

AO 120 (Rev. 08/10)

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

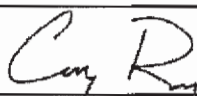
DOCKET NO. 1:23-cv-00369	DATE FILED 3/31/2023	U.S. DISTRICT COURT Western District of Texas, Austin Division
PLAINTIFF GREENTHREAD, LLC		DEFENDANT CIRRUS LOGIC, INC.
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,421,195	4/16/2013	GREENTHREAD, LLC
2 9,190,502	11/17/2015	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 ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT 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 PHILIP J. DEVLIN	(BY) DEPUTY CLERK 	DATE 04/04/2023
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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

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SONY GROUP CORPORATION,
Petitioner,

v.

GREENTHREAD LLC
Patent Owner.

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)¹

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

¹ 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”).² 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

² 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)

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL TECHNOLOGIES INC. AND DELL INC.,
Petitioner,

v.

GREENTHREAD LLC,
Patent Owner.

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)¹

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

¹ 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”).² 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

² 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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nmatich@mckoolsmith.com
smccommas@mckoolsmith.com

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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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. 6:22-cv-00105	DATE FILED 1/27/2022	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF GREENTHREAD, LLC		DEFENDANT INTEL CORPORATION, DELL INC., AND DELL TECHNOLOGIES INC.,
PATENT OR TRADEMARK NO.	DATE OF PATENT 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	
	☒ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT 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	(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

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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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. 6:22-cv-00105	DATE FILED 1/27/2022	U.S. DISTRICT COURT Western District of Texas, Waco Division
PLAINTIFF GREENTHREAD, LLC		DEFENDANT INTEL CORPORATION, DELL INC., AND DELL TECHNOLOGIES INC.