, HU, ID, IE, IL, IS, IT, JP, KR, LT, LU, LV, MA, OA, RU, SU, WO, MC, MD, MY, NL, NO, NZ, PH, PL, PT, RO, RS, SE, SG, SI, SK, TH, TN, TR, TW, UA, VN); FPRS; EPO; JPO; DERWENT; IBM_TDB) | OR               | ON      | ON                  | 2022/02/23 11:02 PM |
| L35   | 544  | (source drain source\$1drain) AND drift AND ((gradient graded) near2 concentration near2 dop\$3) AND well | (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB)                                                                                                                                                                                                                                                           | OR               | OFF     | OFF                 | 2022/02/23 11:22 PM |

## PE2E SEARCH - Search History (Interference)

There are no Interference searches to show.



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|----------------------------|-------------|----------------------|---------------------|------------------|
| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 17/371,839                 | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |
| 25883                      | 7590        | 01/31/2022           |                     |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | EXAMINER            |                  |
| P.O. Drawer 800889         |             |                      | ARORA, AJAY         |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | 2892                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                            |             |                      | 01/31/2022          | 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):

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UNITED STATES PATENT AND TRADEMARK OFFICE

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In re Application of :  
RAO, G.R. MOHAN :  
Application No. 17/371,839 : **DECISION ON PETITION**  
Filed: 9 Jul 2021 :  
For: SEMICONDUCTOR DEVICES WITH :  
GRADED DOPANT REGIONS :

This is a decision on the petition under 37 CFR 1.182 filed October 19, 2021, to expunge an assignment previously recorded against the above-identified application. In particular, the petitioner requests that Assignment 2, i.e., from Greenthread, LLC to Vervain, LLC be expunged.

The petition to expunge the assignment documents is **DISMISSED**. This is not a final agency action.

As discussed in the *Manual of Patent Examining Procedure* (MPEP) § 323.01(d), petitions to correct, modify or "expunge" assignment records are **rarely** granted. Such petitions are granted only if the petitioner can prove that:

- (A) the normal corrective procedures outlined in MPEP § 323.01(a) through § 323.01(c) will not provide the petitioner with adequate relief; and
- (B) the integrity of the assignment records will not be affected by granting the petition.

The petition has not proven either item (A) or (B).

In regard to item (A), petitioner asserts that the corrective procedures outlined in MPEP § 323.01(a) through § 323.01(c) will not provide adequate relief. In particular, petitioner argues that MPEP § 323.01(a) and (b) do not apply because the recordation error is not a typographical error and matches the cover sheet. Further, petitioner argues that MPEP § 323.01(c) does not apply because the assignment was not improperly filed and recorded by another person against the above-identified application. These arguments are not persuasive as the corrective procedures outlined in MPEP § 323.01(a) through § 323.01(c) are not limited to only minor or typographical errors in filing. A corrective document may be recorded as set forth below.

Furthermore, in regard to item (B), petitioner contends that the integrity of the assignment records will not be affected by the desired expungement. However, the removal of a document in its entirety, as requested, will affect the assignment records. The integrity of the records is recognized as separate from the chain of title. Expungement would prevent the records from being searchable in the Assignment Historical Database or otherwise available to the public, which may be necessary for a competent authority to determine the proper chain of title. Moreover, the expungement requested involves a validity determination by the USPTO regarding the information to be expunged, which may impact ownership claims on the related patent. The USPTO, however, has no authority to decide ownership issues. *See Cedars-Sinai Medical Center v. Watkins*, 11F.3d 1573, 1581 n.10, 29 USPQ 2d 1188, 1194 n.10 (Fed. Cir. 1993), *cert. denied*, 114 S. Ct. (1994). Rather, state law governs contractual obligations, including patent assignment agreements. *See Intellectual Ventures I LLC v. Erie Indem. Co.*, 121 USPQ2d 1928, 1930 (Fed. Cir. 2017); *In re Haines*, 1900 C.D. 102, 103 (Comm'r Pat. 1900). While the ownership of patent rights is typically a question exclusively for state courts, the question of whether contractual language effects a present assignment agreement of patent rights, or an agreement to assign rights in the future, is resolved by Federal Circuit law. *See Abraxis Bioscience Inc. v. Navinta LLC*, 96 USPQ2d 1977, 1981 (Fed. Cir. 2010); *Speedplay, Inc. v. Bebbo, Inc.*, 211 F.3d 1245, 1253 [53USPQ2d 1984] (Fed. Cir. 2000).

35 U.S.C. § 261 provides the USPTO with only the limited authority to maintain the assignment records, and does not grant the USPTO with the authority to remove documents.

Petitioner should note that, as discussed in MPEP § 323.01(d),

“Even if a petition to “expunge” a document is granted with respect to a particular application or patent, the image of the recorded document will remain in the records of the Assignment Services Division at the same reel and frame number, and the image will appear when someone views that reel and frame number.”

In the context of the assignment records, “expunge” does not mean that a document will be removed in its entirety. Rather, “expunge” means that a document containing sensitive information, such as a Social Security Number, may be replaced in the electronically searchable records with a redacted copy of the same document. The original document will remain in the assignment records at the reel/frame number given without redaction. Through “expungement,” the electronic links between the document and the application will be deleted so the original document is no longer available through an electronic search.

As background, the USPTO simply acts in a ministerial capacity in recording documents that have been submitted for recordation. *See* 35 USC 261 and 37 CFR 3.11. However, the recording of a document pursuant to 37 CFR 3.11 is **not** a determination by the USPTO of the validity of the document *per se* or the effect that document has on the title to a patent or application. *See* 37 CFR 3.54. Moreover, it is USPTO policy to maintain a complete history of claimed interests in a

given property, and, as such, a recorded assignment document will be retained, even if it is subsequently found to be invalid. *In re Raney*, 24 USPQ2d 1713 (Comm'r Pat. 1992).

Here, petitioner seeks an extraordinary remedy, properly addressed under 37 CFR 1.182. The USPTO will not normally resort to an extraordinary remedy under 37 CFR 1.182 if the rules of practice and the procedures before the USPTO already provide an avenue for the requested relief. *See Cantello v. Rasmussen*, 220 USPQ 664, (Comm'r Pat. 1982).

As set forth in MPEP § 323, an error in a recorded assignment is not corrected by expunging the previous document, but by simply submitting a “corrective document” that explains the nature of the recorded document so as to clarify the assignment records. “Corrective documents” are not limited to assignments, but include any documents affecting title to a patent or application. *See* MPEP § 313. This would include an explanation of the recorded document so as to clarify the assignment records. The new recordation form cover sheet must identify the submission as a “corrective document” submission and indicate the reel and frame number where the incorrectly recorded assignment document appears. The corrective document will be recorded and given a new reel and frame number and recording date. The recording fee set forth in 37 CFR 1.21(h) is required for each patent application and patent against which the corrective document is being recorded. *See* MPEP § 302.06.

Therefore, the rules of practice and the procedures before the USPTO provide an avenue for the requested relief without relying upon extraordinary measures. As a request for the Office to invalidate an assignment is both extraordinary and contrary to USPTO policy, this petition must be dismissed.

Telephone inquiries concerning this communication should be directed to Katherine Zalasky McDonald at (571) 270-7064.

/Christopher Bottorff/

Christopher Bottorff  
Petitions Examiner  
Office of Petitions

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>17/371,839 | Filing Date<br>07/09/2021 | <input type="checkbox"/> To be Mailed |
|-----------------------------------------------------------------------------------|--------------------------------------------|---------------------------|---------------------------------------|

**ENTITY:** ☒ LARGE ☐ SMALL ☐ MICRO

**APPLICATION AS FILED - PART I**

| FOR                                                                        | (Column 1)<br>NUMBER FILED                                                                                                                                                                                                    | (Column 2)<br>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), (i), 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 \$100 = |          |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                     | minus 3 =                                                                                                                                                                                                                     | *                          | x \$480 = |          |
| <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     |          |

**APPLICATION AS AMENDED - PART II**

|                                                                                                                                 |                                                                                          | (Column 1)                       |       | (Column 2)                         | (Column 3)    | RATE (\$)       | ADDITIONAL FEE (\$) |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------|-------|------------------------------------|---------------|-----------------|---------------------|
| <b>AMENDMENT</b>                                                                                                                | 12/01/2021                                                                               | CLAIMS REMAINING AFTER AMENDMENT |       | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA |                 |                     |
|                                                                                                                                 | Total<br>(37 CFR 1.16(i))                                                                | * 30                             | Minus | ** 30                              | = 0           | x \$100 =       | 0                   |
|                                                                                                                                 | Independent<br>(37 CFR 1.16(h))                                                          | * 2                              | Minus | *** 3                              | = 0           | x \$480 =       | 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>                                                                                                                |                                                                                          | 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".                                       |                                                                                          |                                  |       |                                    |               | /TINA M. BELL/  |                     |
| *** 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.*

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

In re application of: G.R. MOHAN RAO  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2892  
Examiner: Ajay ARORA  
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 October 28, 2021.  
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 7 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) An electronic system ~~VLSI semiconductor device~~, the system comprising:

at least one semiconductor device, the at least one semiconductor device including:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface with a second doping type opposite in conductivity to the first doping type and within which 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 can be formed;

transistors formed in at least one of the first active region or second active region;

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 and second active regions towards an area of the substrate where there are no active regions; and

at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface towards the area of the substrate where there are no active regions, wherein at least some of the transistors form digital logic of the ~~[[VLSI]]~~ semiconductor device.

2. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the substrate of the at least one semiconductor device is a p-type substrate.

3. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the substrate of the at least one semiconductor device has epitaxial silicon on top of a nonepitaxial substrate.
4. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the first active region and second active region of the at least one semiconductor device contain digital logic formed by one of either p-channel and n-channel devices.
5. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the first active region and second active region of the at least one semiconductor device contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has at least one graded dopant.
6. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the first active region and second active region of the at least one semiconductor device are each separated by at least one isolation region.
7. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the graded dopant is fabricated with an ion implantation process.
8. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein the first and second active regions of the at least one semiconductor device are formed adjacent the first surface of the substrate of the at least one semiconductor device.
9. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein dopants of the graded dopant concentration in the first active region or the second active region of the at least one semiconductor device are either p-type or n-type.
10. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein dopants of the graded dopant concentration in the first active region of the at least one semiconductor device are both p-type and n-type.

11. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant concentration in the second active region of the at least one semiconductor device are both p-type and n-type.
12. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant region in the well region of the at least one semiconductor device are both p-type and n-type.
13. (Currently amended) The system VLSI semiconductor device of claim 1, wherein the transistors which can be formed in the first and second active regions of the at least one semiconductor device are CMOS digital logic transistors requiring at least a source, a drain, a gate and a channel.
14. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device is a dynamic random access memory (DRAM).
15. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device is a complementary metal oxide semiconductor (CMOS) with a nonepitaxial substrate.
16. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device is a flash memory.
17. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device comprises digital logic and capacitors.
18. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device is a central processing unit.
19. (Currently amended) The system VLSI semiconductor device of Claim 1, wherein the at least one semiconductor device is an image sensor.

20. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 1, wherein each of the first and second active regions of the at least one semiconductor device are in the lateral or vertical direction.

21. (Currently amended) An electronic system ~~VLSI semiconductor device~~, comprising:  
at least one semiconductor device, the at least one semiconductor device including:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface of the substrate with a  
5 second doping type opposite in conductivity to the first doping type and within  
which 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 transistors can be formed in the  
surface thereof;

10 transistors formed in at least one of the first active region or second active  
region;

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 an area of the substrate where there are no active regions; and

15 at least one well region adjacent to the first or second active region  
containing at least one graded dopant region, the graded dopant region to aid carrier  
movement from the surface to the area of the substrate where there are no active  
regions, and wherein the graded dopant concentration is linear, quasilinear, error  
function, complementary error function, or any combination thereof.

22. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the  
substrate of the at least one semiconductor device is an n-type substrate.

23. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the  
substrate of the at least one semiconductor device is a p-type substrate.

24. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the substrate of the at least one semiconductor device has epitaxial silicon on top of a nonepitaxial substrate.
25. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the first active region and second active region of the at least one semiconductor device contain at least one of either p-channel and n-channel devices.
26. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the first active region and second active region of the at least one semiconductor device contain either p-channel or n-channel devices in n-wells or p-wells, respectively, and each well has at least one graded dopant.
27. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein the first active region and second active region of the at least one semiconductor device are each separated by at least one isolation region.
28. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein dopants of the graded dopant concentration in the first active region or the second active region of the at least one semiconductor device are either p-type or n-type.
29. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein dopants of the graded dopant concentration in the first active region of the at least one semiconductor device are both p-type and n-type.
30. (Currently amended) The system ~~VLSI semiconductor device~~ of Claim 21, wherein dopants of the graded dopant concentration in the second active region of the at least one semiconductor device are both p-type and n-type.

## **REMARKS**

Applicant has carefully reviewed the Office Action dated October 28, 2021. Applicant has amended Claims 1-30 to more clearly point out the present inventive concept. The amendments are supported by the specification as filed, such as in paragraph [0002]. No new matter has been added. Reconsideration and favorable action is respectfully requested.

Claims 1-30 were provisionally rejected under 35 U.S.C. § 101 as claiming the same invention as that of Claims 1-30 of co-pending Application No. 16/947,294 (“‘294” Application”). This rejection is respectfully traversed.

A reliable test for double patenting under 35 U.S.C. § 101 is whether a claim in the application could be literally infringed without literally infringing a corresponding claim in the patent. *See* MPEP § 804. Although a terminal disclaimer is not effective in overcoming a statutory double patenting rejection, the claims may be cancelled or amended so that they are not coextensive in scope. *Id.*

Applicant submits that Claims 1-30, as amended herein, are not coextensive in scope with the ‘294 Application. Accordingly, Applicant respectfully requests that the provisional double patenting rejection be withdrawn.

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 [whowison@munckwilson.com](mailto:whowison@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. 50-0208/GRTD60-35314.

Respectfully submitted,  
MUNCK WILSON MANDALA, LLP  
Attorneys for Applicant

/William G. Howison, Reg. #66850/

William G. Howison  
Registration No. 66,850

WGH/als

P.O. Drawer 800889  
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Fax: 972-628-3616  
December 1, 2021

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 44406378                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>                               | William G. Howison                               |
| <b>Filer Authorized By:</b>                 |                                                  |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 01-DEC-2021                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 19:00:40                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

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### File Listing:

| Document Number | Document Description | File Name       | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------|-----------------|------------------------------------------|------------------|------------------|
| 1               |                      | GRT35314AMD.pdf | 123821                                   | yes              | 8                |
|                 |                      |                 | 6ce164b4363ce2aead4fe55db6433770dad9b708 |                  |                  |

| Multipart Description/PDF files in .zip description   |       |     |  |
|-------------------------------------------------------|-------|-----|--|
| Document Description                                  | Start | End |  |
| Amendment/Req. Reconsideration-After Non-Final Reject | 1     | 1   |  |
| Claims                                                | 2     | 6   |  |
| Applicant Arguments/Remarks Made in an Amendment      | 7     | 8   |  |

**Warnings:**

**Information:**

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**New Applications Under 35 U.S.C. 111**  
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**  
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.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 17/371,839         | 07/09/2021            | G.R. MOHAN RAO        | GRTD60-35314           |

**CONFIRMATION NO. 2197**

25883  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

## PUBLICATION NOTICE



\*OC000000129896952\*

**Title:** SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

**Publication No.** US-2021-0359086-A1

**Publication Date:** 11/18/2021

## NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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|----------------------------|-------------|----------------------|---------------------|------------------|
| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
| 17/371,839                 | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |
| 25883                      | 7590        | 10/28/2021           |                     |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | EXAMINER            |                  |
| P.O. Drawer 800889         |             |                      | ARORA, AJAY         |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | 2892                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                            |             |                      | 10/28/2021          | 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):

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admin@dalpat.com  
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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.

### ***Double Patenting***

2. A rejection based on double patenting of the “same invention” type finds its support in the language of 35 U.S.C. 101 which states that “whoever invents or discovers any new and useful process... may obtain a patent therefor...” (Emphasis added). Thus, the term “same invention,” in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the claims that are directed to the same invention so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

3. Claims 1-30, respectively, are provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-30, respectively, of copending Application No. 16/947,294 (reference application). This is a provisional statutory double patenting rejection since the claims directed to the same invention have not in fact been

patented (although a Notice of Allowance for application 16/947,294 dated 8/11/2021 has been issued, a patent has not yet been issued).

### ***Art Based Rejection***

4. No art based rejection has been provided, as the prior art does not teach or suggest the features of claims 1-30. The closest prior art is Hong (US 2007/0045682), hereinafter Hong, especially see Figures 4A-4D and 5A-5C and para 26-32 (as also explained in Notice of Allowance of 8/11/2021 for parent application 16/947,294).

### ***Conclusion***

5. 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 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 published or unpublished applications may be obtained from Patent Center. Unpublished application information in Patent Center is available to registered users. To file and manage patent submissions in Patent Center,

visit: <https://patentcenter.uspto.gov>. Visit <https://www.uspto.gov/patents/apply/patent-center> for more information about Patent Center and <https://www.uspto.gov/patents/docx> for information about filing in DOCX format. For additional questions, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AJAY ARORA/  
Primary Examiner, Art Unit 2892

|                                          |                                       |  |                                                               |             |
|------------------------------------------|---------------------------------------|--|---------------------------------------------------------------|-------------|
| <b><i>Notice of References Cited</i></b> | Application/Control No.<br>17/371,839 |  | Applicant(s)/Patent Under<br>Reexamination<br>RAO, G.R. MOHAN |             |
|                                          | Examiner<br>AJAY ARORA                |  | Art Unit<br>2892                                              | Page 1 of 1 |

**U.S. PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Name              | CPC Classification | US Classification |
|---|---|--------------------------------------------------|-----------------|-------------------|--------------------|-------------------|
| * | A | US-20070045682-A1                                | 03-2007         | Hong; Sungkwon C. | H01L27/14689       | 257/292           |
| * | B | US-20140034997-A1                                | 02-2014         | RAHIMO; Munaf     | H01L29/861         | 257/139           |
|   | C |                                                  |                 |                   |                    |                   |
|   | D |                                                  |                 |                   |                    |                   |
|   | E |                                                  |                 |                   |                    |                   |
|   | F |                                                  |                 |                   |                    |                   |
|   | G |                                                  |                 |                   |                    |                   |
|   | H |                                                  |                 |                   |                    |                   |
|   | I |                                                  |                 |                   |                    |                   |
|   | J |                                                  |                 |                   |                    |                   |
|   | K |                                                  |                 |                   |                    |                   |
|   | L |                                                  |                 |                   |                    |                   |
|   | M |                                                  |                 |                   |                    |                   |

**FOREIGN PATENT DOCUMENTS**

| * |   | Document Number<br>Country Code-Number-Kind Code | Date<br>MM-YYYY | Country | Name | CPC Classification |
|---|---|--------------------------------------------------|-----------------|---------|------|--------------------|
|   | N |                                                  |                 |         |      |                    |
|   | O |                                                  |                 |         |      |                    |
|   | P |                                                  |                 |         |      |                    |
|   | Q |                                                  |                 |         |      |                    |
|   | R |                                                  |                 |         |      |                    |
|   | S |                                                  |                 |         |      |                    |
|   | T |                                                  |                 |         |      |                    |

**NON-PATENT DOCUMENTS**

| * |   | Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages) |
|---|---|-------------------------------------------------------------------------------------------|
|   | U |                                                                                           |
|   | V |                                                                                           |
|   | W |                                                                                           |
|   | X |                                                                                           |

\*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)  
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

|                                                                                                          |                                              |                                                                   |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b>Search Notes</b><br> | <b>Application/Control No.</b><br>17/371,839 | <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 - Searched* |            |          |
|-----------------|------------|----------|
| Symbol          | Date       | Examiner |
| H01L 29/1095    | 10/23/2021 | AKA      |

| CPC Combination Sets - Searched* |      |          |
|----------------------------------|------|----------|
| Symbol                           | Date | Examiner |
|                                  |      |          |

| US Classification - Searched* |          |            |          |
|-------------------------------|----------|------------|----------|
| Class                         | Subclass | Date       | Examiner |
| 257                           | 25       | 10/23/2021 | AKA      |

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

| Search Notes                                                                                                    |            |          |
|-----------------------------------------------------------------------------------------------------------------|------------|----------|
| Search Notes                                                                                                    | Date       | Examiner |
| Inventor search                                                                                                 | 10/23/2021 | AKA      |
| Assignee search                                                                                                 | 10/23/2021 | AKA      |
| References for all parent applications (10/934,915; 11/622,496; 15/590,282; 16/717950 and 16/947294) considered | 10/23/2021 | AKA      |
| .clm. interference search                                                                                       | 10/23/2021 | AKA      |
| EAST search history report                                                                                      | 10/23/2021 | AKA      |

| Interference Search |                       |            |          |
|---------------------|-----------------------|------------|----------|
| US Class/CPC Symbol | US Subclass/CPC Group | Date       | Examiner |
| H01L                | 29/1095               | 10/23/2021 | AKA      |
| 257                 | 25                    | 10/23/2021 | AKA      |

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

|                                                                                                                 |                                              |                                                                   |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Search Notes</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <b>Applicant(s)/Patent Under Reexamination</b><br>RAO, G.R. MOHAN |
|                                                                                                                 | <b>Examiner</b><br>AJAY ARORA                | <b>Art Unit</b><br>2892                                           |

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

|                                                                                                                    |                                              |                                                                   |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------------|
| <b><i>Index of Claims</i></b><br> | <b>Application/Control No.</b><br>17/371,839 | <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>Rejected</b> | - | <b>Cancelled</b>  | N | <b>Non-Elected</b>  | A | <b>Appeal</b>   |
| = | <b>Allowed</b>  | ÷ | <b>Restricted</b> | I | <b>Interference</b> | O | <b>Objected</b> |

| CLAIMS                                                                                                                                                                            |          |            |  |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|--|--|--|--|--|--|--|--|
| <input 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 |          |            |  |  |  |  |  |  |  |  |
| CLAIM                                                                                                                                                                             |          | DATE       |  |  |  |  |  |  |  |  |
| Final                                                                                                                                                                             | Original | 10/23/2021 |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 1        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 2        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 3        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 4        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 5        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 6        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 7        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 8        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 9        | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 10       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 11       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 12       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 13       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 14       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 15       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 16       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 17       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 18       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 19       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 20       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 21       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 22       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 23       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 24       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 25       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 26       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 27       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 28       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 29       | ✓          |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                   | 30       | ✓          |  |  |  |  |  |  |  |  |

## EAST Search History

### EAST Search History (Prior Art)

| Ref # | Hits   | Search Query                                                                                            | DBs                                                                        | Default Operator | Plurals | Time Stamp          |
|-------|--------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------|---------------------|
| L2    | 574    | (source drain source/drain) and drift and ((gradient graded) near2 concentration near2 dop\$3) and well | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2021/10/23<br>15:37 |
| L3    | 574    | L2                                                                                                      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2021/10/23<br>15:37 |
| L4    | 1      | ("9647070").PN.                                                                                         | US-PGPUB;<br>USPAT                                                         | OR               | OFF     | 2021/10/23<br>16:21 |
| L5    | 1      | ("6384431").PN.                                                                                         | US-PGPUB;<br>USPAT                                                         | OR               | OFF     | 2021/10/23<br>16:21 |
| S1    | 0      | 17/371,839                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | OFF     | 2021/10/23<br>10:17 |
| S2    | 31     | ((("GREENTHREAD") near3 ("LLC"))).AS,AANM.                                                              | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2021/10/23<br>10:18 |
| S3    | 29     | ((("RAO") near3 ("G.R") near3 ("MOHAN"))).INV.                                                          | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR               | ON      | 2021/10/23<br>10:19 |
| S4    | 30,065 | H01L29/1095.cpc.                                                                                        | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;                                | OR               | OFF     | 2021/10/23<br>10:19 |

|     |     |                                                                                                                                                                                                                                                                                                                                                                                           |                                                                            |    |     |                     |
|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |     |                                                                                                                                                                                                                                                                                                                                                                                           | JPO;<br>DERWENT;<br>IBM_TDB                                                |    |     |                     |
| S5  | 669 | (257/25).CCLS.                                                                                                                                                                                                                                                                                                                                                                            | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:19 |
| S6  | 56  | ("20010028097"   "20020195656"  <br>"20030183856"   "20070045682"  <br>"20080142899"   "20140034997"  <br>"20170243876"   "4160985"  <br>"4684971"   "4688063"   "4907058"  <br>"4994887"   "5835402"   "6025237"  <br>"6384431"   "6465862").PN.                                                                                                                                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>10:20 |
| S7  | 29  | ("5448087"   "5888857"  <br>"20030030488"   "6720622"  <br>"20030026126"   "5973575"  <br>"5262345"   "20040027753").PN.                                                                                                                                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:20 |
| S8  | 12  | (US-20040027753-\$ or US-<br>20030030488-\$ or US-20140034997-\$<br>or US-20060049464-\$ or US-<br>20030026126-\$ or US-20070181927-\$<br>or US-20070045682-\$).did. or (US-<br>5973575-\$ or US-5262345-\$ or US-<br>5448087-\$ or US-6720622-\$ or US-<br>5888857-\$).did.                                                                                                              | US-PGPUB;<br>USPAT                                                         | OR | ON  | 2021/10/23<br>10:21 |
| S9  | 47  | ("20020056883"   "20020084430"  <br>"20020102783"   "20030042511"  <br>"4160985"   "5637898"   "5517052"  <br>"4481522"   "6831292"  <br>"20020093281"   "5029277"  <br>"20060113592"   "20020134419").PN.                                                                                                                                                                                | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:22 |
| S10 | 118 | ("20020074585"   "5496746"  <br>"6683343"   "6696314"   "6452086"  <br>"6472715"   "6747883"   "5797999"  <br>"6670544"   "20040063288"  <br>"4347654"   "4866000"   "6744117"  <br>"6754093"   "5213988"   "5569612"  <br>"RE37441"   "4001864"   "6756616"  <br>"5130262"   "5329144"   "6706550"  <br>"6753202"   "5480816"   "6713813"  <br>"6737722"   "5575862"  <br>"6211028").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:23 |

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|-----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
| S11 | 255 | (<br>"20020102783"   "20030026126"  <br>"20030030488"   "6211028"  <br>"6310366"   "6753202"   "7115925"  <br>"8164124"   "6878603"  <br>"20020056883"   "20020093281"  <br>"20150200314"   "4347654"  <br>"5496746"   "6452086"   "6737722"  <br>"6747883"   "6780713"  <br>"20030042511"   "5029277"  <br>"5888857"   "6670544"   "6706550"  <br>"6713813"   "6921943"   "7504692"  <br>"20040027753"   "4160985"  <br>"5448087"   "6472715"   "6683343"  <br>"6831292"   "7307327"   "5569612"  <br>"5575862"   "5637898"   "6720622"  <br>"6744117"   "20070045682"  <br>"20020134419"   "20060113592"  <br>"20130001661"   "4481522"  <br>"5262345"   "6756616"   "6933215"  <br>"7233044"   "20010040622"  <br>"20020074585"   "5130262"  <br>"5213988"   "5329144"   "6465862"  <br>"6696314"   "RE37441"  <br>"20020084430"   "4001864"  <br>"4866000"   "5480816"   "5517052"  <br>"5797999"   "5973575"   "6754093"  <br>"7064385"   "20120048462").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:58 |
| S12 | 271 | (<br>"20020102783"   "20020134419"  <br>"20070045682"   "6310366"  <br>"RE37441"   "20040027753"  <br>"20120048462"   "4160985"  <br>"4347654"   "5213988"   "5575862"  <br>"8164124"   "20130001661"  <br>"5329144"   "5496746"   "5569612"  <br>"5637898"   "5973575"   "6211028"  <br>"6683343"   "6696314"   "6713813"  <br>"6754093"   "7064385"  <br>"20030030488"   "20070045682"  <br>"4481522"   "6753202"  <br>"20020056883"   "20020084430"  <br>"20020093281"   "20030026126"  <br>"20030042511"   "4001864"  <br>"5130262"   "5262345"   "5448087"  <br>"6472715"   "6670544"   "6720622"  <br>"6780713"   "6921946"   "10510842"  <br>"20010040622"   "20020074585"  <br>"6465862"   "6747883"   "7233044"  <br>"7307327"   "20030030488"  <br>"20040063288"   "20060113592"  <br>"20150200314"   "4866000"  <br>"5029277"   "5480816"   "5517052"  <br>"5797999"   "6452086"   "6706550"                                                           | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>10:59 |

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|     |     | "6737722"   "6831292"   "6878603"  <br>"7115925"   "9190502"   "9647070"  <br>"5888857"   "6744117"   "6756616"  <br>"6933215"   "7504692"  <br>"8421195").PN.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                            |    |     |                     |
| S13 | 316 | ("20020102783"   "20020134419"  <br>"20070045682"   "6310366"  <br>"RE37441"   "4907058"  <br>"20040027753"   "20080142899"  <br>"20120048462"   "4160985"  <br>"4347654"   "5213988"   "5575862"  <br>"8164124"   "20010028097"  <br>"4994887"   "6025237"  <br>"20130001661"   "5329144"  <br>"5496746"   "5569612"   "5637898"  <br>"5973575"   "6211028"   "6683343"  <br>"6696314"   "6713813"   "6754093"  <br>"7064385"   "20140034997"  <br>"10734481"   "4481522"   "6753202"  <br>"20020195656"   "20030183856"  <br>"20020056883"   "20020084430"  <br>"20020093281"   "20030026126"  <br>"20030042511"   "4001864"  <br>"5130262"   "5262345"   "5448087"  <br>"6472715"   "6670544"   "6720622"  <br>"6780713"   "6921946"  <br>"20170243876"   "5835402"  <br>"20070045682"   "10510842"  <br>"20010040622"   "20020074585"  <br>"20030183856"   "4684971"  <br>"6465862"   "6747883"   "7233044"  <br>"7307327"   "4688063"  <br>"20030030488"   "20040063288"  <br>"20060113592"   "20150200314"  <br>"4866000"   "5029277"   "5480816"  <br>"5517052"   "5797999"   "6452086"  <br>"6706550"   "6737722"   "6831292"  <br>"6878603"   "7115925"   "9190502"  <br>"9647070"   "20080142899"  <br>"6384431"   "5888857"   "6744117"  <br>"6756616"   "6933215"   "7504692"  <br>"8421195").PN. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:00 |
| S14 | 319 | S7 S9 S10 S11 S12 S13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:01 |
| S15 | 10  | S3 and drift                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US-PGPUB;<br>USPAT;                                                        | OR | OFF | 2021/10/23<br>11:02 |

|     |        |                                                                                                               |                                                                            |    |     |                     |
|-----|--------|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |        |                                                                                                               | USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB                        |    |     |                     |
| S16 | 14     | S2 and drift                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:02 |
| S17 | 574    | (source drain source/drain) and drift<br>and ((gradient graded) near2<br>concentration near2 dop\$3) and well | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:03 |
| S18 | 25,930 | H01L27/11521.cpc.                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:03 |
| S19 | 14,669 | H01L27/11524.cpc.                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:04 |
| S20 | 29,711 | H01L27/14643.cpc.                                                                                             | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:04 |
| S21 | 11,836 | H01L29/36.cpc.                                                                                                | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:04 |
| S22 | 13,097 | H01L29/7395.cpc.                                                                                              | US-PGPUB;<br>USPAT;<br>USOCR;                                              | OR | ON  | 2021/10/23<br>11:04 |

|     |    |                                                                                                                                                                     |                                                                            |    |     |                     |
|-----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----|-----|---------------------|
|     |    |                                                                                                                                                                     | FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB                                  |    |     |                     |
| S23 | 18 | S4 and S18 and S21                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:08 |
| S24 | 18 | S4 and S18 and S20                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:10 |
| S25 | 18 | S4 and S19 and S20                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:10 |
| S26 | 66 | S4 and S19 and S21                                                                                                                                                  | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | ON  | 2021/10/23<br>11:10 |
| S27 | 2  | ((source drain "source/drain" active)<br>and drift and ((gradient graded) near2<br>concentration near2 dop\$3) and well<br>and ((no near2 active) (inactive))).clm. | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:11 |
| S28 | 32 | ((source drain "source/drain" active)<br>and drift and ((gradient graded) near2<br>concentration near2 dop\$3) and well<br>and ((no near2 active) (inactive)))      | US-PGPUB;<br>USPAT;<br>USOCR;<br>FPRS; EPO;<br>JPO;<br>DERWENT;<br>IBM_TDB | OR | OFF | 2021/10/23<br>11:13 |

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Doc code: IDS

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Doc description: Information Disclosure Statement (IDS) Filed

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

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|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

| U.S.PATENTS       |         |               |                        |            |                                                 | <a href="#">Remove</a>                                                 |
|-------------------|---------|---------------|------------------------|------------|-------------------------------------------------|------------------------------------------------------------------------|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
| /A.A/             | 1       | 4160985       | A                      | 1979-07-10 | Kamins et al.                                   |                                                                        |
| /A.A/             | 2       | 4684971       | A                      | 1987-08-04 | Payne                                           |                                                                        |
| /A.A/             | 3       | 4688063       | A                      | 1987-08-18 | Lu et al.                                       |                                                                        |
| /A.A/             | 4       | 4907058       | A                      | 1990-03-06 | Sakai                                           |                                                                        |
| /A.A/             | 5       | 4994887       | A                      | 1991-02-19 | Hutter et al.                                   |                                                                        |
| /A.A/             | 6       | 5835402       | A                      | 1998-11-10 | Rao et al.                                      |                                                                        |
| /A.A/             | 7       | 6025237       | A                      | 2000-02-15 | Choi                                            |                                                                        |
| /A.A/             | 8       | 6384431       | B1                     | 2002-05-07 | Takahashi et al.                                |                                                                        |

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A/

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|       |   |         |    |            |        |
|-------|---|---------|----|------------|--------|
| /A.A/ | 9 | 6465862 | B1 | 2002-10-15 | Harris |
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|-------------------|---------|--------------------|------------------------|------------------|-------------------------------------------------|--------------------------------------------------------------------------|
| /A.A/             | 1       | 20010028097        | A1                     | 2001-10-11       | Matsuoka et al.                                 |                                                                          |
| /A.A/             | 2       | 20020195656        | A1                     | 2002-12-26       | Hattori                                         |                                                                          |
| /A.A/             | 3       | 20030183856        | A1                     | 2003-10-02       | Wieczorek et al.                                |                                                                          |
| /A.A/             | 4       | 20070045682        | A1                     | 2007-03-01       | Hong et al.                                     |                                                                          |
| /A.A/             | 5       | 20080142899        | A1                     | 2008-06-19       | Morris et al.                                   |                                                                          |
| /A.A/             | 6       | 20140034997        | A1                     | 2014-02-06       | Rahimo et al.                                   |                                                                          |
| /A.A/             | 7       | 20170243876        | A1                     | 2017-08-24       | Rao                                             |                                                                          |

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| Examiner Name          |                |            |
| Attorney Docket Number | GRTD60-35314   |            |

| Examiner Initial* | Cite No | Foreign Document Number <sup>3</sup> | Country Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |
|-------------------|---------|--------------------------------------|---------------------------|------------------------|------------------|-------------------------------------------------|--------------------------------------------------------------------------|----------------|
| /A.A/             | 1       | 2003051551                           | JP                        | A                      | 2003-02-21       | Miyamoto et al.                                 |                                                                          | ×              |
| /A.A/             | 2       | 2003218356                           | JP                        | A                      | 2003-07-31       | Matsumoto et al.                                |                                                                          | ☒              |
| /A.A/             | 3       | 6482563                              | JP                        | A                      | 1989-03-28       | Kondo                                           |                                                                          | ☒              |
| /A.A/             | 4       | 2004049453                           | WO                        | A1                     | 2004-06-10       | Zheng et al.                                    |                                                                          | ☒              |

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|--------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | 1       | IPR2020-00288-Exhibit 1029-Claim Construction District Court 4 20-2020                                                                                                                                                                                          |                |
|                    | 2       | IPR2020-00288-Exhibit 2007-Minutes for Markman Hearing Held Via Video Conference Before U.S. District Judge Rodney Gilstrap, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 61                                       |                |
|                    | 3       | IPR2020-00288-Petitioner Reply                                                                                                                                                                                                                                  |                |
|                    | 4       | IPR2020-00289-00289 Petitioner Reply                                                                                                                                                                                                                            |                |

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| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

|    |                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | IPR2020-00292 - Petition for IPR                                                                                                                                                                            |
| 6  | IPR2020-00292-Exhibit 2002-Excerpt from Exhibit 4 to Appendix B of Samsung Electronics Co., Ltd.'s Invalidity Contentions (Invalidity Contention based on U.S. Patent No. 6,384,431 to Takahashi            |
| 7  | IPR2020-00288 - Ex. 1020 - Michael Nastasi and James W. Mayer, Ion Implantation and Synthesis of Materials (2006). 4 pages                                                                                  |
| 8  | IPR2020-00288-Exhibit 2001 - IPR2020-00288 - Excerpt from Exhibit 1 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Morris                                                |
| 9  | IPR2020-00288-Exhibit 2002-xcerpt from Exhibit 2 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Miyamoto                                                                 |
| 10 | IPR2020-00288-Exhibit 2009-Complaint for Patent Infringement, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 1                                                   |
| 11 | IPR2020-00288-Exhibit 2011- Exhibit A to Revised Joint Claim Construction Chart Pursuant to Patent Rule 4-5, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 60-1 |
| 12 | IPR2020-00288-Exhibit 2012-Samsungs Responsive Claim Construction Brief - District Court                                                                                                                    |
| 13 | IPR2020-00288-Exhibit 2013- Glew Dec                                                                                                                                                                        |
| 14 | IPR2020-00288-Exhibit 2014- Excerpt from Exhibit 10 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions                                                                                 |
| 15 | IPR2020-00288-Patent Owner Preliminary Response                                                                                                                                                             |

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| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

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| 16 | PR2020-00288-Patent Owner Sur Reply                                                                                                                     |
| 17 | PR2020-00288-Petition                                                                                                                                   |
| 18 | PR2020-00289-Exhibit 1 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Payne                                          |
| 19 | PR2020-00289-Exhibit 1003-Smith Dec                                                                                                                     |
| 20 | PR2020-00289-Exhibit 1010- S. M. Sze et al., Semiconductor Devices: Physics and Technology, John Wiley & Sons, 2nd Ed., 2002 ("Sze '02")                |
| 21 | PR2020-00289-Exhibit 1012-Ben G. Streetman, Solid State Electronic Devices, 2nd Ed., Prentice-Hall, 1980 ("Streetman")                                  |
| 22 | PR2020-00289-Exhibit 2001-Exhibit 1 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Payne                             |
| 23 | PR2020-00289-Exhibit 2002- Exhibit 3 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Wieczorek                        |
| 24 | PR2020-00289-Exhibit 2011-Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2001 ("Razavi")                                                     |
| 25 | PR2020-00289-Exhibit 2012-Excerpts from Wolf, S., Silicon Processing for the VLSI Era, Vol.4 - Deep-Submicron Process Technology (2002) ("Wolf Vol. 4") |
| 26 | PR2020-00289-Exhibit 2013-Glew Dec                                                                                                                      |

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| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

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| 27 | PR2020-00289-Patent Owner Pre Resp                                                                                                                    |
| 28 | PR2020-00289-Patent Owner Sur reply                                                                                                                   |
| 29 | PR2020-00289-Petition                                                                                                                                 |
| 30 | PR2020-00290-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                              |
| 31 | PR2020-00290-Exhibit 1013-Tango, Mega bit Memory Technology                                                                                           |
| 32 | PR2020-00290-Patent Owner Preliminary Resp                                                                                                            |
| 33 | PR2020-00290-Patent Owner Sur Reply                                                                                                                   |
| 34 | PR2020-00290-Petition                                                                                                                                 |
| 35 | PR2020-00290-Petitioners Reply to Patent Owner Preliminary Response                                                                                   |
| 36 | PR2020-00291-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                              |
| 37 | PR2020-00291-Exhibit 1011- The Insulated Gate Bipolar Transistor: IGBT Theory and Design, Vinod Kumar Khanna, IEEE Press and Wiley-Interscience, 2003 |

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| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

|    |                                                                                                                                                                                                                                           |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 38 | PR2020-00291-Exhibit 1020-S. M. Sze, Physics of Semiconductor Devices, Wiley-Interscience, 2nd Ed., 1981 ("Sze '81")                                                                                                                      |
| 39 | PR2020-00291-Exhibit 1021-S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons, 2nd Ed., 2002 ("Sze '02")                                                                                                          |
| 40 | PR2020-00291-Exhibit 2001-Exhibit 2 to Appendix B of Samsung Electronics Co., LTD's Invalidity Contentions (Invalidity Contention based on U.S. Patent Application Publication No. 2002/0195656 ("Hattori"))                              |
| 41 | PR2020-00291-Exhibit 2013- Declaration of Dr. Alexander D. Glew                                                                                                                                                                           |
| 42 | PR2020-00291-Patent Owner Preliminary Resp                                                                                                                                                                                                |
| 43 | PR2020-00291-Patent Owner Sur Reply                                                                                                                                                                                                       |
| 44 | PR2020-00291-Petition                                                                                                                                                                                                                     |
| 45 | PR2020-00291-Petitioners Reply                                                                                                                                                                                                            |
| 46 | PR2020-00292-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                                                                                                                  |
| 47 | PR2020-00292-Exhibit 2001-Excerpt from Exhibit 1 to Appendix B of Samsung Electronics Co., Ltd.'s Invalidity Contentions (Invalidity Contention based on "Insulated Gate Bipolar Transistor IGBT Theory and Design" by Vinod Kumar Khanna |
| 48 | PR2020-00292-Exhibit 2012-Excerpt from Exhibit A to Joint Claim Construction Chart Pursuant to Patent Rule 4-5, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 53-1 (Mar. 18, 2020)            |

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| Art Unit               | 2812           |            |
| Examiner Name          |                |            |
| Attorney Docket Number | GRTD60-35314   |            |

|    |                                                |
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| 49 | PR2020-00292-Patent Owner Preliminary Response |
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.A/

Copies of non-patent literature documents listed not provided in current application but provided in parent application 16/947,294

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| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

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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  | /Gregory M. Howison, Reg. #30646/ | Date (YYYY-MM-DD)   | 2021-08-11 |
| Name/Print | Gregory M. Howison                | Registration Number | 30646      |

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: G.R. Mohan RAO  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2892  
Examiner: Ajay ARORA  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

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

Dear Sir:

**PETITION TO EXPUNGE ASSIGNMENT RECORDING**

Petitioner respectfully petitions to suspend the rules under 37 C.F.R. § 1.182 and requests that Assignment: 2, i.e., from Greenthread, LLC to Vervain, LLC be deleted to reflect the correct ownership of the patent. The reasons why justice requires a waiver of the requirements are as follows:

- The normal corrective procedures as outlined in MPEP § 323.01(a) through § 323.01(c) will not provide petitioners with adequate relief.
- An assignment totally unrelated to the current application was incorrectly recorded in the application. (A copy of the recorded Assignment document is attached)
- The assignment recordation error is not of a typographical nature; thus, MPEP § 323.01(a) does not apply.
- The recorded assignment document does not contain a typographical error and, additionally, matches the cover sheet. As such, MPEP § 323.01(b) does not apply.
- The assignment was not improperly filed and recorded by another person against the current Application. Therefore, MPEP § 323.01(c) does not apply.

**PETITION TO EXPUNGE ASSIGNMENT RECORDING**

S/N 17/371,839

Atty. Dkt. No. GRTD60-35314

Thus,

- There never existed an assignment from Greenthread, LLC to Vervain, LLC with respect to U.S. Application No. 17/371,839 or any applications or patents related to it. (A copy of the USPTO Parent Continuity Data is attached.)
- The recorded assignment is void and should be expunged from the record.
- No right, title or interest was transferred to any existing entity as the result of this recorded document.
- All right, title and interest remain as originally recorded, from inventor G.R. Mohan Rao to Greenthread, LLC.
- There was no intent to assign the patent from Greenthread, LLC to Vervain, LLC, and such recordation was made in error.

For the reasons set forth above, Petitioner respectfully requests that this Petition be granted. Petitioner submits that the integrity of the assignment records will not be affected by the granting of the petition.

Accordingly, Petitioner requests expunction of the recorded assignment from Greenthread, LLC to Vervain, LLC such that all right, title and interest remain in Greenthread, LLC.

Enclosed is the fee of \$420.00 as set forth under C.F.R. 1.17(f). Please charge any deficiency or credit any overpayment to deposit account number 50-0208/GRTD60-35314 of MUNCK, WILSON, MANDALA, LLP.

Respectfully submitted,  
MUNCK, WILSON, MANDALA, LLP  
Attorneys for Petitioners

/Gregory M. Howison, Reg. #30646/

Gregory M. Howison  
Registration No. 30,646

GMH/als  
P.O. Drawer 800889  
Dallas, Texas 75380  
Tel: 972-628-3600  
Fax: 972-628-3616  
October 19, 2021

**PETITION TO EXPUNGE ASSIGNMENT RECORDING**  
S/N 17/371,839  
Atty. Dkt. No. GRTD60-35314

|                                                                                                                                                                                                          |                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ASSIGNOR</b><br>Greenthread, LLC<br>Philip W. John, Jr. Manager<br>6307 Bandera Ave, Apt B<br>Dallas, Texas 75225-3617<br>Email: <a href="mailto:john@greenthreadllc.com">john@greenthreadllc.com</a> | <b>ASSIGNEE</b><br>Vervain, LLC<br>Philip W. John, Jr., Member<br>7424 Mason Dells Drive<br>Dallas, Texas 75230-3244<br>Email: <a href="mailto:john@vervainllc.com">john@vervainllc.com</a> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

## ASSIGNMENT AGREEMENT

This Assignment Agreement ("Assignment") is entered into by and between Vervain, LLC, a Texas limited liability company, hereinafter referred to as "Assignee," and Greenthread, LLC, a Texas limited liability company, hereinafter referred to as "Assignor," and shall become effective upon being duly signed by the authorized representative of Assignor ("Effective Date").

### RECITALS:

Assignor and Assignee are entering into a Patent Assignment Agreement (the "Agreement").

Pursuant to the Agreement, Assignor hereby desires to assign to Assignee all of its rights, title and interest in and to the following United States patents and pending application:

1. U.S. Provisional Application Number 61/509,256, entitled, "Lifetime Mixed Level Nand Flash System," filed on July 19, 2011;
2. U.S. Patent Number 8,891,298, entitled, "Lifetime Mixed Level Non-Volatile Memory System," filed on April 25, 2012, and issued on November 18, 2014;
3. U.S. Patent Number 9,196,385, entitled, "Lifetime Mixed Level Non-Volatile Memory System," filed on October 28, 2014, and issued on November 24, 2015;
4. U.S. Patent Number 9,997,240, entitled, "Lifetime Mixed Level Non-Volatile Memory System," filed on November 24, 2015, and issued on June 12, 2018, and
5. U.S. Patent Application Number 16/006,299, entitled, "Lifetime Mixed Level Non-Volatile Memory System," filed on June 12, 2018, and is pending (collectively referred to hereinafter referred to as the "Patent").

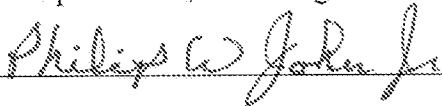
For good and valuable consideration, Assignor and Assignee hereby agree as follows:

## ASSIGNMENT:

1. Assignor hereby assigns to Assignee its entire worldwide right, title and interest in and to Assignor's Patent, including the entire worldwide right, title and interest in and to any reexamination or reissue of the Patent. This includes, without limitation, Assignor's right to prosecute, and receive, all damages, royalties, awards and compensation for past, present and/or future infringement.
2. Assignor agrees to do the following without further consideration, in order to carry out the intent of this Assignment:
  - i. Execute all oaths, assignments, applications, and other papers necessary or desirable to fully secure to Assignee the rights, titles and interests herein conveyed; and
  - ii. Generally do all lawful acts for vesting in Assignee the rights, titles, and interests herein conveyed.
3. Assignor has not made and will not hereafter make any assignment, grant, mortgage, license, or other agreement affecting the rights, titles, and interests herein conveyed to Assignee.
4. Assignor hereby represents and warrants that Assignor has the authority to assign the applicable Patent pursuant to this Assignment.

The undersigned having read this Assignment and fully understanding the provisions of this Assignment, hereby executes this Assignment as of the Effective Date.

Greenthread, LLC (Assignor)  
Philip W. John, Jr. Manager

  
\_\_\_\_\_

Signature:

Printed Name: Philip W. John, Jr.

Date: August 9, 2019

### Parent Continuity Data

| Description                           | Parent Number | Parent Filing or 371(c) Date | AIA (First Inventor to File) | Parent Status | Patent Number |
|---------------------------------------|---------------|------------------------------|------------------------------|---------------|---------------|
| This application is a Continuation of | 16/947,294    | 07-27-2020                   | No                           | Patented      | 11,121,222    |
| is a continuation of                  | 16/717,950    | 12-17-2019                   | No                           | Patented      | 10,734,481    |
| is a continuation of                  | 15/590,282    | 05-09-2017                   | No                           | Patented      | 10,510,842    |
| is a continuation of                  | 14/931,636    | 11-03-2015                   | No                           | Patented      | 9,647,070     |
| is a continuation of                  | 14/515,584    | 10-16-2014                   | No                           | Patented      | 9,190,502     |
| is a continuation of                  | 13/854,319    | 04-01-2013                   | No                           | Abandoned     | -             |
| is a continuation of                  | 11/622,496    | 01-12-2007                   | No                           | Patented      | 8,421,195     |
| is a Division of                      | 10/934,915    | 09-03-2004                   | No                           | Abandoned     | -             |

### Child Continuity Data

No Child Continuity Data Found

Close Window

## Electronic Patent Application Fee Transmittal

|                                                       |                                                  |                 |               |                             |
|-------------------------------------------------------|--------------------------------------------------|-----------------|---------------|-----------------------------|
| <b>Application Number:</b>                            | 17371839                                         |                 |               |                             |
| <b>Filing Date:</b>                                   | 09-Jul-2021                                      |                 |               |                             |
| <b>Title of Invention:</b>                            | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                 |               |                             |
| <b>First Named Inventor/Applicant Name:</b>           | G.R. MOHAN RAO                                   |                 |               |                             |
| <b>Filer:</b>                                         | Gregory Michael Howison/Anna Nguyen              |                 |               |                             |
| <b>Attorney Docket Number:</b>                        | GRTD60-35314                                     |                 |               |                             |
| Filed as Large Entity                                 |                                                  |                 |               |                             |
| <b>Filing Fees for    Utility under 35 USC 111(a)</b> |                                                  |                 |               |                             |
| <b>Description</b>                                    | <b>Fee Code</b>                                  | <b>Quantity</b> | <b>Amount</b> | <b>Sub-Total in USD(\$)</b> |
| <b>Basic Filing:</b>                                  |                                                  |                 |               |                             |
| <b>Pages:</b>                                         |                                                  |                 |               |                             |
| <b>Claims:</b>                                        |                                                  |                 |               |                             |
| <b>Miscellaneous-Filing:</b>                          |                                                  |                 |               |                             |
| <b>Petition:</b>                                      |                                                  |                 |               |                             |
| PETITION FEE- 37 CFR 1.17(F) (GROUP I)                | 1462                                             | 1               | 420           | 420                         |
| <b>Patent-Appeals-and-Interference:</b>               |                                                  |                 |               |                             |
| <b>Post-Allowance-and-Post-Issuance:</b>              |                                                  |                 |               |                             |

| Description        | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|--------------------|----------|----------|--------|----------------------|
| Extension-of-Time: |          |          |        |                      |
| Miscellaneous:     |          |          |        |                      |
| Total in USD (\$)  |          |          |        | 420                  |

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 44060872                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 19-OCT-2021                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 11:10:49                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                                          |                  |
|------------------------------------------|------------------|
| Submitted with Payment                   | yes              |
| Payment Type                             | DA               |
| Payment was successfully received in RAM | \$ 420           |
| RAM confirmation Number                  | E20210IB11500206 |
| Deposit Account                          | 500208           |
| Authorized User                          | Gregory Howison  |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

37 CFR 1.20 (Post Issuance fees)

**File Listing:**

| Document Number | Document Description                           | File Name                     | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|------------------------------------------------|-------------------------------|------------------------------------------|------------------|------------------|
| 1               | Petition for review by the Office of Petitions | GRT35314PetitiontoExpunge.pdf | 1713018                                  | no               | 5                |
|                 |                                                |                               | c055f20e57ec2274e0cd97b77d2df6f98953b462 |                  |                  |

**Warnings:****Information:**

|   |                      |              |                                          |    |   |
|---|----------------------|--------------|------------------------------------------|----|---|
| 2 | Fee Worksheet (SB06) | fee-info.pdf | 38237                                    | no | 2 |
|   |                      |              | ffd80fae29ff2a114a9e9cd93834d8403b477dbc |    |   |

**Warnings:****Information:**

|                                     |         |
|-------------------------------------|---------|
| <b>Total Files Size (in bytes):</b> | 1751255 |
|-------------------------------------|---------|

**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.**

**New Applications Under 35 U.S.C. 111**

**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**

**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.**



# UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

| APPLICATION NO.            | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|----------------------------|-------------|----------------------|---------------------|------------------|
| 17/371,839                 | 07/09/2021  | G.R. MOHAN RAO       | GRTD60-35314        | 2197             |
| 25883                      | 7590        | 10/05/2021           |                     |                  |
| MUNCK WILSON MANDALA L.L.P |             |                      | EXAMINER            |                  |
| P.O. Drawer 800889         |             |                      | CENTRAL, DOCKET     |                  |
| DALLAS, TX 75380           |             |                      |                     |                  |
|                            |             |                      | ART UNIT            | PAPER NUMBER     |
|                            |             |                      | OPAP                |                  |
|                            |             |                      | NOTIFICATION DATE   | DELIVERY MODE    |
|                            |             |                      | 10/05/2021          | 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@appcoll.com

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                      |                                        |                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------|--------------------------------|
| <b><i>Decision Granting Request for<br/>Prioritized Examination (Track I)</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Application No.</b><br>17/371,839 | <b>Applicant(s)</b><br>RAO, G.R. MOHAN |                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Examiner</b><br>APRIL M WISE      | <b>Art Unit</b><br>OPET                | <b>AIA (FITF) Status</b><br>No |
| <p>1. THE REQUEST FILED <u>09 July 2021</u> IS <b>GRANTED</b> .</p> <p>The above-identified application has met the requirements for prioritized examination</p> <p>A. <input checked="" type="checkbox"/> for an original nonprovisional application (Track I).</p> <p>B. <input type="checkbox"/> for an application undergoing continued examination (RCE).</p> <p>2. <b>The above-identified application will undergo prioritized examination.</b> The application will be accorded special status throughout its entire course of prosecution until one of the following occurs:</p> <p>A. filing a <b><u>petition for extension of time</u></b> to extend the time period for filing a reply;</p> <p>B. filing an <b><u>amendment to amend the application to contain more than four independent claims, more than thirty total claims</u></b>, or a multiple dependent claim;</p> <p>C. filing a <b><u>request for continued examination</u></b> ;</p> <p>D. filing a notice of appeal;</p> <p>E. filing a request for suspension of action;</p> <p>F. mailing of a notice of allowance;</p> <p>G. mailing of a final Office action;</p> <p>H. completion of examination as defined in 37 CFR 41.102; or</p> <p>I. abandonment of the application.</p> <p>Telephone inquiries with regard to this decision should be directed to undersigned at (571)272-1642. In his/her absence, calls may be directed to Petition Help Desk at (571) 272-3282.</p> |                                      |                                        |                                |
| /APRIL M WISE/<br>Paralegal Specialist, Office of Petitions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                      |                                        |                                |

|                                                                                                     |                        |                |            |
|-----------------------------------------------------------------------------------------------------|------------------------|----------------|------------|
| <b>INFORMATION DISCLOSURE<br/>STATEMENT BY APPLICANT</b><br>( Not for submission under 37 CFR 1.99) | Application Number     |                | 17371839   |
|                                                                                                     | Filing Date            |                | 2021-07-09 |
|                                                                                                     | First Named Inventor   | G.R. Mohan Rao |            |
|                                                                                                     | Art Unit               | 2812           |            |
|                                                                                                     | Examiner Name          |                |            |
|                                                                                                     | Attorney Docket Number | GRTD60-35314   |            |

| U.S.PATENTS       |         |               |                        |            |                                                 | <a href="#">Remove</a>                                                 |
|-------------------|---------|---------------|------------------------|------------|-------------------------------------------------|------------------------------------------------------------------------|
| Examiner Initial* | Cite No | Patent Number | Kind Code <sup>1</sup> | Issue Date | Name of Patentee or Applicant of cited Document | Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear |
|                   | 1       | 4160985       | A                      | 1979-07-10 | Kamins et al.                                   |                                                                        |
|                   | 2       | 4684971       | A                      | 1987-08-04 | Payne                                           |                                                                        |
|                   | 3       | 4688063       | A                      | 1987-08-18 | Lu et al.                                       |                                                                        |
|                   | 4       | 4907058       | A                      | 1990-03-06 | Sakai                                           |                                                                        |
|                   | 5       | 4994887       | A                      | 1991-02-19 | Hutter et al.                                   |                                                                        |
|                   | 6       | 5835402       | A                      | 1998-11-10 | Rao et al.                                      |                                                                        |
|                   | 7       | 6025237       | A                      | 2000-02-15 | Choi                                            |                                                                        |
|                   | 8       | 6384431       | B1                     | 2002-05-07 | Takahashi et al.                                |                                                                        |

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

|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

|   |         |    |            |        |
|---|---------|----|------------|--------|
| 9 | 6465862 | B1 | 2002-10-15 | Harris |
|---|---------|----|------------|--------|

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| Examiner Initial* | Cite No | Publication Number | Kind Code <sup>1</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear |
|-------------------|---------|--------------------|------------------------|------------------|-------------------------------------------------|--------------------------------------------------------------------------|
|                   | 1       | 20010028097        | A1                     | 2001-10-11       | Matsuoka et al.                                 |                                                                          |
|                   | 2       | 20020195656        | A1                     | 2002-12-26       | Hattori                                         |                                                                          |
|                   | 3       | 20030183856        | A1                     | 2003-10-02       | Wieczorek et al.                                |                                                                          |
|                   | 4       | 20070045682        | A1                     | 2007-03-01       | Hong et al.                                     |                                                                          |
|                   | 5       | 20080142899        | A1                     | 2008-06-19       | Morris et al.                                   |                                                                          |
|                   | 6       | 20140034997        | A1                     | 2014-02-06       | Rahimo et al.                                   |                                                                          |
|                   | 7       | 20170243876        | A1                     | 2017-08-24       | Rao                                             |                                                                          |

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( Not for submission under 37 CFR 1.99)

|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

| Examiner Initial* | Cite No | Foreign Document Number <sup>3</sup> | Country Code <sup>2</sup> | Kind Code <sup>4</sup> | Publication Date | Name of Patentee or Applicant of cited Document | Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear | T <sup>5</sup> |
|-------------------|---------|--------------------------------------|---------------------------|------------------------|------------------|-------------------------------------------------|--------------------------------------------------------------------------|----------------|
|                   | 1       | 2003051551                           | JP                        | A                      | 2003-02-21       | Miyamoto et al.                                 |                                                                          | ×              |
|                   | 2       | 2003218356                           | JP                        | A                      | 2003-07-31       | Matsumoto et al.                                |                                                                          | ☒              |
|                   | 3       | 6482563                              | JP                        | A                      | 1989-03-28       | Kondo                                           |                                                                          | ☒              |
|                   | 4       | 2004049453                           | WO                        | A1                     | 2004-06-10       | Zheng et al.                                    |                                                                          | ☒              |

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**NON-PATENT LITERATURE DOCUMENTS**

| Examiner Initials* | Cite No | Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published. | T <sup>5</sup> |
|--------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
|                    | 1       | IPR2020-00288-Exhibit 1029-Claim Construction District Court 4 20-2020                                                                                                                                                                                          |                |
|                    | 2       | IPR2020-00288-Exhibit 2007-Minutes for Markman Hearing Held Via Video Conference Before U.S. District Judge Rodney Gilstrap, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 61                                       |                |
|                    | 3       | IPR2020-00288-Petitioner Reply                                                                                                                                                                                                                                  |                |
|                    | 4       | IPR2020-00289-00289 Petitioner Reply                                                                                                                                                                                                                            |                |

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

|                        |                |              |
|------------------------|----------------|--------------|
| Application Number     |                | 17371839     |
| Filing Date            |                | 2021-07-09   |
| First Named Inventor   | G.R. Mohan Rao |              |
| Art Unit               |                | 2812         |
| Examiner Name          |                |              |
| Attorney Docket Number |                | GRTD60-35314 |

|    |                                                                                                                                                                                                             |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5  | IPR2020-00292 - Petition for IPR                                                                                                                                                                            |
| 6  | IPR2020-00292-Exhibit 2002-Excerpt from Exhibit 4 to Appendix B of Samsung Electronics Co., Ltd.'s Invalidity Contentions (Invalidity Contention based on U.S. Patent No. 6,384,431 to Takahashi            |
| 7  | IPR2020-00288 - Ex. 1020 - Michael Nastasi and James W. Mayer, Ion Implantation and Synthesis of Materials (2006). 4 pages                                                                                  |
| 8  | IPR2020-00288-Exhibit 2001 - IPR2020-00288 - Excerpt from Exhibit 1 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Morris                                                |
| 9  | IPR2020-00288-Exhibit 2002-xcerpt from Exhibit 2 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Miyamoto                                                                 |
| 10 | IPR2020-00288-Exhibit 2009-Complaint for Patent Infringement, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 1                                                   |
| 11 | IPR2020-00288-Exhibit 2011- Exhibit A to Revised Joint Claim Construction Chart Pursuant to Patent Rule 4-5, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 60-1 |
| 12 | IPR2020-00288-Exhibit 2012-Samsungs Responsive Claim Construction Brief - District Court                                                                                                                    |
| 13 | IPR2020-00288-Exhibit 2013- Glew Dec                                                                                                                                                                        |
| 14 | IPR2020-00288-Exhibit 2014- Excerpt from Exhibit 10 to Appendix A of Samsung Electronics Co., Ltd.'s Invalidity Contentions                                                                                 |
| 15 | IPR2020-00288-Patent Owner Preliminary Response                                                                                                                                                             |

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

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|------------------------|----------------|
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| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

|    |                                                                                                                                                         |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | PR2020-00288-Patent Owner Sur Reply                                                                                                                     |
| 17 | PR2020-00288-Petition                                                                                                                                   |
| 18 | PR2020-00289-Exhibit 1 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Payne                                          |
| 19 | PR2020-00289-Exhibit 1003-Smith Dec                                                                                                                     |
| 20 | PR2020-00289-Exhibit 1010- S. M. Sze et al., Semiconductor Devices: Physics and Technology, John Wiley & Sons, 2nd Ed., 2002 ("Sze '02")                |
| 21 | PR2020-00289-Exhibit 1012-Ben G. Streetman, Solid State Electronic Devices, 2nd Ed., Prentice-Hall, 1980 ("Streetman")                                  |
| 22 | PR2020-00289-Exhibit 2001-Exhibit 1 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Payne                             |
| 23 | PR2020-00289-Exhibit 2002- Exhibit 3 to Appendix C of Samsung Electronics Co., Ltd.'s Invalidity Contentions regarding Wieczorek                        |
| 24 | PR2020-00289-Exhibit 2011-Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2001 ("Razavi")                                                     |
| 25 | PR2020-00289-Exhibit 2012-Excerpts from Wolf, S., Silicon Processing for the VLSI Era, Vol.4 - Deep-Submicron Process Technology (2002) ("Wolf Vol. 4") |
| 26 | PR2020-00289-Exhibit 2013-Glew Dec                                                                                                                      |

**INFORMATION DISCLOSURE  
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| Application Number     |                | 17371839     |
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| First Named Inventor   | G.R. Mohan Rao |              |
| Art Unit               |                | 2812         |
| Examiner Name          |                |              |
| Attorney Docket Number |                | GRTD60-35314 |

|    |                                                                                                                                                       |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| 27 | PR2020-00289-Patent Owner Pre Resp                                                                                                                    |
| 28 | PR2020-00289-Patent Owner Sur reply                                                                                                                   |
| 29 | PR2020-00289-Petition                                                                                                                                 |
| 30 | PR2020-00290-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                              |
| 31 | PR2020-00290-Exhibit 1013-Tango, Mega bit Memory Technology                                                                                           |
| 32 | PR2020-00290-Patent Owner Preliminary Resp                                                                                                            |
| 33 | PR2020-00290-Patent Owner Sur Reply                                                                                                                   |
| 34 | PR2020-00290-Petition                                                                                                                                 |
| 35 | PR2020-00290-Petitioners Reply to Patent Owner Preliminary Response                                                                                   |
| 36 | PR2020-00291-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                              |
| 37 | PR2020-00291-Exhibit 1011- The Insulated Gate Bipolar Transistor: IGBT Theory and Design, Vinod Kumar Khanna, IEEE Press and Wiley-Interscience, 2003 |

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

|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

|    |                                                                                                                                                                                                                                           |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 38 | PR2020-00291-Exhibit 1020-S. M. Sze, Physics of Semiconductor Devices, Wiley-Interscience, 2nd Ed., 1981 ("Sze '81")                                                                                                                      |
| 39 | PR2020-00291-Exhibit 1021-S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons, 2nd Ed., 2002 ("Sze '02")                                                                                                          |
| 40 | PR2020-00291-Exhibit 2001-Exhibit 2 to Appendix B of Samsung Electronics Co., LTD's Invalidity Contentions (Invalidity Contention based on U.S. Patent Application Publication No. 2002/0195656 ("Hattori"))                              |
| 41 | PR2020-00291-Exhibit 2013- Declaration of Dr. Alexander D. Glew                                                                                                                                                                           |
| 42 | PR2020-00291-Patent Owner Preliminary Resp                                                                                                                                                                                                |
| 43 | PR2020-00291-Patent Owner Sur Reply                                                                                                                                                                                                       |
| 44 | PR2020-00291-Petition                                                                                                                                                                                                                     |
| 45 | PR2020-00291-Petitioners Reply                                                                                                                                                                                                            |
| 46 | PR2020-00292-Exhibit 1003-Declaration of Dr. Bruce Smith                                                                                                                                                                                  |
| 47 | PR2020-00292-Exhibit 2001-Excerpt from Exhibit 1 to Appendix B of Samsung Electronics Co., Ltd.'s Invalidity Contentions (Invalidity Contention based on "Insulated Gate Bipolar Transistor IGBT Theory and Design" by Vinod Kumar Khanna |
| 48 | PR2020-00292-Exhibit 2012-Excerpt from Exhibit A to Joint Claim Construction Chart Pursuant to Patent Rule 4-5, Greenthread, LLC v. Samsung Electronics Co., Ltd., et al., Case No. 2:19-CV-147-JRG, Dkt. 53-1 (Mar. 18, 2020)            |

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|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

49

PR2020-00292-Patent Owner Preliminary Response

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**EXAMINER SIGNATURE**

|                    |  |                 |  |
|--------------------|--|-----------------|--|
| Examiner Signature |  | Date Considered |  |
|--------------------|--|-----------------|--|

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

<sup>1</sup> See Kind Codes of USPTO Patent Documents at [www.USPTO.GOV](http://www.USPTO.GOV) or MPEP 901.04. <sup>2</sup> Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). <sup>3</sup> For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. <sup>4</sup> Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. <sup>5</sup> Applicant is to place a check mark here if English language translation is attached.

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

|                        |                |
|------------------------|----------------|
| Application Number     | 17371839       |
| Filing Date            | 2021-07-09     |
| First Named Inventor   | G.R. Mohan Rao |
| Art Unit               | 2812           |
| Examiner Name          |                |
| Attorney Docket Number | GRTD60-35314   |

**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  | /Gregory M. Howison, Reg. #30646/ | Date (YYYY-MM-DD)   | 2021-08-11 |
| Name/Print | Gregory M. Howison                | Registration Number | 30646      |

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.

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 43485685                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 13-AUG-2021                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 13:18:02                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

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|------------------------|----|
| Submitted with Payment | no |
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### File Listing:

| Document Number | Document Description                               | File Name                  | File Size(Bytes)/<br>Message Digest               | Multi Part /.zip | Pages (if appl.) |
|-----------------|----------------------------------------------------|----------------------------|---------------------------------------------------|------------------|------------------|
| 1               | Information Disclosure Statement (IDS) Form (SB08) | GRT35314IDSTransmittal.pdf | 72988<br>e400130c27c0fc12e2dff0b81893cb8d61952629 | no               | 1                |

### Warnings:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |                 |                                          |         |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|-----------------|------------------------------------------|---------|----|
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                 |                                          |         |    |
| This is not an USPTO supplied IDS fillable form                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |                 |                                          |         |    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Information Disclosure Statement (IDS)<br>Form (SB08) | GRT35314IDS.pdf | 1055703                                  | no      | 10 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                       |                 | 28cb5924ed51719ac3d30056384a0a0d7946e1da |         |    |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                       |                 |                                          |         |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                       |                 |                                          |         |    |
| Total Files Size (in bytes):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                       |                 |                                          | 1128691 |    |
| <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: G.R. Mohan Rao  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2812  
Examiner: to be assigned  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT  
REGIONS

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

Dear Sir:

**INFORMATION DISCLOSURE STATEMENT**

In accordance with the requirements of 37 C.F.R. §§ 1.56, 1.97, and 1.98, attached please find a Form PTO SB/08 listing information for consideration by the Office in connection with its examination of the above-captioned patent application.

It is brought to Examiner's attention that the references listed on the attached Form PTO SB/08 were previously submitted to the Office in connection with a prior application, namely Application Serial No. 16/947,294, which is relied upon in the current application for an earlier filing date under 35 U.S.C. §120. Pursuant to 37 C.F.R. 1.98(d), copies of such previously submitted items are not provided herein.

Respectfully submitted,  
MUNCK WILSON MANDALA, LLP  
Attorneys for Applicant(s)

/Gregory M. Howison, Reg. #30646/

Gregory M. Howison  
Registration No. 30,646

GMH/als  
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Tel: 972-628-3600  
Fax: 972-628-3616  
August 11, 2021

Information Disclosure Statement  
SN: 17/371,839  
Atty. Dkt. No. GRTD60-35314

| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                  |          |                                    |               | Application or Docket Number<br>17/371,839 |                    |                               |                    |                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|----------|------------------------------------|---------------|--------------------------------------------|--------------------|-------------------------------|--------------------|--------------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                       |          | SMALL ENTITY                       |               | OR<br>OTHER THAN SMALL ENTITY              |                    |                               |                    |                    |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                                                                                                                                                                                  | NUMBER EXTRA                     | RATE(\$) | FEE(\$)                            |               | RATE(\$)                                   | FEE(\$)            |                               |                    |                    |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                                                                                                                                                                                           | N/A                              | N/A      |                                    |               | N/A                                        | 320                |                               |                    |                    |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                                                                                                                                                                                           | N/A                              | N/A      |                                    |               | N/A                                        | 700                |                               |                    |                    |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                                                                                                                                                                                           | N/A                              | N/A      |                                    |               | N/A                                        | 800                |                               |                    |                    |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                           | 30      minus 20 =                                                                                                                                                                                                            | *                                |          |                                    |               | x    100    =                              | 1000               |                               |                    |                    |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 2      minus 3 =                                                                                                                                                                                                              | *                                |          |                                    |               | x    480    =                              | 0.00               |                               |                    |                    |
| APPLICATION SIZE FEE<br>(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). |                                  |          |                                    |               |                                            | 0.00               |                               |                    |                    |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                            | 0.00               |                               |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  | TOTAL    |                                    |               | TOTAL                                      | 2820               |                               |                    |                    |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                               | (Column 2)                       |          | (Column 3)                         |               | SMALL ENTITY                               |                    | OR<br>OTHER THAN SMALL ENTITY |                    |                    |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                   | ADDITIONAL FEE(\$) |                               | RATE(\$)           | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                | Minus    | **                                 | =             | x      =                                   |                    |                               | x      =           |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                | Minus    | ***                                | =             | x      =                                   |                    |                               | x      =           |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  |          |                                    |               | TOTAL<br>ADD'L FEE                         |                    |                               | TOTAL<br>ADD'L FEE |                    |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                               | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE(\$)                                   | ADDITIONAL FEE(\$) |                               | RATE(\$)           | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                                                                                                                                                                                     | *                                | Minus    | **                                 | =             | x      =                                   |                    |                               | x      =           |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                                                                                                                                                                               | *                                | Minus    | ***                                | =             | x      =                                   |                    |                               | x      =           |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                                                                                                                                                                                         |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                               |                                  |          |                                    |               | TOTAL<br>ADD'L FEE                         |                    |                               | TOTAL<br>ADD'L FEE |                    |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                                                                                                                                                                               |                                  |          |                                    |               |                                            |                    |                               |                    |                    |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|-----------------|------------|------------|
| 17/371,839            | 07/09/2021               | 2812            | 2820          | GRTD60-35314    | 30         | 2          |

25883  
MUNCK WILSON MANDALA L.L.P.  
P.O. Drawer 800889  
DALLAS, TX 75380

**CONFIRMATION NO. 2197**  
**UPDATED FILING RECEIPT**



Date Mailed: 08/13/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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**Inventor(s)**

G.R. MOHAN RAO, ALLEN, TX;

**Applicant(s)**

GREENTHREAD, LLC, Dallas, TX;

**Power of Attorney:** The patent practitioners associated with Customer Number 25883

**Domestic Priority data as claimed by applicant**

This application is a CON of 16/947,294 07/27/2020  
which is a CON of 16/717,950 12/17/2019 PAT 10734481  
which is a CON of 15/590,282 05/09/2017 PAT 10510842  
which is a CON of 14/931,636 11/03/2015 PAT 9647070  
which is a CON of 14/515,584 10/16/2014 PAT 9190502  
which is a CON of 13/854,319 04/01/2013 ABN  
which is a CON of 11/622,496 01/12/2007 PAT 8421195  
which is a DIV of 10/934,915 09/03/2004 ABN

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results: Yes**

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted: 07/22/2021**

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/371,839**

**Projected Publication Date: 11/18/2021**

**Non-Publication Request: No**

**Early Publication Request: No**

**Title**

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

**Preliminary Class**

438

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No**

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

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

In re application of: G.R. Mohan RAO  
Serial No.: 17/371,839  
Confirmation No.: 2197  
Filed: July 9, 2021  
Group: 2812  
Examiner: To be assigned  
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

**Mail Stop: Missing Parts**  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Dear Sir:

---

**RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS**

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In response to the Notice to File Corrected Application Papers dated July 23, 2021, the Applicant submits replacement Drawings marked "Replacement Sheets."

Please charge any additional fees or deficiencies in fees or credit any overpayment to Deposit Account No. 50-0208/GRTD60-35314.

Respectfully submitted,  
MUNCK WILSON MANDALA, LLP  
Attorneys for Applicant(s)

/Gregory M. Howison, Reg. #30,646/

Gregory M. Howison  
Registration No. 30,646

GMH/als  
P.O. Drawer 800889  
Dallas, Texas 75380  
Tel: 972-628-3600  
Fax: 972-628-3616  
August 9, 2021

**RESPONSE TO NOTICE TO FILE CORRECTED APPLICATION PAPERS**

SN: 17/371,839  
Atty. Dkt. No. GRTD60-35314

Page 1 of 1

MPS EX. 1029 - 149/212



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 17/371,839         | 07/09/2021            | G.R. MOHAN RAO        | GRTD60-35314           |

**CONFIRMATION NO. 2197**

## FORMALITIES LETTER



25883  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380

Date Mailed: 07/23/2021

## NOTICE TO FILE CORRECTED APPLICATION PAPERS

### *Filing Date Granted*

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings contain excessive text. Suitable descriptive legends may be used, or may be required by the Examiner where necessary for understanding of the drawing but should contain as few words as possible (see 37 CFR 1.84(o)). See Figure(s) 3D.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

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Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice".  
<https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html>

For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

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Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hnguyen/

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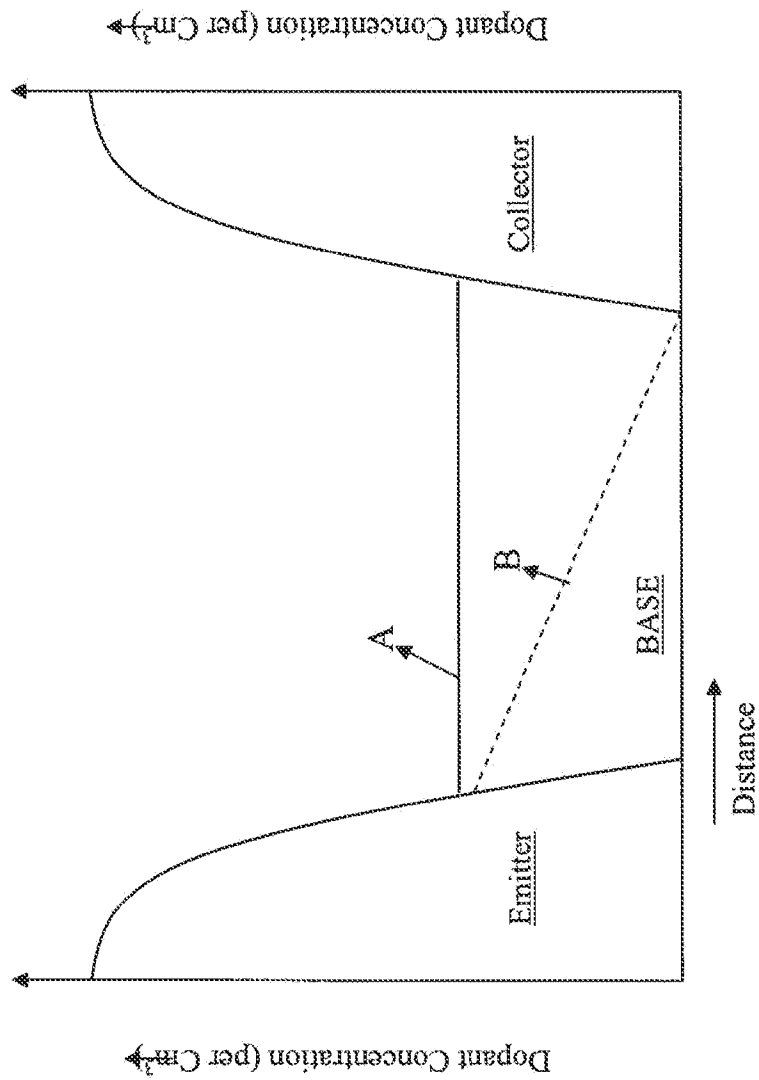
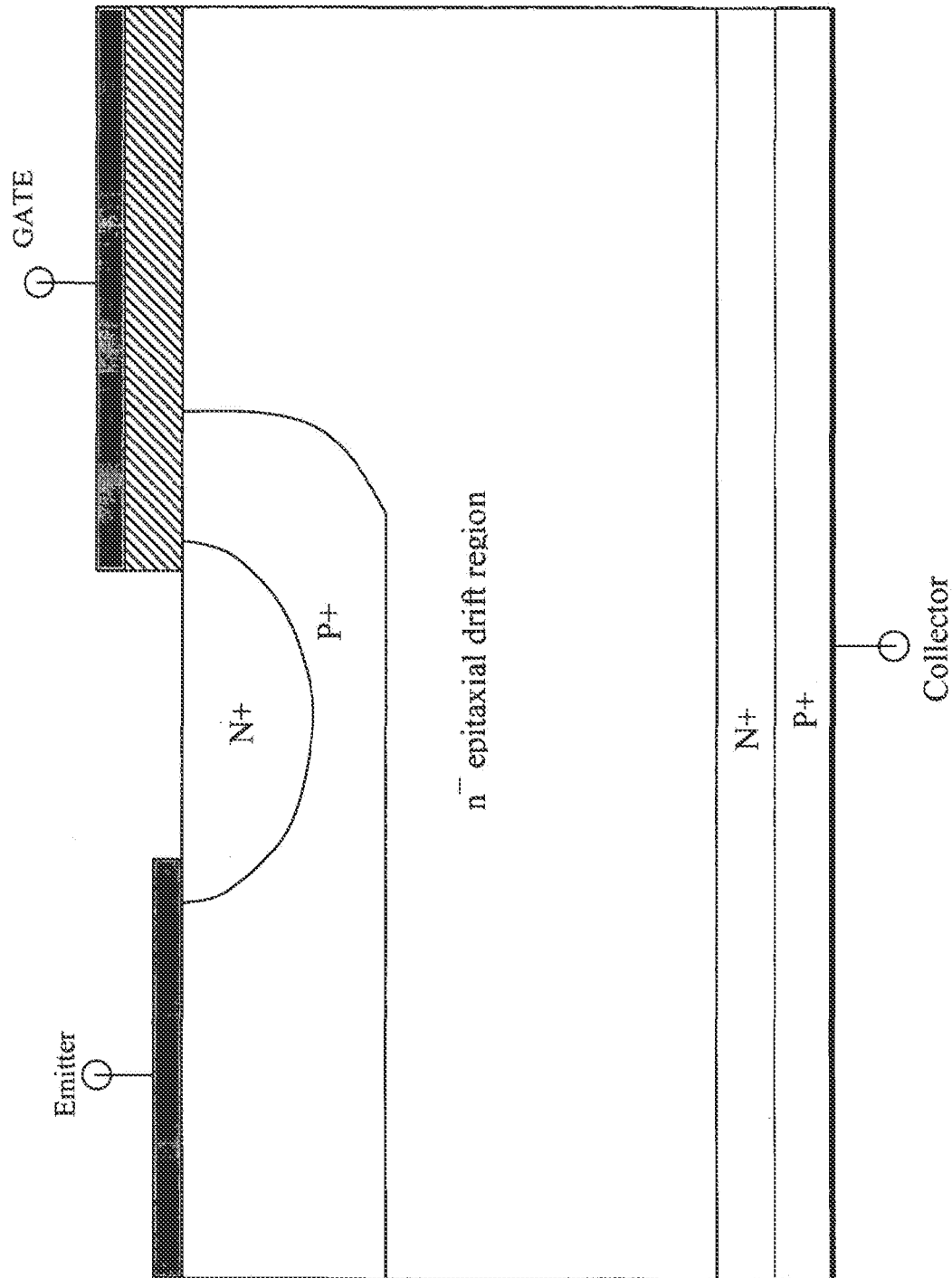
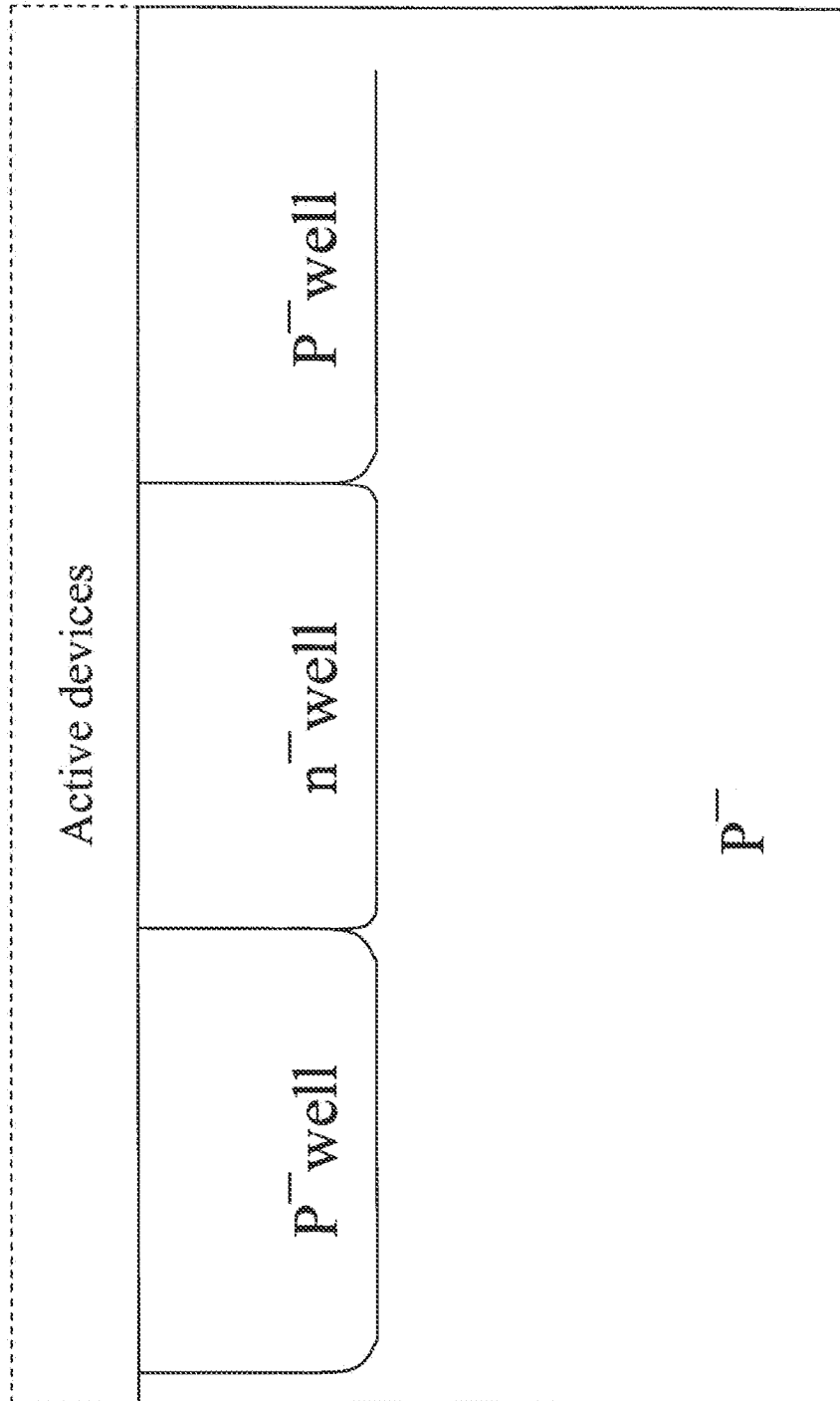
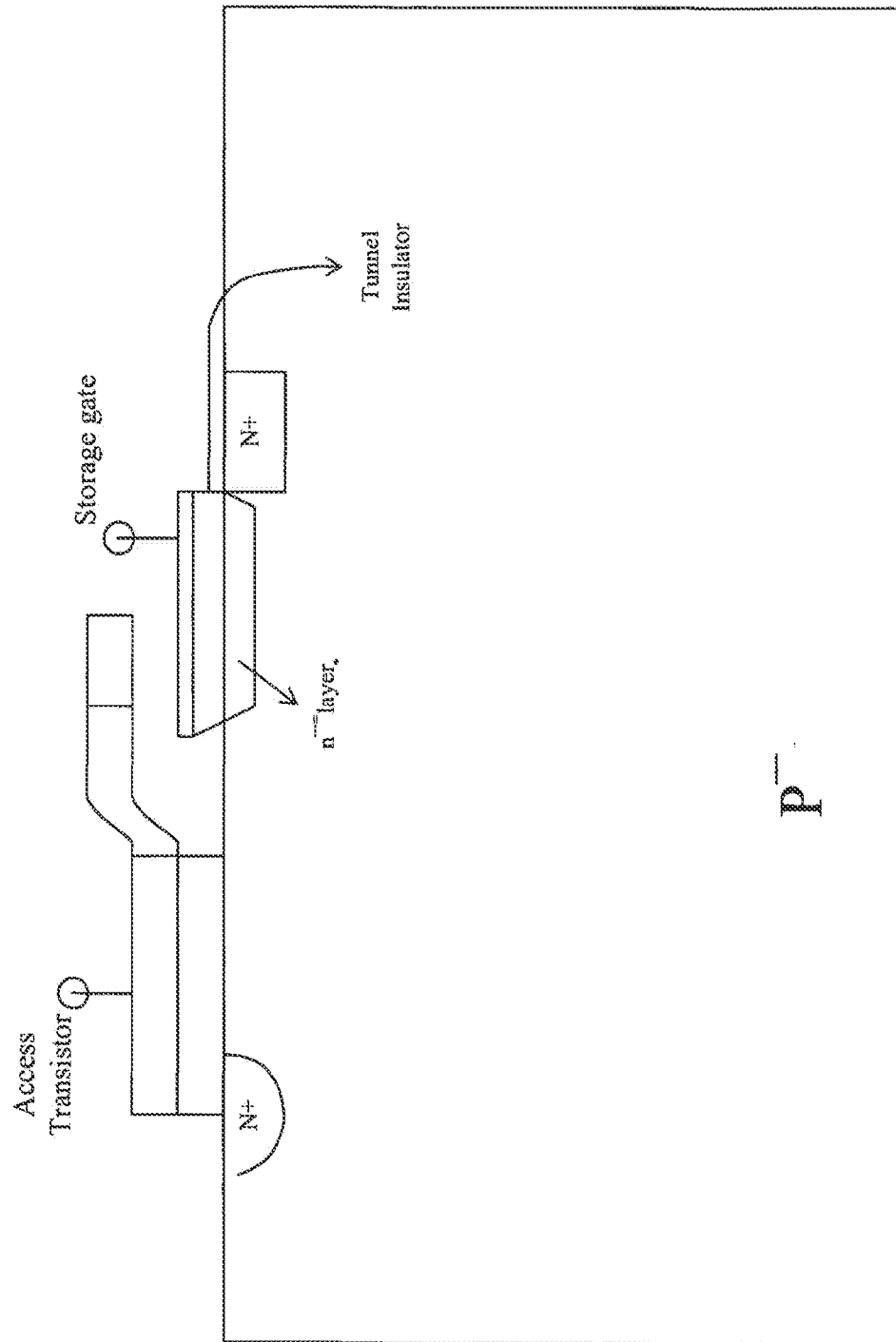
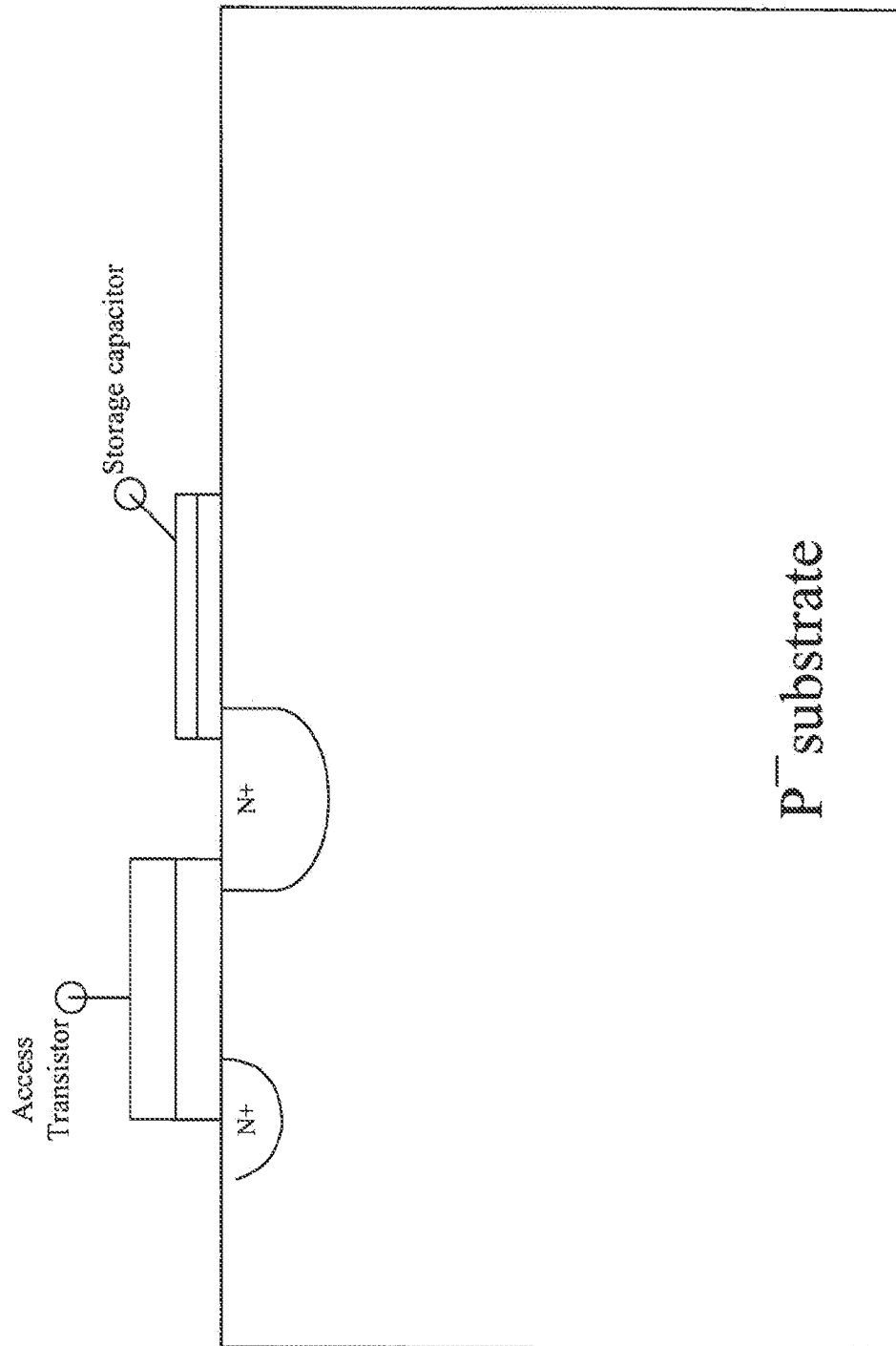


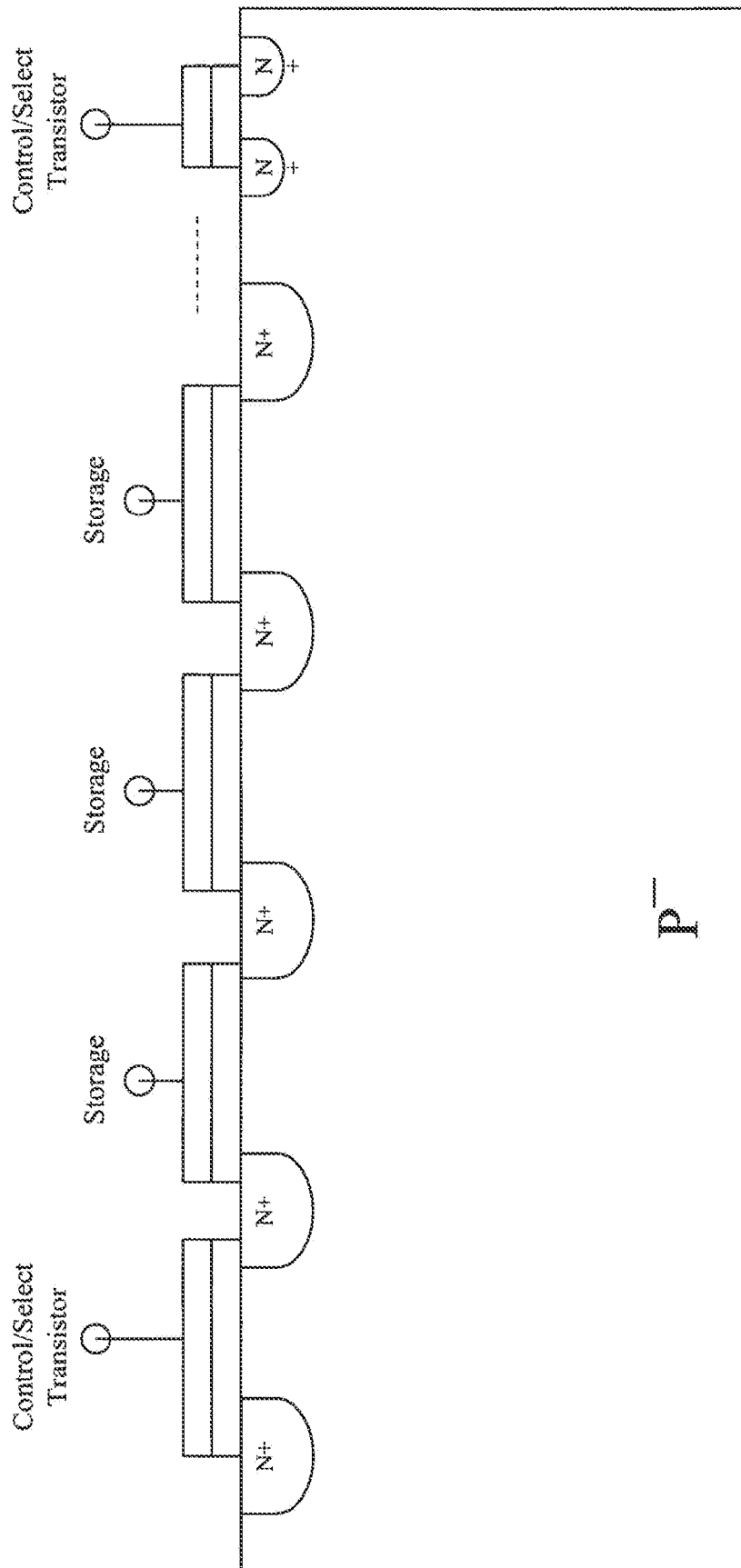
Figure 1 Prior Art

FIGURE 2 Prior art

FIGURE 3A Prior art

FIGURE 3B Prior art

FIGURE 3C Prior art

FIGURE 3D Prior art

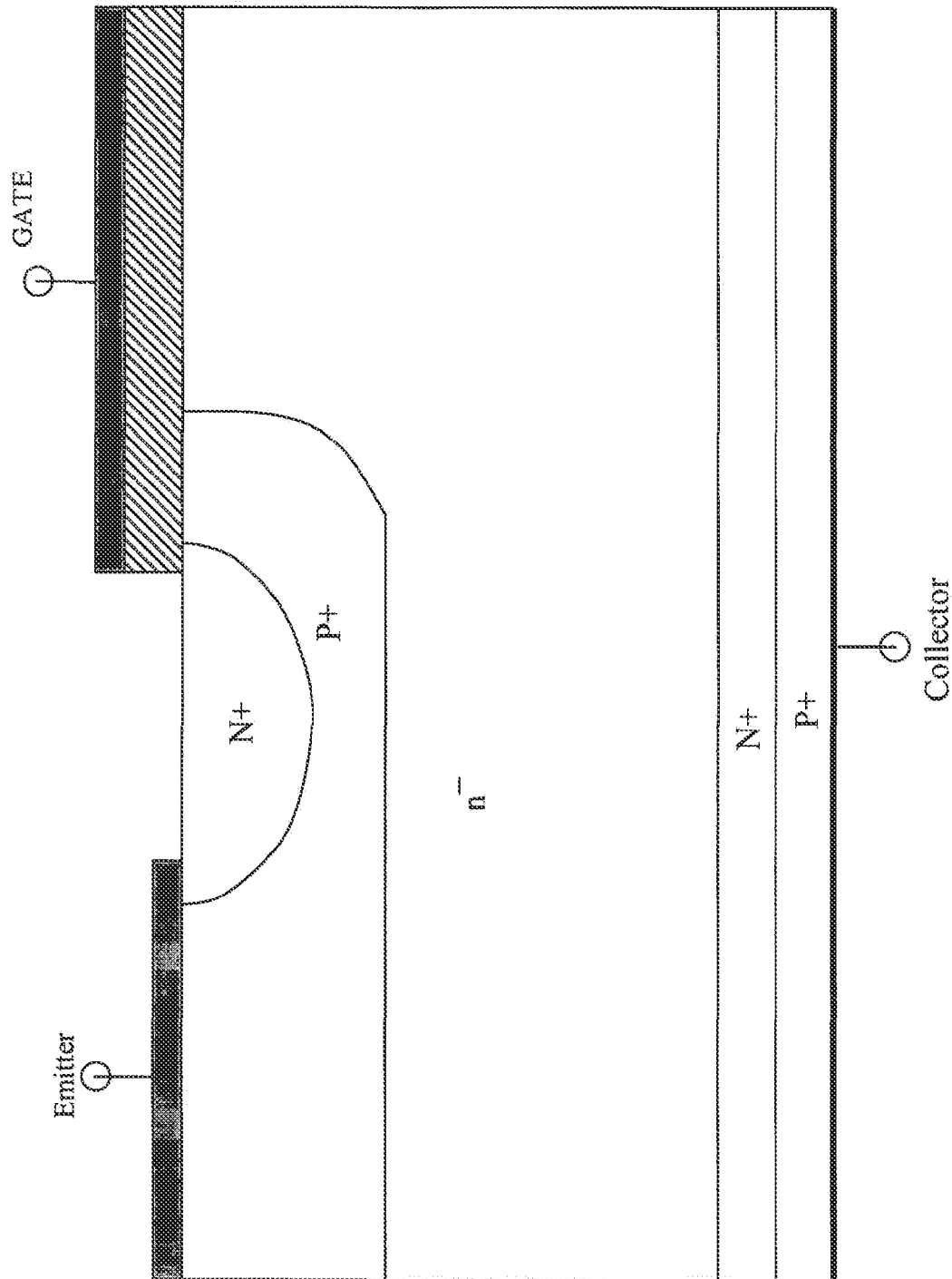
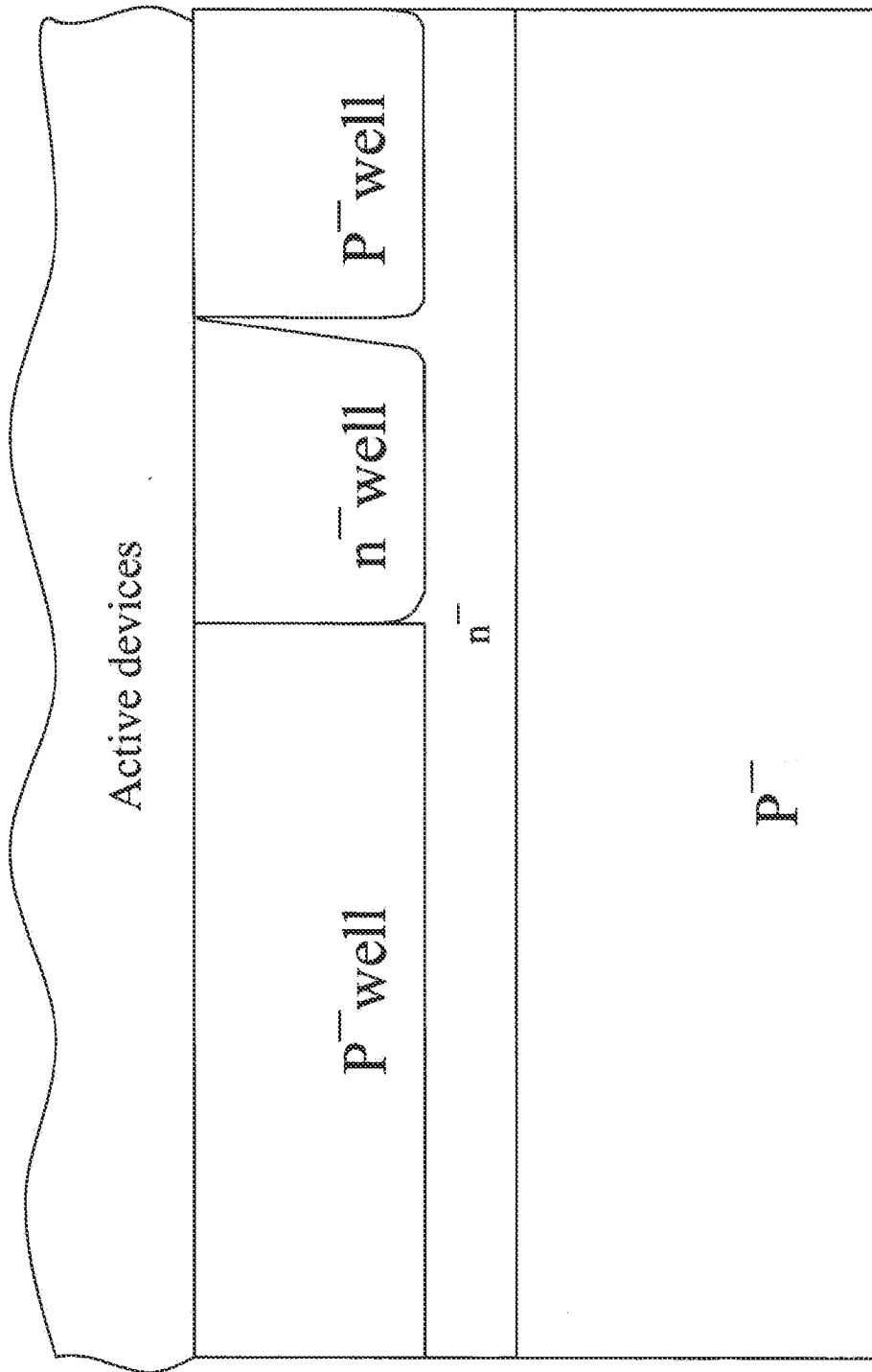
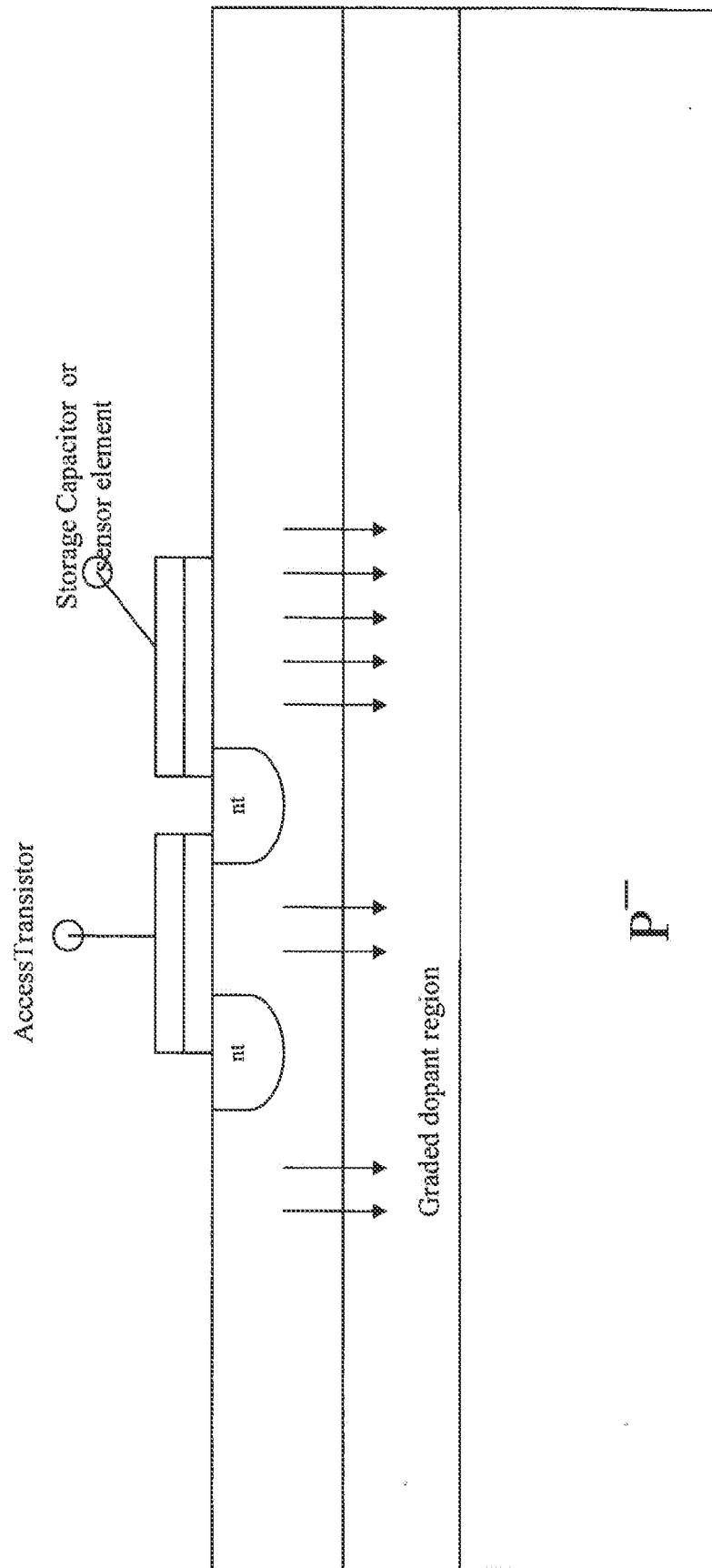


**FIGURE 4**

FIGURE 5A

**FIGURE 5B**

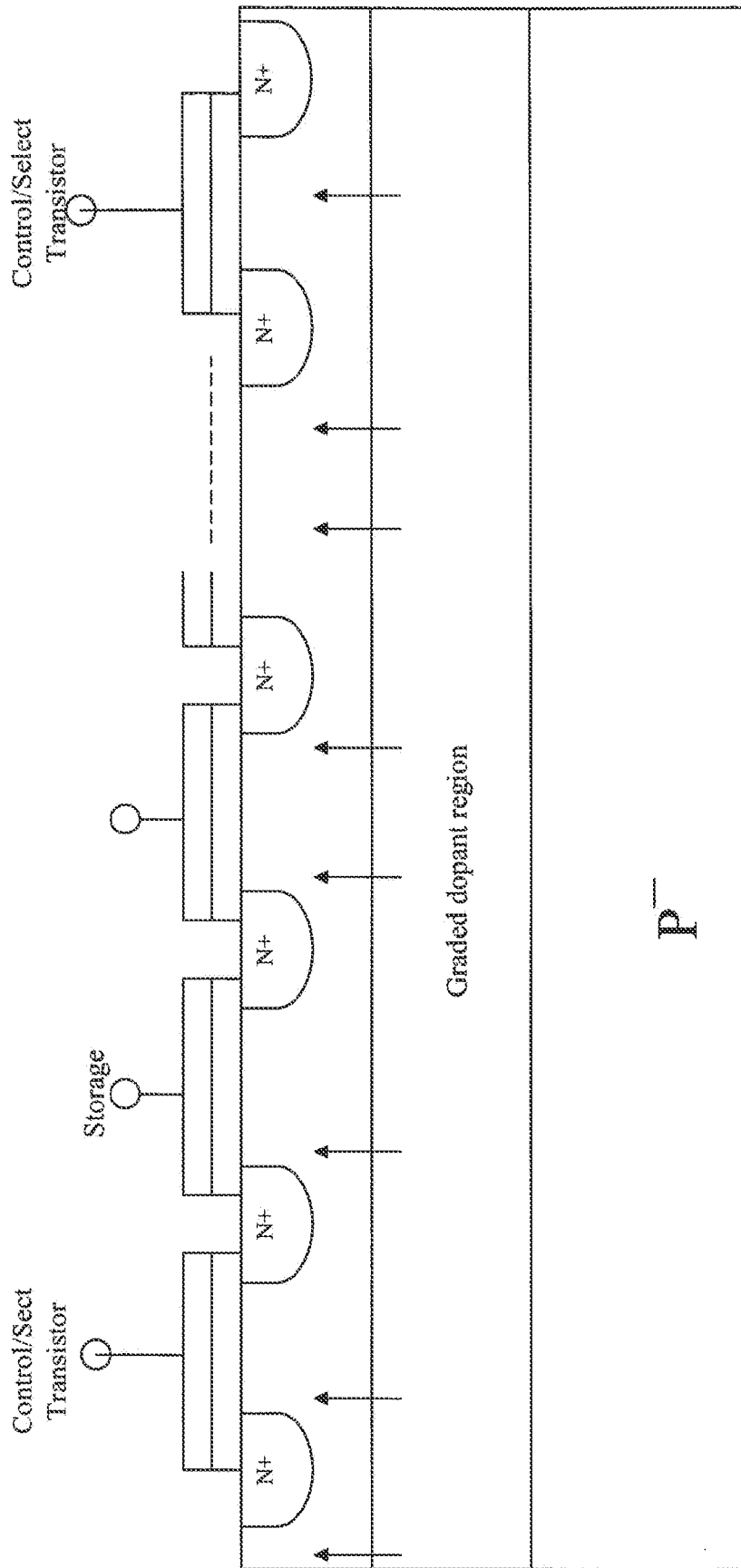


FIGURE 5C

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 43455028                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 11-AUG-2021                                      |
| <b>Filing Date:</b>                         | 09-JUL-2021                                      |
| <b>Time Stamp:</b>                          | 12:00:40                                         |
| <b>Application Type:</b>                    | Utility under 35 USC 111(a)                      |

### Payment information:

|                        |    |
|------------------------|----|
| Submitted with Payment | no |
|------------------------|----|

### File Listing:

| Document Number | Document Description                              | File Name                           | File Size(Bytes)/<br>Message Digest                        | Multi Part /.zip | Pages (if appl.) |
|-----------------|---------------------------------------------------|-------------------------------------|------------------------------------------------------------|------------------|------------------|
| 1               | Applicant Response to Pre-Exam Formalities Notice | GRT35314ResponseNTCCORRP<br>PRS.pdf | 140749<br><br>c5bf953560418734698dda9fb92096cd615<br>ce9b1 | no               | 3                |

### Warnings:

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                  |                                          |    |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------|------------------------------------------|----|----|
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |                  |                                          |    |    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Drawings-only black and white line drawings | GRT35314DWGS.pdf | 3531672                                  | no | 10 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                  | 969dd9563ede422ad99ba4e86bd6299ca60c5702 |    |    |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                             |                  |                                          |    |    |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |                  |                                          |    |    |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |                  | 3672421                                  |    |    |
| <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/> <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>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.</b></p> |                                             |                  |                                          |    |    |



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| APPLICATION<br>NUMBER | FILING or<br>371(c) DATE | GRP ART<br>UNIT | FIL FEE REC'D | ATTY. DOCKET NO | TOT CLAIMS | IND CLAIMS |
|-----------------------|--------------------------|-----------------|---------------|-----------------|------------|------------|
| 17/371,839            | 07/09/2021               | 2812            | 2820          | GRTD60-35314    | 30         | 2          |

CONFIRMATION NO. 2197

## FILING RECEIPT

25883  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380



Date Mailed: 07/23/2021

Receipt is acknowledged of this non-provisional utility patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

**Please verify the accuracy of the data presented on this receipt.** If an error is noted on this Filing Receipt, please submit a written request for a corrected Filing Receipt, including a properly marked-up ADS showing the changes with strike-through for deletions and underlining for additions. If you received a "Notice to File Missing Parts" or other Notice requiring a response for this application, please submit any request for correction to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections provided that the request is grantable.

### Inventor(s)

G.R. MOHAN RAO, ALLEN, TX;

### Applicant(s)

GREENTHREAD, LLC, Dallas, TX;

**Power of Attorney:** The patent practitioners associated with Customer Number 25883

### Domestic Priority data as claimed by applicant

This application is a CON of 16/947,294 07/27/2020  
which is a CON of 16/717,950 12/17/2019 PAT 10734481  
which is a CON of 15/590,282 05/09/2017 PAT 10510842  
which is a CON of 14/931,636 11/03/2015 PAT 9647070  
which is a CON of 14/515,584 10/16/2014 PAT 9190502  
which is a CON of 13/854,319 04/01/2013 ABN  
which is a CON of 11/622,496 01/12/2007 PAT 8421195  
which is a DIV of 10/934,915 09/03/2004 ABN

**Foreign Applications** for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.) - None.

*Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.*

**Permission to Access Application via Priority Document Exchange:** Yes

**Permission to Access Search Results:** Yes

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

**If Required, Foreign Filing License Granted:** 07/22/2021

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 17/371,839**

**Projected Publication Date:** To Be Determined - pending completion of Corrected Papers

**Non-Publication Request:** No

**Early Publication Request:** No

**Title**

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

**Preliminary Class**

438

**Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:** No

**PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES**

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific

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**Title 37, Code of Federal Regulations, 5.11 & 5.15**

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**NOT GRANTED**

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| <b>PATENT APPLICATION FEE DETERMINATION RECORD</b><br>Substitute for Form PTO-875                                                                                                                                                                                                                                                                                                                          |                                                                 |                                  |          |                                    |                    | Application or Docket Number<br>17/371,839 |                    |                         |                    |                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------|----------|------------------------------------|--------------------|--------------------------------------------|--------------------|-------------------------|--------------------|--------------------|
| <b>APPLICATION AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                       |                                                                 |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                 | (Column 2)                       |          | SMALL ENTITY                       |                    | OTHER THAN SMALL ENTITY                    |                    |                         |                    |                    |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                                                    | NUMBER EXTRA                     | RATE(\$) | FEE(\$)                            |                    | RATE(\$)                                   | FEE(\$)            |                         |                    |                    |
| BASIC FEE<br>(37 CFR 1.16(a), (b), or (c))                                                                                                                                                                                                                                                                                                                                                                 | N/A                                                             | N/A                              | N/A      |                                    |                    | N/A                                        | 320                |                         |                    |                    |
| SEARCH FEE<br>(37 CFR 1.16(k), (l), or (m))                                                                                                                                                                                                                                                                                                                                                                | N/A                                                             | N/A                              | N/A      |                                    |                    | N/A                                        | 700                |                         |                    |                    |
| EXAMINATION FEE<br>(37 CFR 1.16(o), (p), or (q))                                                                                                                                                                                                                                                                                                                                                           | N/A                                                             | N/A                              | N/A      |                                    |                    | N/A                                        | 800                |                         |                    |                    |
| TOTAL CLAIMS<br>(37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                                           | 30                                                              | minus 20 = *                     | 10       |                                    |                    | x 100 =                                    | 1000               |                         |                    |                    |
| INDEPENDENT CLAIMS<br>(37 CFR 1.16(h))                                                                                                                                                                                                                                                                                                                                                                     | 2                                                               | minus 3 = *                      |          |                                    |                    | x 480 =                                    | 0.00               |                         |                    |                    |
| APPLICATION SIZE FEE<br>(37 CFR 1.16(s))<br>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).                                                                                                                                  |                                                                 |                                  |          |                                    |                    |                                            | 0.00               |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                  |          |                                    |                    |                                            | 0.00               |                         |                    |                    |
| MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))                                                                                                                                                                                                                                                                                                                                                          |                                                                 |                                  |          |                                    |                    |                                            | 0.00               |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                  | TOTAL    |                                    |                    | TOTAL                                      | 2820               |                         |                    |                    |
| * If the difference in column 1 is less than zero, enter "0" in column 2.                                                                                                                                                                                                                                                                                                                                  |                                                                 |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
| <b>APPLICATION AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                    |                                                                 |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
| (Column 1)                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                 | (Column 2)                       |          | (Column 3)                         |                    | SMALL ENTITY                               |                    | OTHER THAN SMALL ENTITY |                    |                    |
| AMENDMENT A                                                                                                                                                                                                                                                                                                                                                                                                |                                                                 | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA      | RATE(\$)                                   | ADDITIONAL FEE(\$) |                         | RATE(\$)           | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                       | *                                | Minus    | **                                 | =                  | x                                          | =                  |                         | x                  | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                 | *                                | Minus    | ***                                | =                  | x                                          | =                  |                         | x                  | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                           |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                  |          |                                    | TOTAL<br>ADD'L FEE |                                            |                    |                         | TOTAL<br>ADD'L FEE |                    |
| AMENDMENT B                                                                                                                                                                                                                                                                                                                                                                                                |                                                                 | CLAIMS REMAINING AFTER AMENDMENT |          | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA      | RATE(\$)                                   | ADDITIONAL FEE(\$) |                         | RATE(\$)           | ADDITIONAL FEE(\$) |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Total<br>(37 CFR 1.16(i))                                       | *                                | Minus    | **                                 | =                  | x                                          | =                  |                         | x                  | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Independent<br>(37 CFR 1.16(h))                                 | *                                | Minus    | ***                                | =                  | x                                          | =                  |                         | x                  | =                  |
|                                                                                                                                                                                                                                                                                                                                                                                                            | Application Size Fee (37 CFR 1.16(s))                           |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            | FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j)) |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |
|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                 |                                  |          |                                    | TOTAL<br>ADD'L FEE |                                            |                    |                         | TOTAL<br>ADD'L FEE |                    |
| * If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".<br>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".<br>The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1. |                                                                 |                                  |          |                                    |                    |                                            |                    |                         |                    |                    |



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| APPLICATION NUMBER | FILING OR 371(C) DATE | FIRST NAMED APPLICANT | ATTY. DOCKET NO./TITLE |
|--------------------|-----------------------|-----------------------|------------------------|
| 17/371,839         | 07/09/2021            | G.R. MOHAN RAO        | GRTD60-35314           |

**CONFIRMATION NO. 2197**

## FORMALITIES LETTER



25883  
MUNCK WILSON MANDALA L.L.P  
P.O. Drawer 800889  
DALLAS, TX 75380

Date Mailed: 07/23/2021

## NOTICE TO FILE CORRECTED APPLICATION PAPERS

### *Filing Date Granted*

An application number and filing date have been accorded to this application. The application is informal since it does not comply with the regulations for the reason(s) indicated below. Applicant is given **TWO MONTHS** from the date of this Notice within which to correct the informalities indicated below. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

The required item(s) identified below must be timely submitted to avoid abandonment:

- Replacement drawings in compliance with 37 CFR 1.84 and 37 CFR 1.121(d) are required. The drawings submitted are not acceptable because:
  - The drawings contain excessive text. Suitable descriptive legends may be used, or may be required by the Examiner where necessary for understanding of the drawing but should contain as few words as possible (see 37 CFR 1.84(o)). See Figure(s) 3D.

Applicant is cautioned that correction of the above items may cause the specification and drawings page count to exceed 100 pages. If the specification and drawings exceed 100 pages, applicant will need to submit the required application size fee.

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

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Alexandria VA 22313-1450

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For more information about EFS-Web please call the USPTO Electronic Business Center at 1-866-217-9197 or visit our website at <http://www.uspto.gov/ebc>.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/hnguyen/

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## TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

|                        |                                                  |
|------------------------|--------------------------------------------------|
| Application Number     |                                                  |
| Filing Date            |                                                  |
| First Named Inventor   | G.R. MOHAN RAO                                   |
| Title                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |
| Art Unit               |                                                  |
| Examiner Name          |                                                  |
| Attorney Docket Number | GRTD60-35314                                     |

### SIGNATURE of Applicant or Patent Practitioner

|                                                    |                                   |                     |        |
|----------------------------------------------------|-----------------------------------|---------------------|--------|
| Signature                                          | /Gregory M. Howison, Reg. #30646/ | Date (Optional)     |        |
| Name                                               | GREGORY M. HOWISON                | Registration Number | 30,646 |
| Title (if Applicant is a juristic entity)          |                                   |                     |        |
| Applicant Name (if Applicant is a juristic entity) |                                   |                     |        |

**NOTE:** This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.



\*Total of ONE forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 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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**POWER OF ATTORNEY BY APPLICANT**

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

| Application Number | Filing Date |
|--------------------|-------------|
|                    |             |

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☒ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above:

25883

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☒ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

**GREENTHREAD, LLC**

- ☐ Inventor or Joint Inventor (title not required below)
- ☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
- ☒ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
- ☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

**SIGNATURE of Applicant for Patent**

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature

Date (Optional)

Name

Title

GREENTHREAD, LLC

**NOTE:** Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☒ Total of ONE forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 3 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.

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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN  
APPLICATION DATA SHEET (37 CFR 1.76)****Title of  
Invention****SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS**

As the below named inventor, I hereby declare that:

This declaration  
is directed to:

The attached application, or



United States application or PCT International application number \_\_\_\_\_

filed on \_\_\_\_\_

The above-identified application was made or authorized to be made by me.

I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001  
by fine or imprisonment of not more than five (5) years, or both.**WARNING:**

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2036 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2036 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

**LEGAL NAME OF INVENTOR**Inventor: G.R. Mohan RaoDate (Optional): Sept 30, 2015Signature: G.R. Mohan Rao

Note: An application data sheet (PTO/AIA/14 or equivalent), including naming the entire inventive entity, must accompany this form.  
Use an additional PTO/SB/AIA01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 1 minute 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.

**ABSTRACT**

Most semiconductor devices manufactured today, have uniform dopant concentration, either in the lateral or vertical device active (and isolation) regions. By grading the dopant concentration, the performance in various semiconductor devices can be significantly improved. Performance improvements can be obtained in application specific areas like increase in frequency of operation for digital logic, various power MOSFET and IGBT ICs, improvement in refresh time for DRAMs, decrease in programming time for nonvolatile memory, better visual quality including pixel resolution and color sensitivity for imaging ICs, better sensitivity for varactors in tunable filters, higher drive capabilities for JFETs, and a host of other applications.

**WHAT IS CLAIMED IS:**

1. A VLSI semiconductor device, comprising:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface with a second doping type opposite in conductivity to the first doping type and within which transistors can be formed;

5 a second active region separate from the first active region disposed adjacent to the first active region and within which transistors can be formed;

transistors formed in at least one of the first active region or second active region;

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 and second active regions towards an area of the substrate where there are no active regions; and

10 at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface towards the area of the substrate where there are no active regions, wherein at least some of the transistors form digital logic of the VLSI semiconductor device.

2. The VLSI semiconductor device of Claim 1, wherein the substrate is a p-type substrate.

3. The VLSI semiconductor device of Claim 1, wherein the substrate has epitaxial silicon on top of a non-epitaxial substrate.

4. The VLSI semiconductor device of Claim 1, wherein the first active region and second active region contain digital logic formed by one of either p-channel and n-channel devices.

5. The VLSI 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 at least one graded dopant.

6. The VLSI semiconductor device of Claim 1, wherein the first active region and second active region are each separated by at least one isolation region.

7. The VLSI semiconductor device of Claim 1, wherein the graded dopant is fabricated with an ion implantation process.
8. The VLSI semiconductor device of Claim 1, wherein the first and second active regions are formed adjacent the first surface of the substrate.
9. The VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant concentration in the first active region or the second active region are either p-type or n-type.
10. The VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant concentration in the first active region are both p-type and n-type.
11. The VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant concentration in the second active region are both p-type and n-type.
12. The VLSI semiconductor device of Claim 1, wherein dopants of the graded dopant region in the well region are both p-type and n-type.
13. The VLSI semiconductor device of claim 1, wherein the transistors which can be formed in the first and second active regions are CMOS digital logic transistors requiring at least a source, a drain, a gate and a channel.
14. The VLSI semiconductor device of Claim 1, wherein the device is a dynamic random access memory (DRAM).
15. The VLSI semiconductor device of Claim 1, wherein the device is a complementary metal oxide semiconductor (CMOS) with a nonepitaxial substrate.
16. The VLSI semiconductor device of Claim 1, wherein the device is a flash memory.
17. The VLSI semiconductor device of Claim 1, wherein the device comprises digital logic and capacitors.
18. The VLSI semiconductor device of Claim 1, wherein the device is central processing unit.

19. The VLSI semiconductor device of Claim 1, wherein the device is an image sensor.

20. The VLSI semiconductor device of Claim 1, wherein each of the first and second active regions are in the lateral or vertical direction.

21. A VLSI semiconductor device, comprising:

a substrate of a first doping type at a first doping level having a surface;

a first active region disposed adjacent the surface of the substrate with a second doping type opposite in conductivity to the first doping type and within which 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 transistors can be formed in the surface thereof;

transistors formed in at least one of the first active region or second active region;

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 an area of the substrate where there are no active regions; and

at least one well region adjacent to the first or second active region containing at least one graded dopant region, the graded dopant region to aid carrier movement from the surface to the area of the substrate where there are no active regions, and wherein the graded dopant concentration is linear, quasilinear, error function, complementary error function, or any combination thereof.

22. The VLSI semiconductor device of Claim 21, wherein the substrate is an n-type substrate.

23. The VLSI semiconductor device of Claim 21, wherein the substrate is a p-type substrate.

24. The VLSI semiconductor device of Claim 21, wherein the substrate has epitaxial silicon on top of a nonepitaxial substrate.

25. The VLSI semiconductor device of Claim 21, wherein the first active region and second active region contain at least one of either p-channel and n-channel devices.

26. The VLSI semiconductor device of Claim 21, 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 at least one graded dopant.
27. The VLSI semiconductor device of Claim 21, wherein the first active region and second active region are each separated by at least one isolation region.
28. The VLSI semiconductor device of Claim 21, wherein dopants of the graded dopant concentration in the first active region or the second active region are either p-type or n-type.
29. The VLSI semiconductor device of Claim 21, wherein dopants of the graded dopant concentration in the first active region are both p-type and n-type.
30. The VLSI semiconductor device of Claim 21, wherein dopants of the graded dopant concentration in the second active region are both p-type and n-type.

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

**SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS**

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE****SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS****CROSS-REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application is a Continuation of U.S. Patent Application No. 16/947,294, filed July 27, 2020, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, which is a Continuation of U.S. Patent Application No. 16/717,950, filed December 17, 2019, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, issued as U.S. Patent No. 10,734,481 on August 04, 2020. U.S. Patent Application No. 16/717,950 is a Continuation of U.S. Patent Application No. 15/590,282, filed May 9, 2017, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, issued as U.S. Patent No. 10,510, 842 on December 17, 2019, which is a Continuation of U.S. Patent Application No. 14/931,636, filed November 3, 2015, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, issued as U.S. Patent No. 9,647,070 on May 9, 2017, which is Continuation of U.S. Patent Application No. 14/515,584, filed October 16, 2014, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, issued as U.S. Patent No. 9,190,502 on November 17, 2015, which is a Continuation of U.S. Patent Application No. 13/854,319 filed April 1, 2013, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, which is a Continuation of 11/622,496, filed January 12, 2007, entitled SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS, issued as U.S. Patent No. 8,421,195 on April 16, 2013, which is a Divisional of U.S. Patent Application No. 10/934,915, filed September 3, 2004. The disclosures of which are incorporated herein by reference in their entirety.

**TECHNICAL FIELD**

**[0002]** This present invention relates to all semiconductor devices and systems. Particularly it applies to diffused diodes, avalanche diodes, Schottky devices, power MOS transistors, JFET's, RF bipolar transistors, IGBTs (Insulated Gate Bipolar Transistors), varactors, digital VLSI, mixed signal circuits and sensor devices including camera ICs employing CCD (Charge Coupled Device) as well as CMOS technologies.

## BACKGROUND

**[0003]** Bipolar Junction Transistors (BJT) are classified as minority carrier devices because minority carriers are the principle device conduction mechanism. However, majority carriers also play a small but finite role in modulating the conductivity in BJTs. Consequently, both carriers (electrons and holes) play a role in the switching performance of BJTs. The maximum frequency of operation in BJTs is limited by the base transit time as well as the quick recombination of the majority carriers when the device is switched off (prior to beginning the next cycle). The dominant carrier mechanism in BJTs is carrier diffusion. The carrier drift current component is fairly small, especially in uniformly doped base BJTs. Efforts have been made in graded base transistors to create an aiding drift field to enhance the diffusing minority carrier's speed from emitter to collector. However, most semiconductor devices, including various power MOSFETs (traditional, DMOS, lateral, vertical and a host of other configurations), IGBT's (Insulated Gated Base Transistors), still use a uniformly doped 'drift epitaxial' region in the base. FIG. 1 shows the relative doping concentration versus distance in a BJT. FIG. 2 shows the uniformly doped epi region in an IGBT. In contrast to BJTs, MOS devices are majority carrier devices for conduction. The conduction is channel dominated. The channel can be a surface in one plane in planar devices. The surface can also be on the sidewalls in a vertical device. Other device architectures to combine planar and vertical conduction are also possible. The maximum frequency of operation is dictated primarily by source-drain separation distance. Most MOS devices use a uniformly doped substrate (or a well region). When a MOSFET is optimally integrated with a BJT in a monolithic fashion, an IGBT results. The IGBT inherits the advantages of both MOSFET and BJT. It also brings new challenges because the required characteristics (electron transit and hole recombination as fast as possible in n-channel IGBT) necessitate different dopant gradients either in the same layer at different positions, or at the interfaces of similar or dissimilar layers.

**[0004]** Retrograde wells have been attempted, with little success, to help improve soft error immunity in SRAMs and visual quality in imaging circuits. FIG. 3A shows a typical CMOS VLSI device employing a twin well substrate, on which active devices are subsequently fabricated. FIGS. 3B, 3C, and 3D illustrate device cross sections, as practiced today. Retrograde and halo wells have also been attempted to improve refresh time in DRAMs (dynamic random-access memories), as well as, reducing dark current (background noise) and enhance RGB (Red, Green,

Blue) color resolution in digital camera ICs. Most of these techniques either divert the minority carriers away from the active regions of critical charge storage nodes at the surface, or, increase minority carrier density locally as the particular application requires.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**[0005]** For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

**[0006]** FIG. 1 illustrates the relative doping profiles of emitter, base and collector for the two most popular bipolar junction transistors: namely, uniform base (“A”) and graded base (“B”);

**[0007]** FIG. 2 illustrates the cross section of a commercial IGBT with a uniform epitaxial drift region (base);

**[0008]** FIGS. 3A, 3B, 3C, and 3D illustrate cross sections of commonly used prior art CMOS silicon substrates; FIG. 3A showing a typical prior art IC with two wells (one n<sup>-</sup>well in which p-channel transistors are subsequently fabricated and one p<sup>-</sup>well in which n-channel transistors are subsequently fabricated); FIG. 3B showing a prior art EEPROM (Electrically Erasable Programmable Read-Only Memory) memory cell having a tunnel insulator; FIG. 3C showing a prior art DRAM memory cell; and FIG. 3D showing a prior art NAND flash memory cell;

**[0009]** FIG. 4 illustrates the cross section of an IGBT, using one embodiment of the invention described here, where the dopant is optimally graded in the epitaxial drift region; and

**[0010]** FIGS. 5A, 5B, and 5C illustrate the cross sections of a CMOS silicon substrate with two wells and an underlying layer using embodiments of the invention to improve performance in each application—VLSI logic, DRAM/image IC, nonvolatile memory IC.

**DETAILED DESCRIPTION**

**[0011]** The relative doping concentrations of emitter and collector regions varies from  $10^{18}$  to  $10^{20}/\text{cm}^3$ , whereas the base region is  $10^{14}$  to  $10^{16}/\text{cm}^3$  depending on the desired characteristics of the BJT. In graded base p-n-p transistors, the donor dopant concentration may be 10 to  $100\times$  at the emitter-base junction, relative to the base-collector junction ( $1\times$ ). The gradient can be linear, quasi linear, exponential or complimentary error function. The relative slope of the donor concentration throughout the base creates a suitable aiding drift electric field, to help the holes (p-n-p transistor) transverse from emitter to collector. Since the aiding drift electric field helps hole conduction, the current gain at a given frequency is enhanced, relative to a uniformly-doped (base) BJT. The improvement in cut-off frequency (or, frequency at unity gain,  $f_T$ ) can be as large as  $2\times$ - $5\times$ . Similar performance improvements are also applicable to n-p-n transistors.

**[0012]** As illustrated in FIG. 4, in one embodiment according to the invention, a donor gradient is established from the emitter-drift epitaxial base region junction of the punch-through IGBT, to the drift epitaxial base region— $n^+$  buffer layer boundary (electrons in this case are accelerated in their transit from emitter to collector). The “average” base resistance is optimized so that conductivity modulation and lifetime (for minority carriers) in the base region are not compromised. By sweeping the carriers towards the  $n^+$  buffer region a number of advantages are obtained. First, the frequency of operation (combination of  $t_{on}$  and  $t_{off}$  as is known in the IGBT commercial nomenclature) can be enhanced. Second, and maybe more importantly, during  $t_{off}$ , holes can be recombined much quicker at the  $n^+$  buffer layer, compared to the uniformly doped  $n^-$  epitaxial drift region by establishing a different dopant gradient near the  $n^+$  buffer layer. It should be noted that the drift region can also be a non-epitaxial silicon substrate. Although epitaxy enhances lifetime, it is not mandatory. Different layers of dopant regions can be transferred through wafer to wafer bonding (or other similar transfer mechanisms) for eventual device fabrication. The “reverse recovery time” for an IGBT is significantly improved due to the optimized graded dopant in the so called “drift region” as well as at the interfaces of the drift region. Graded dopants can also be implemented in the  $n^+$  buffer layer as well as other regions adjacent to the respective layers. Two important performance enhancements are the result of dopant gradients. For example, in an n-channel IGBT, electrons can be swept from source to drain rapidly, while at the same time holes can be recombined closer to the  $n^+$  buffer layer. This can improve  $t_{on}$  and  $t_{off}$  in the same device.

**[0013]** As illustrated in FIGS. 5A, 5B, and 5C, donor gradient is also of benefit to very large scale integrated circuits (VLSI)—VLSI logic, DRAM, nonvolatile memory like NAND flash. Spurious minority carriers can be generated by clock switching in digital VLSI logic and memory ICs. These unwanted carriers can discharge dynamically-held “actively held high” nodes. In most cases, statically-held nodes (with  $V_{cc}$ ) cannot be affected. Degradation of refresh time in DRAMs is one of the results, because the capacitor holds charge dynamically. Similarly, degradation of CMOS digital images in digital imaging ICs is another result of the havoc caused by minority carriers. Pixel and color resolution can be significantly enhanced in imaging ICs with the embodiments described herein. Creating “subterranean” recombination centers underneath the wells (gold doping, platinum doping) as is done in some high-voltage diodes is not practical for VLSI circuits. Hence, a novel technique is described herein which creates a drift field to sweep these unwanted minority carriers from the active circuitry at the surface into the substrate in a monolithic die as quickly as possible. In a preferred embodiment, the subterranean  $n^-$  layer has a graded donor concentration to sweep the minority carriers deep into the substrate. One or more of such layers can also be implemented through wafer to wafer bonding or similar “transfer” mechanisms. This  $n^-$  layer can be a deeply-implanted layer. It can also be an epitaxial layer. As desired, the  $n^-$  well and  $p^-$  wells can also be graded or retrograded in dopants to sweep those carriers away from the surface as well. The graded dopant can also be implemented in surface channel MOS devices to accelerate majority carriers towards the drain. To decrease programming time in nonvolatile memory devices, carriers should be accelerated towards the surface when programming of memory cells is executed. The graded dopant can also be used to fabricate superior Junction Field-Effect transistors where the “channel pinch-off” is controlled by a graded channel instead of a uniformly doped channel (as practiced in the prior art).

**[0014]** One of ordinary skill and familiarity in the art will recognize that the concepts taught herein can be customized and tailored to a particular application in many advantageous ways. For instance, minority carriers can be channeled to the surface to aid programming in nonvolatile memory devices (NOR, NAND, multivalued-cell). Moreover, single-well, and triple-well CMOS fabrication techniques can also be optimized to incorporate these embodiments individually and collectively. Any modifications of such embodiments (described here) fall within the spirit and scope of the invention. Hence, they fall within the scope of the claims described below.

**[0015]** Although the invention has been described with reference to specific embodiments, these descriptions are not meant to be construed in a limiting sense. Various modifications of the disclosed embodiments, as well as alternative embodiments of the invention will become apparent to persons skilled in the art upon reference to the description of the invention. It should be appreciated by those skilled in the art that the conception and the specific embodiment disclosed may be readily utilized as a basis for modifying or designing other structures for carrying out the same purposes of the present invention. It should also be realized by those skilled in the art that such equivalent constructions do not depart from the spirit and scope of the invention as set forth in the appended claims.

**[0016]** It is therefore, contemplated that the claims will cover any such modifications or embodiments that fall within the true scope of the invention.

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |                        |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  | Application Number     |              |
| Title of Invention                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |
| <p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p> |                                                  |                        |              |

**Secrecy Order 37 CFR 5.2:**

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|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.) |
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**Inventor Information:**

|                                                                                                                                             |                       |                |             |                      |                        |  |
|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------|-------------|----------------------|------------------------|--|
| Inventor                                                                                                                                    | 1                     |                |             |                      | <a href="#">Remove</a> |  |
| Legal Name                                                                                                                                  |                       |                |             |                      |                        |  |
| Prefix                                                                                                                                      | Given Name            | Middle Name    | Family Name | Suffix               |                        |  |
|                                                                                                                                             | G.R. MOHAN            |                | RAO         |                      |                        |  |
| Residence Information (Select One) • US Residency Non US Residency Active US Military Service                                               |                       |                |             |                      |                        |  |
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| Address 2                                                                                                                                   |                       |                |             |                      |                        |  |
| City                                                                                                                                        | ALLEN                 | State/Province | TX          |                      |                        |  |
| Postal Code                                                                                                                                 | 75013                 | Country        | US          |                      |                        |  |
| All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the <b>Add</b> button. |                       |                |             |                      |                        |  |

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| Enter either Customer Number or complete the Correspondence Information section below.<br>For further information see 37 CFR 1.33(a). |                                                        |
| <input type="checkbox"/> An Address is being provided for the correspondence information of this application.                         |                                                        |
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**Application Information:**

|                                         |                                                  |                                           |                          |
|-----------------------------------------|--------------------------------------------------|-------------------------------------------|--------------------------|
| Title of the Invention                  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                                           |                          |
| Attorney Docket Number                  | GRTD60-35314                                     | Small Entity Status Claimed               | <input type="checkbox"/> |
| Application Type                        | Nonprovisional                                   |                                           |                          |
| Subject Matter                          | Utility                                          |                                           |                          |
| Total Number of Drawing Sheets (if any) |                                                  | Suggested Figure for Publication (if any) |                          |

|                                           |                                                  |                        |              |
|-------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

## Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

|                                                        |                          |                                            |
|--------------------------------------------------------|--------------------------|--------------------------------------------|
| Application number of the previously filed application | Filing date (YYYY-MM-DD) | Intellectual Property Authority or Country |
|                                                        |                          |                                            |

## Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not be** the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

## Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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## Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

When referring to the current application, please leave the "Application Number" field blank.

|                          |                 |                          |                                    |
|--------------------------|-----------------|--------------------------|------------------------------------|
| Prior Application Status | Pending         | <a href="#">Remove</a>   |                                    |
| Application Number       | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |
|                          | Continuation of | 16947294                 | 2020-07-27                         |

|                                           |  |                                                  |  |              |  |
|-------------------------------------------|--|--------------------------------------------------|--|--------------|--|
| <b>Application Data Sheet 37 CFR 1.76</b> |  | Attorney Docket Number                           |  | GRTD60-35314 |  |
|                                           |  | Application Number                               |  |              |  |
| Title of Invention                        |  | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |  |              |  |

|                                                                                                                                                                              |                 |                          |                                    |                        |                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------|------------------------------------|------------------------|-------------------------|
| Prior Application Status                                                                                                                                                     |                 | Patented                 |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD)           | Patent Number          | Issue Date (YYYY-MM-DD) |
| 16947294                                                                                                                                                                     | Continuation of | 16717950                 | 2019-12-17                         | 10734481               | 2020-08-04              |
| Prior Application Status                                                                                                                                                     |                 | Patented                 |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD)           | Patent Number          | Issue Date (YYYY-MM-DD) |
| 16717950                                                                                                                                                                     | Continuation of | 15590282                 | 2017-05-09                         | 10510842               | 2019-12-17              |
| Prior Application Status                                                                                                                                                     |                 | Patented                 |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD)           | Patent Number          | Issue Date (YYYY-MM-DD) |
| 15590282                                                                                                                                                                     | Continuation of | 14931636                 | 2015-11-03                         | 9647070                | 2017-05-09              |
| Prior Application Status                                                                                                                                                     |                 | Patented                 |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD)           | Patent Number          | Issue Date (YYYY-MM-DD) |
| 14931636                                                                                                                                                                     | Continuation of | 14515584                 | 2014-10-16                         | 9190502                | 2015-11-17              |
| Prior Application Status                                                                                                                                                     |                 | Abandoned                |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |                        |                         |
| 14515584                                                                                                                                                                     | Continuation of | 13854319                 | 2013-04-01                         |                        |                         |
| Prior Application Status                                                                                                                                                     |                 | Patented                 |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing Date (YYYY-MM-DD)           | Patent Number          | Issue Date (YYYY-MM-DD) |
| 13854319                                                                                                                                                                     | Continuation of | 11622496                 | 2007-01-12                         | 8421195                | 2013-04-16              |
| Prior Application Status                                                                                                                                                     |                 | Abandoned                |                                    | <a href="#">Remove</a> |                         |
| Application Number                                                                                                                                                           | Continuity Type | Prior Application Number | Filing or 371(c) Date (YYYY-MM-DD) |                        |                         |
| 11622496                                                                                                                                                                     | Division of     | 10934915                 | 2004-09-03                         |                        |                         |
| Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the <b>Add</b> button. <span style="float: right;"><a href="#">Add</a></span> |                 |                          |                                    |                        |                         |

## Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)<sup>i</sup> the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

|                                           |                                                  |                        |              |
|-------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

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|--------------------------------------------------------------------------------------------------------|----------------------|--------------------------|------------------------------------------|
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| Application Number                                                                                     | Country <sup>i</sup> | Filing Date (YYYY-MM-DD) | Access Code <sup>j</sup> (if applicable) |
|                                                                                                        |                      |                          |                                          |
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## Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <input type="checkbox"/> | <p>This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.</p> <p>NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.</p> |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                           |                                                  |                        |              |
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| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

## Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

**NOTE:** This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

### 1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

**A. Priority Document Exchange (PDX)** - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

**B. Search Results from U.S. Application to EPO** - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

### 2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

**NOTE:** Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

|                                           |                                                  |                        |              |
|-------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

## Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------|
| <b>Applicant</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                                        | <a href="#">Remove</a>                           |
| <p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p> <p style="text-align: right;"><a href="#">Clear</a></p> |                                          |                                                  |
| <input checked="" type="radio"/> Assignee                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Legal Representative under 35 U.S.C. 117 | Joint Inventor                                   |
| Person to whom the inventor is obligated to assign.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          | Person who shows sufficient proprietary interest |
| If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          |                                                  |
| <div style="border: 1px solid black; height: 20px; width: 100%;"></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                          |                                                  |
| Name of the Deceased or Legally Incapacitated Inventor: <div style="border: 1px solid black; height: 20px; width: 100%;"></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                          |                                                  |
| If the Applicant is an Organization check here. <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          |                                                  |
| Organization Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | GREENTHREAD, LLC                         |                                                  |
| <b>Mailing Address Information For Applicant:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          |                                                  |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4544 Harrys Lane                         |                                                  |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                          |                                                  |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Dallas                                   | State/Province TX                                |
| Country                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | US                                       | Postal Code 75229                                |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          | Fax Number                                       |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                          |                                                  |
| Additional Applicant Data may be generated within this form by selecting the Add button. <a href="#">Add</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                          |                                                  |

## Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

|                                           |                                                  |                        |              |
|-------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                      |                      |                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|---------------------------------------|
| <b>Assignee</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                    |                      |                      |                                       |
| Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication. |                      |                      |                      |                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |                      |                      | <input type="button" value="Remove"/> |
| If the Assignee or Non-Applicant Assignee is an Organization check here.                                                                                                                                                                                                                                                                                                                                                                               |                      |                      |                      | <input type="checkbox"/>              |
| Prefix                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Given Name           | Middle Name          | Family Name          | Suffix                                |
| <input type="text"/>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/>                  |
| <b>Mailing Address Information For Assignee including Non-Applicant Assignee:</b>                                                                                                                                                                                                                                                                                                                                                                      |                      |                      |                      |                                       |
| Address 1                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      | <input type="text"/> |                      |                                       |
| Address 2                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      | <input type="text"/> |                      |                                       |
| City                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | State/Province       | <input type="text"/> |                                       |
| Country <sup>i</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <input type="text"/> | Postal Code          | <input type="text"/> |                                       |
| Phone Number                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="text"/> | Fax Number           | <input type="text"/> |                                       |
| Email Address                                                                                                                                                                                                                                                                                                                                                                                                                                          | <input type="text"/> |                      |                      |                                       |
| Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.                                                                                                                                                                                                                                                                                                                                      |                      |                      |                      | <input type="button" value="Add"/>    |

**Signature:**

**NOTE:** This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). However, if this Application Data Sheet is submitted with the **INITIAL** filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

|                                                                                     |                                   |           |                   |                                    |
|-------------------------------------------------------------------------------------|-----------------------------------|-----------|-------------------|------------------------------------|
| <b>Signature</b>                                                                    | /Gregory M. Howison, Reg. #30646/ |           | Date (YYYY-MM-DD) | 2021-07-09                         |
| First Name                                                                          | Gregory                           | Last Name | Howison           | Registration Number                |
|                                                                                     |                                   |           |                   | 30646                              |
| Additional Signature may be generated within this form by selecting the Add button. |                                   |           |                   | <input type="button" value="Add"/> |

|                                           |                                                  |                        |              |
|-------------------------------------------|--------------------------------------------------|------------------------|--------------|
| <b>Application Data Sheet 37 CFR 1.76</b> |                                                  | Attorney Docket Number | GRTD60-35314 |
|                                           |                                                  | Application Number     |              |
| Title of Invention                        | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                        |              |

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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.

| Electronic Patent Application Fee Transmittal                                                    |          |                                                  |        |                      |
|--------------------------------------------------------------------------------------------------|----------|--------------------------------------------------|--------|----------------------|
| Application Number:                                                                              |          |                                                  |        |                      |
| Filing Date:                                                                                     |          |                                                  |        |                      |
| Title of Invention:                                                                              |          | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |        |                      |
| First Named Inventor/Applicant Name:                                                             |          | G. R. Mohan Rao                                  |        |                      |
| Filer:                                                                                           |          | Gregory Michael Howison/Joselyn Rodriguez        |        |                      |
| Attorney Docket Number:                                                                          |          | GRTD60-35314                                     |        |                      |
| Filed as Large Entity                                                                            |          |                                                  |        |                      |
| Filing Fees for Track I Prioritized Examination - Nonprovisional Application under 35 USC 111(a) |          |                                                  |        |                      |
| Description                                                                                      | Fee Code | Quantity                                         | Amount | Sub-Total in USD(\$) |
| <b>Basic Filing:</b>                                                                             |          |                                                  |        |                      |
| UTILITY APPLICATION FILING                                                                       | 1011     | 1                                                | 320    | 320                  |
| UTILITY SEARCH FEE                                                                               | 1111     | 1                                                | 700    | 700                  |
| UTILITY EXAMINATION FEE                                                                          | 1311     | 1                                                | 800    | 800                  |
| REQUEST FOR PRIORITIZED EXAMINATION                                                              | 1817     | 1                                                | 4200   | 4200                 |
| <b>Pages:</b>                                                                                    |          |                                                  |        |                      |
| <b>Claims:</b>                                                                                   |          |                                                  |        |                      |
| CLAIMS IN EXCESS OF 20                                                                           | 1202     | 10                                               | 100    | 1000                 |
| <b>Miscellaneous-Filing:</b>                                                                     |          |                                                  |        |                      |

| Description                              | Fee Code | Quantity | Amount | Sub-Total in USD(\$) |
|------------------------------------------|----------|----------|--------|----------------------|
| PUBL. FEE- EARLY, VOLUNTARY, OR NORMAL   | 1504     | 1        | 0      | 0                    |
| PROCESSING FEE, EXCEPT PROV. APPLS.      | 1830     | 1        | 140    | 140                  |
| <b>Petition:</b>                         |          |          |        |                      |
| <b>Patent-Appeals-and-Interference:</b>  |          |          |        |                      |
| <b>Post-Allowance-and-Post-Issuance:</b> |          |          |        |                      |
| <b>Extension-of-Time:</b>                |          |          |        |                      |
| <b>Miscellaneous:</b>                    |          |          |        |                      |
| <b>Total in USD (\$)</b>                 |          |          |        | <b>7160</b>          |

## Electronic Acknowledgement Receipt

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| <b>EFS ID:</b>                              | 43208746                                         |
| <b>Application Number:</b>                  | 17371839                                         |
| <b>International Application Number:</b>    |                                                  |
| <b>Confirmation Number:</b>                 | 2197                                             |
| <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/Joselyn Rodriguez        |
| <b>Filer Authorized By:</b>                 | Gregory Michael Howison                          |
| <b>Attorney Docket Number:</b>              | GRTD60-35314                                     |
| <b>Receipt Date:</b>                        | 09-JUL-2021                                      |
| <b>Filing Date:</b>                         |                                                  |
| <b>Time Stamp:</b>                          | 15:54:57                                         |
| <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 | \$7160            |
| RAM confirmation Number                  | E202179F55414118  |
| Deposit Account                          | 500208            |
| Authorized User                          | Joselyn Rodriguez |

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

**File Listing:**

| Document Number | Document Description                                | File Name            | File Size(Bytes)/<br>Message Digest      | Multi Part /.zip | Pages (if appl.) |
|-----------------|-----------------------------------------------------|----------------------|------------------------------------------|------------------|------------------|
| 1               | TrackOne Request                                    | GRT35314TRACKONE.pdf | 140549                                   | no               | 2                |
|                 |                                                     |                      | 779d93c31db6608eb657b16f6f66853e26f30ffe |                  |                  |
| Warnings:       |                                                     |                      |                                          |                  |                  |
| Information:    |                                                     |                      |                                          |                  |                  |
| 2               | Drawings-only black and white line drawings         | GRT35314DWGS.pdf     | 3441256                                  | no               | 10               |
|                 |                                                     |                      | 31b25c7e387f925f58cd58d1c08f8bd71bdaf80e |                  |                  |
| Warnings:       |                                                     |                      |                                          |                  |                  |
| Information:    |                                                     |                      |                                          |                  |                  |
| 3               | Power of Attorney                                   | GRT35314POAEXE.pdf   | 1583112                                  | no               | 2                |
|                 |                                                     |                      | 08b2695aac1899d04843b5ffb8b114e330f0cdf3 |                  |                  |
| Warnings:       |                                                     |                      |                                          |                  |                  |
| Information:    |                                                     |                      |                                          |                  |                  |
| 4               | Oath or Declaration filed                           | GRT35314DECEXE.pdf   | 102924                                   | no               | 1                |
|                 |                                                     |                      | 425aabcd457f692cf118f871fd294b201f2de5f  |                  |                  |
| Warnings:       |                                                     |                      |                                          |                  |                  |
| Information:    |                                                     |                      |                                          |                  |                  |
| 5               |                                                     | GRT35314CON.pdf      | 145967                                   | yes              | 13               |
|                 |                                                     |                      | 34de3341512aa1ec1f11993602ac6ed6210a5b2e |                  |                  |
|                 | Multipart Description/PDF files in .zip description |                      |                                          |                  |                  |
|                 | Document Description                                |                      | Start                                    | End              |                  |
|                 | Abstract                                            |                      | 13                                       | 13               |                  |
|                 | Claims                                              |                      | 9                                        | 12               |                  |
|                 | Specification                                       |                      | 1                                        | 8                |                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                 |                                          |    |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----------------|------------------------------------------|----|---|
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                        |                 |                                          |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |                 |                                          |    |   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Application Data Sheet | GRT35314ADS.pdf | 1874721                                  | no | 9 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                 | 78965d0da00b7db97d3f7430b8be76363c3fa998 |    |   |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                        |                 |                                          |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |                 |                                          |    |   |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Fee Worksheet (SB06)   | fee-info.pdf    | 41799                                    | no | 2 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                 | 2b3d674d035c0fbc0e3fa6592b303de43ff4633a |    |   |
| <b>Warnings:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                        |                 |                                          |    |   |
| <b>Information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |                 |                                          |    |   |
| <b>Total Files Size (in bytes):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                        |                 | 7330328                                  |    |   |
| <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/> <b>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.</b></p> <p><b><u>National Stage of an International Application under 35 U.S.C. 371</u></b><br/> <b>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.</b></p> <p><b><u>New International Application Filed with the USPTO as a Receiving Office</u></b><br/> <b>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.</b></p> |                        |                 |                                          |    |   |

**CERTIFICATION AND REQUEST FOR PRIORITIZED EXAMINATION  
UNDER 37 CFR 1.102(e) (Page 1 of 1)**

|                       |                                                  |                                               |  |
|-----------------------|--------------------------------------------------|-----------------------------------------------|--|
| First Named Inventor: | G.R. MOHAN Rao                                   | Nonprovisional Application Number (if known): |  |
| Title of Invention:   | SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS |                                               |  |

**APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS PRIORITIZED EXAMINATION FOR THE ABOVE-IDENTIFIED APPLICATION.**

1. The processing fee set forth in 37 CFR 1.17(i), the prioritized examination fee set forth in 37 CFR 1.17(c), and if not already paid, the publication fee set forth in 37 CFR 1.18(d) have been filed with the request. The basic filing fee, search fee, examination fee, and any required excess claims and application size fees are filed with the request or have been already been paid.
2. The application contains or is amended to contain no more than four independent claims and no more than thirty total claims, and no multiple dependent claims.
3. The applicable box is checked below:

**I. ☒ Original Application (Track One) - Prioritized Examination under § 1.102(e)(1)**

- i. (a) The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a). This certification and request is being filed with the utility application via EFS-Web.  
---OR---  
(b) The application is an original nonprovisional plant application filed under 35 U.S.C. 111(a). This certification and request is being filed with the plant application in paper.
- ii. An executed oath or declaration under 37 CFR 1.63 is filed with the application.

**II. ☐ Request for Continued Examination - Prioritized Examination under § 1.102(e)(2)**

- i. A request for continued examination has been filed with, or prior to, this form.
- ii. If the application is a utility application, this certification and request is being filed via EFS-Web.
- iii. The application is an original nonprovisional utility application filed under 35 U.S.C. 111(a), or is a national stage entry under 35 U.S.C. 371.
- iv. This certification and request is being filed prior to the mailing of a first Office action responsive to the request for continued examination.
- v. No prior request for continued examination has been granted prioritized examination status under 37 CFR 1.102(e)(2).

|                                                                                                                                                                                                                                                                                                                   |                                   |                                     |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------|--------------|
| Signature                                                                                                                                                                                                                                                                                                         | /Gregory M. Howison, Reg. #30646/ | Date                                | July 9, 2021 |
| Name<br>(Print/Typed)                                                                                                                                                                                                                                                                                             | Gregory M. Howison                | Practitioner<br>Registration Number | 30,646       |
| <b>Note:</b> Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required in accordance with 37 CFR 1.33 and 11.18. Please see 37 CFR 1.4(d) for the form of the signature. If necessary, submit multiple forms for more than one signature, see below*. |                                   |                                     |              |
| <input checked="" type="checkbox"/> *Total of <u>ONE</u> forms are submitted.                                                                                                                                                                                                                                     |                                   |                                     |              |

## 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.

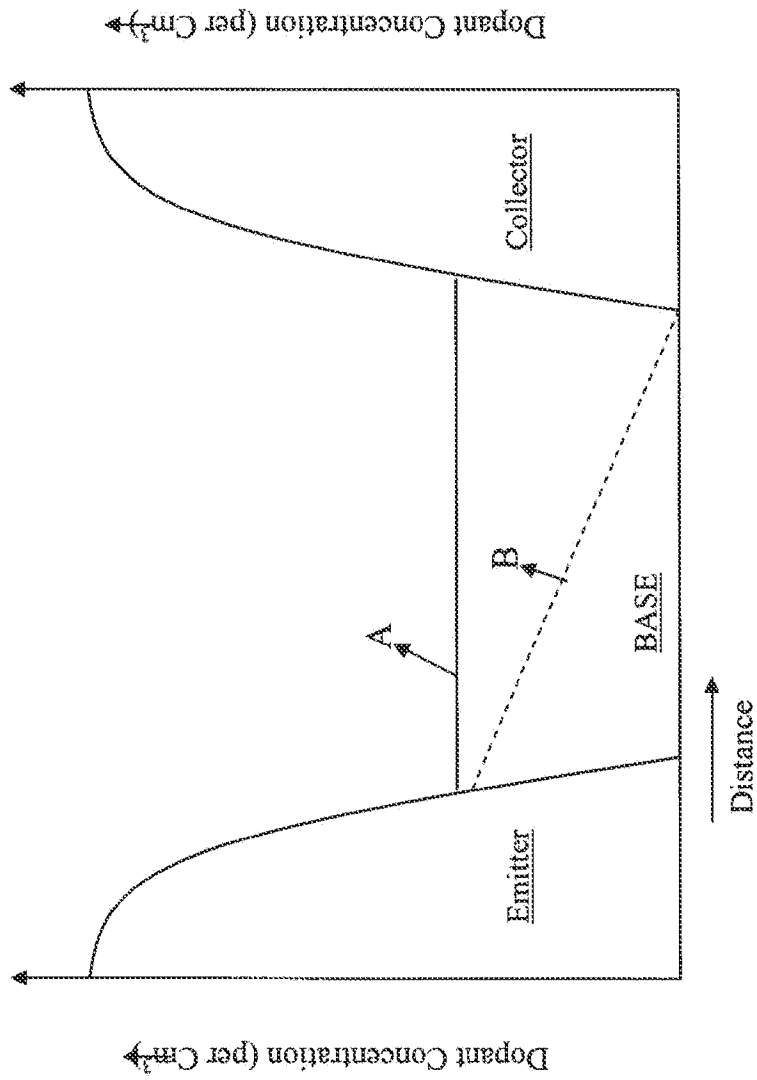


Figure 1 Prior Art

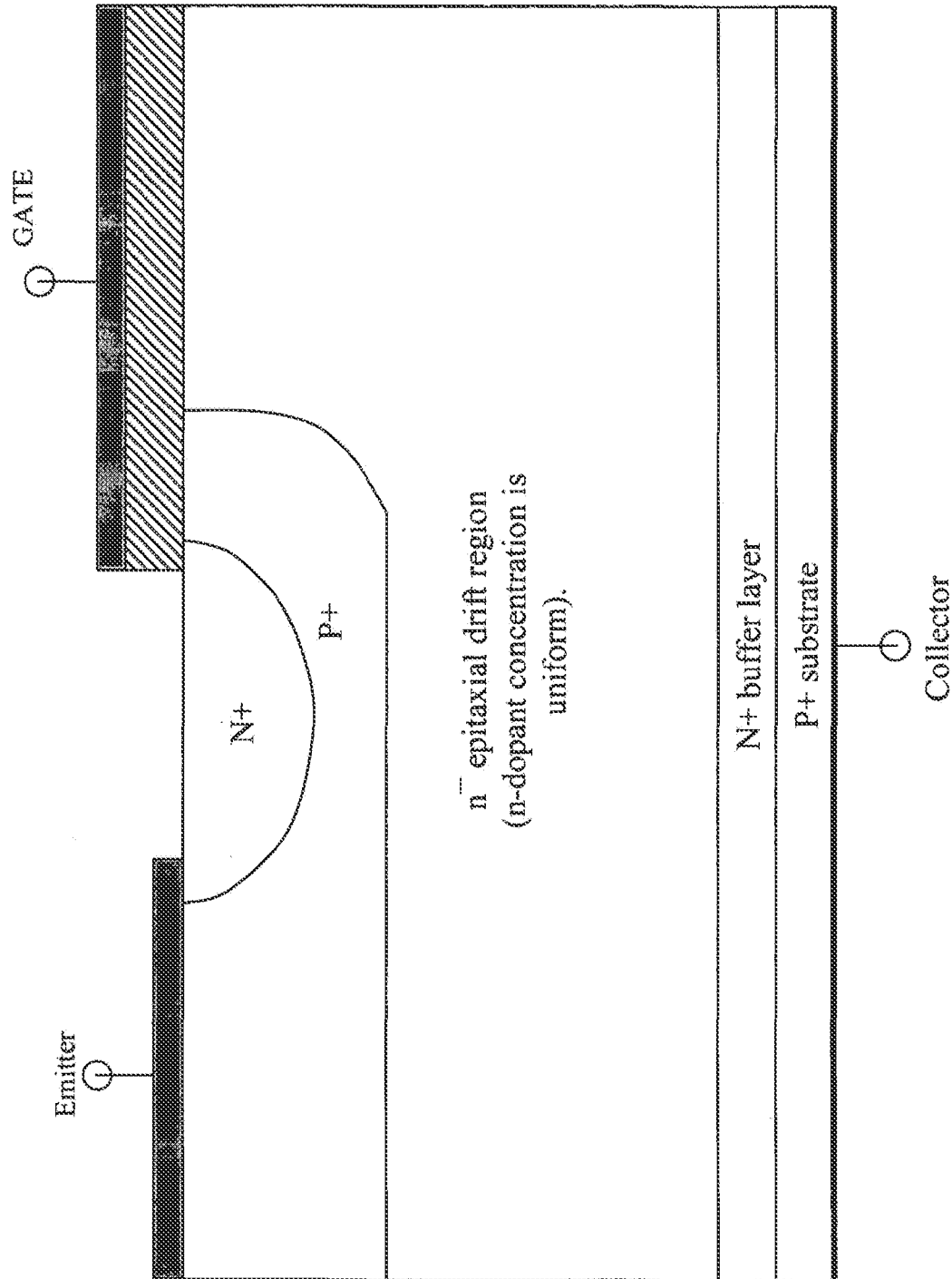


**FIGURE 2 Prior art**

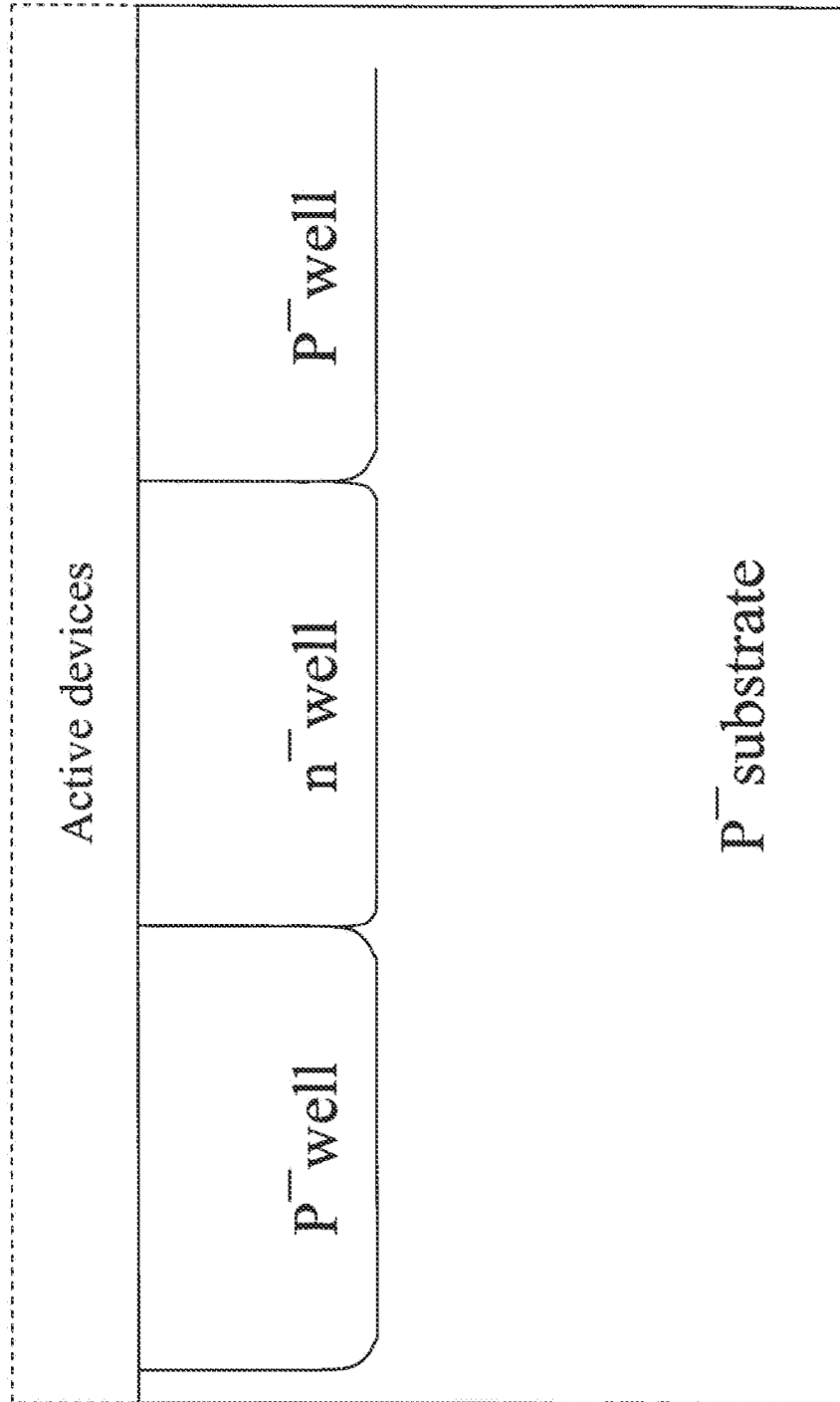


**FIGURE 3A** Prior art (Twin well CMOS) for a CMOS integrated circuit

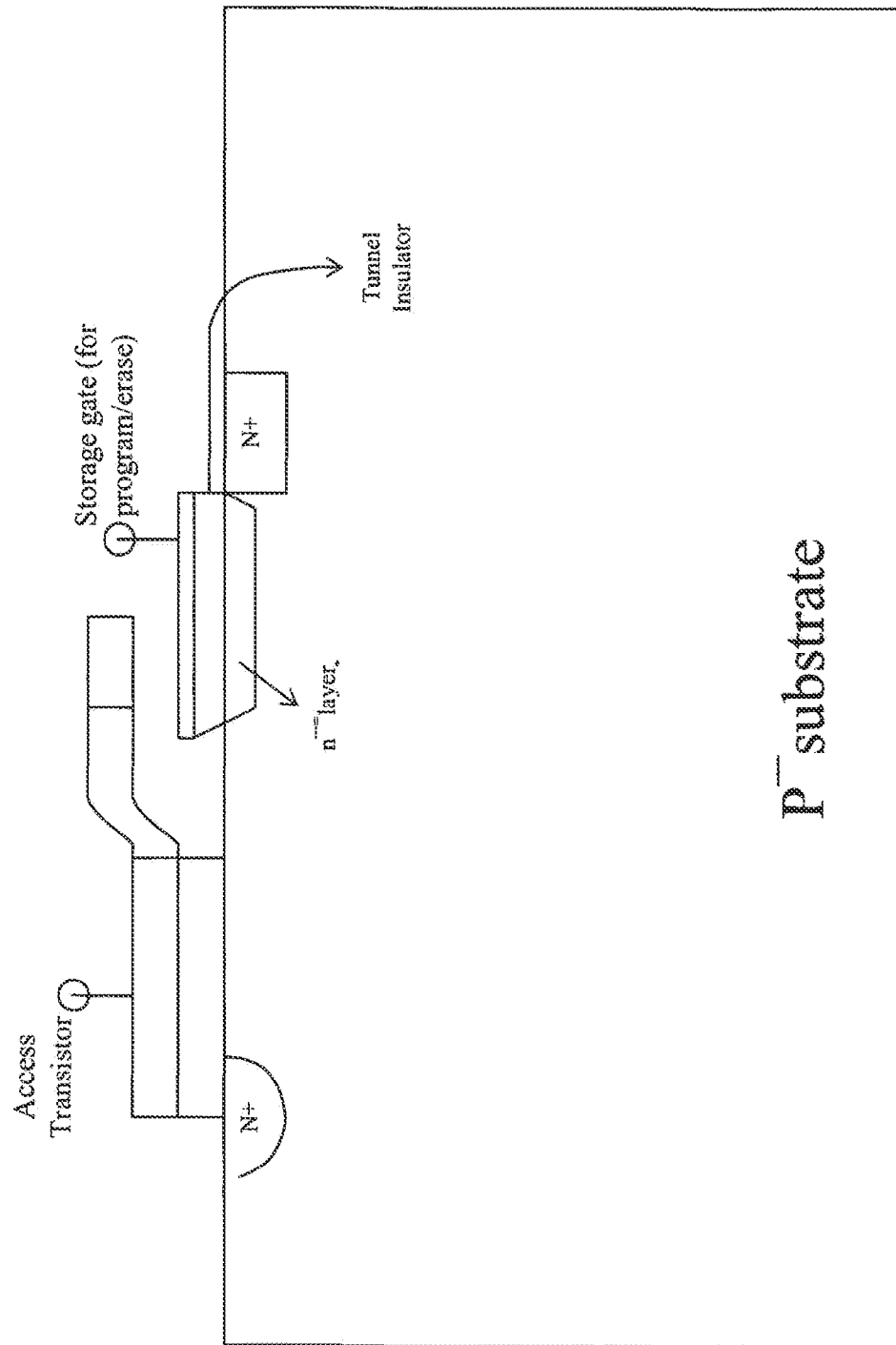


**FIGURE 3B** Prior art for a two-device EEPROM memory cell

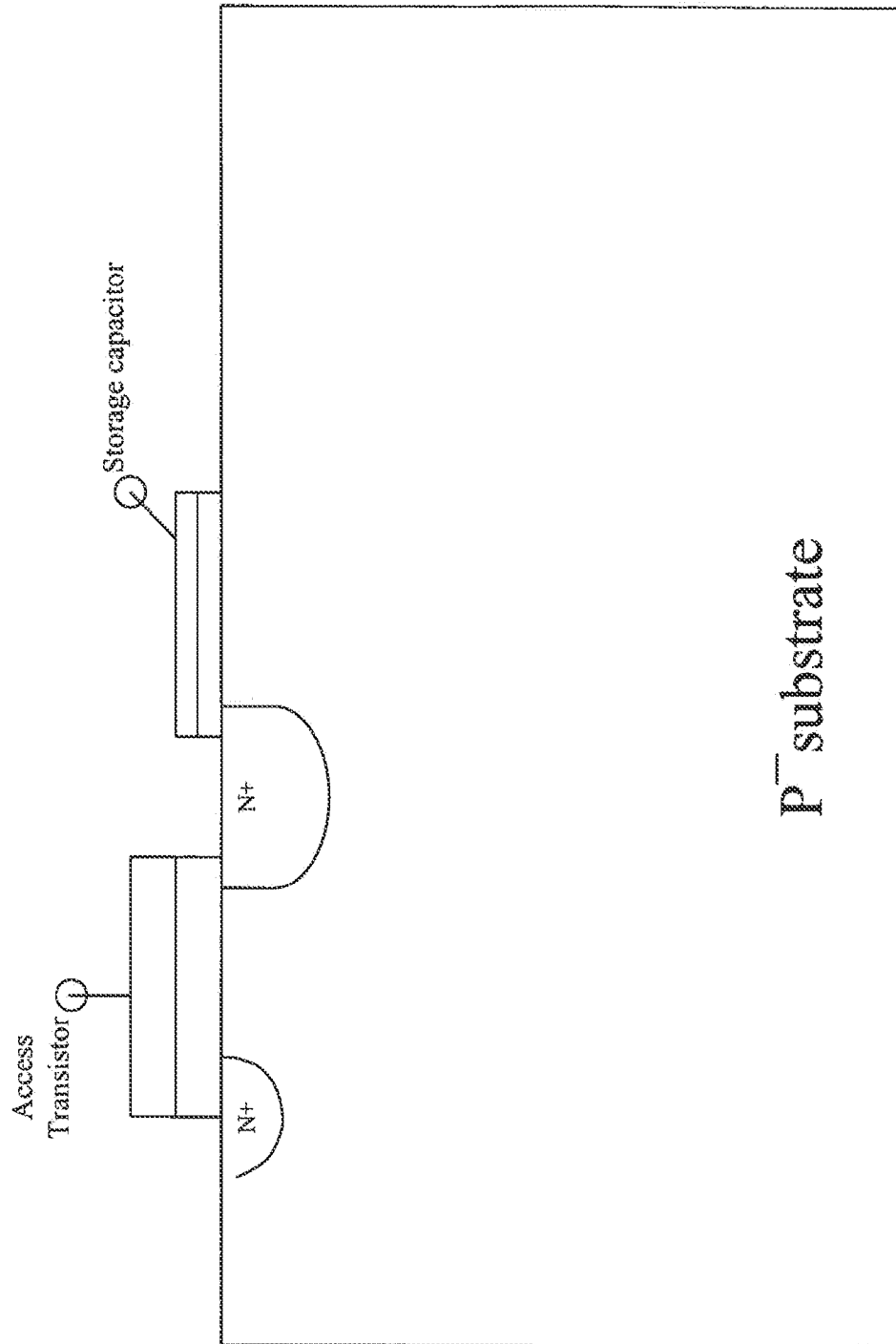


**FIGURE 3C** Prior art for a 1T-1C DRAM memory cell

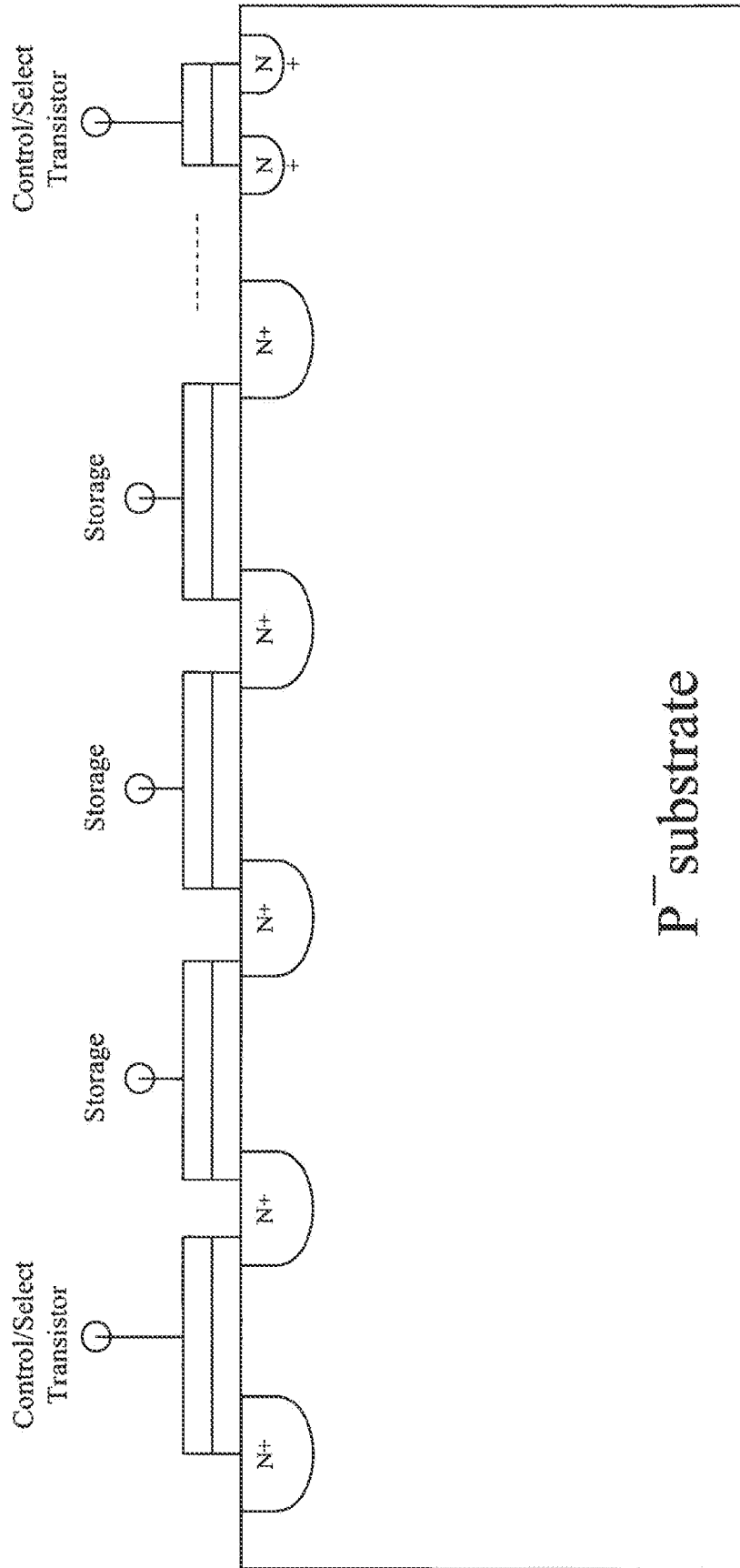


**FIGURE 3D Prior art for a NAND flash memory cell**

Note: Control/ Sect transistors have a single insulator - traditional MOS transistor.

Storage nodes have a stacked gate structure, typically with a floating gate and control gate comprising the stack.

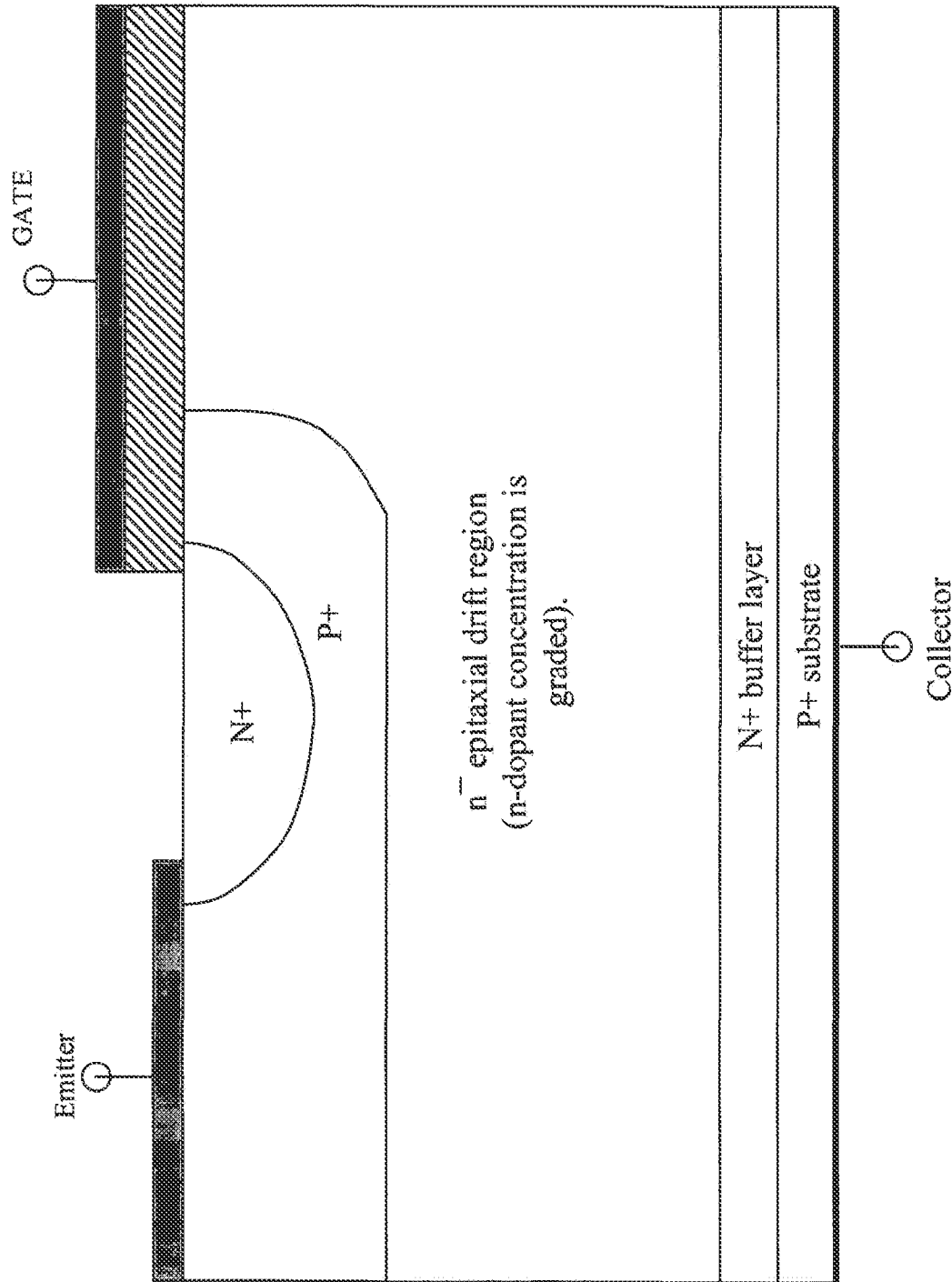


**FIGURE 4** A dopant - concentration graded drift region in a IGBT

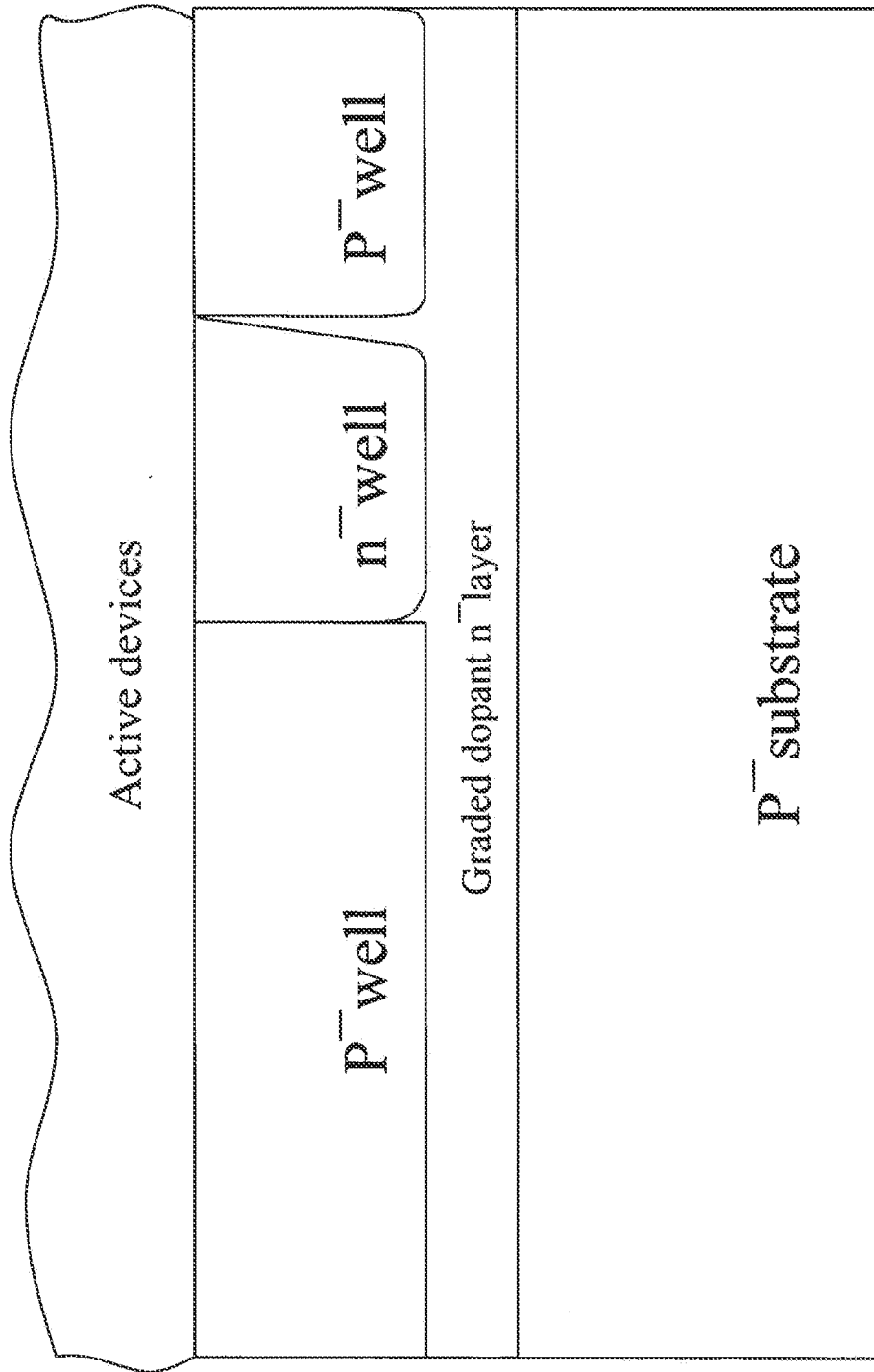


**FIGURE 5A** A CMOS Substrate for digital, mixed, signal, and sensors IC's

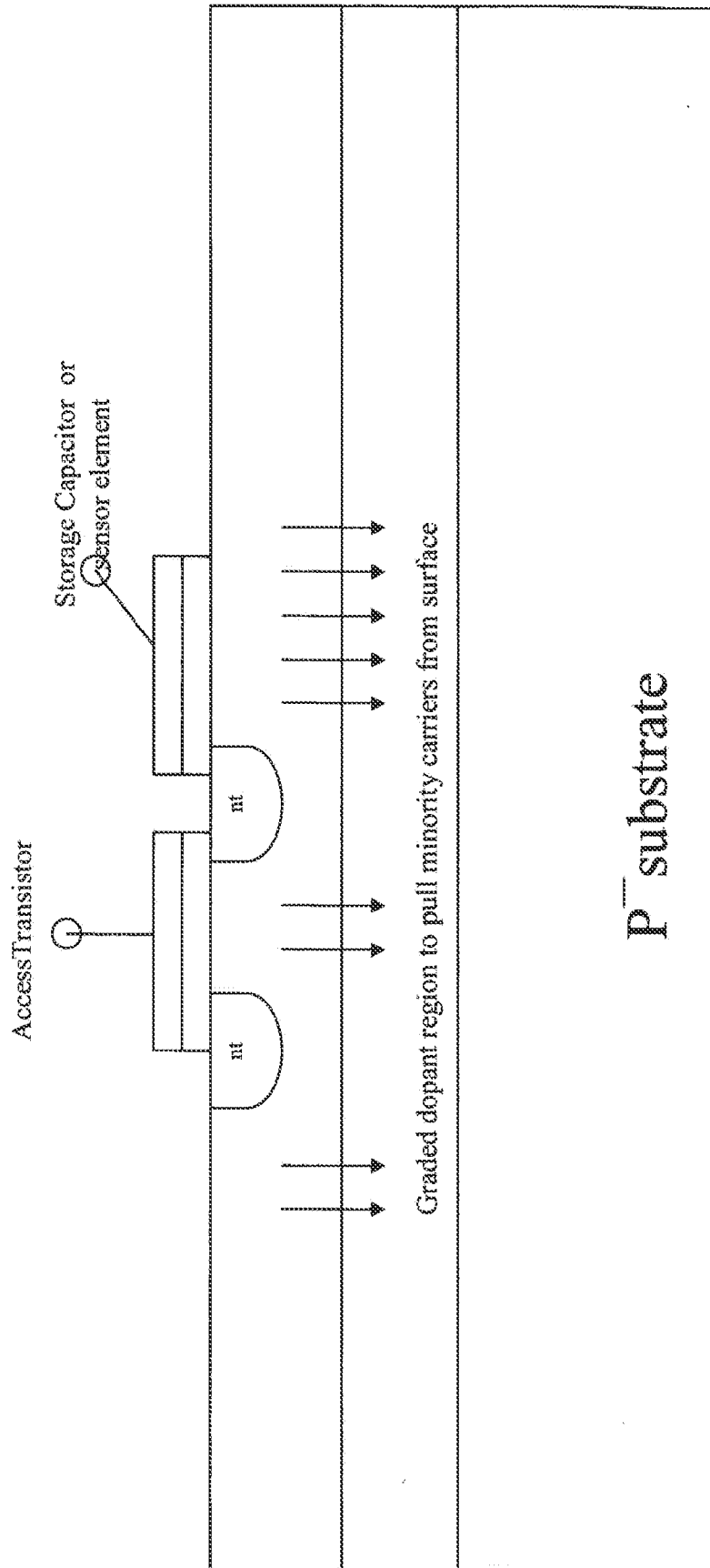


**FIGURE 5B CMOS Substrate for a DRAM or image sensor, with one embodiment of the invention**

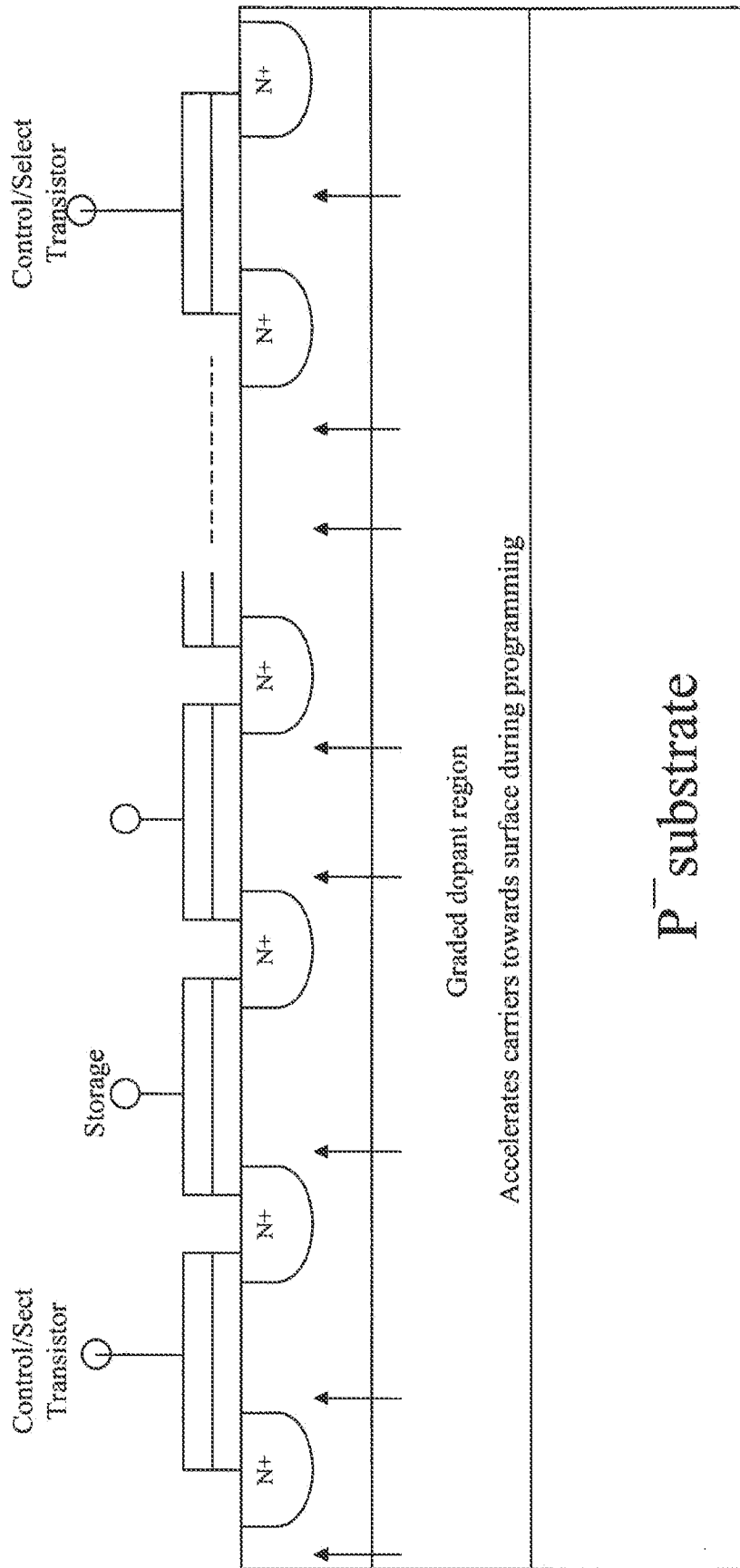


**FIGURE 5C CMOS Substrate for a NAND flash device to improve programming times**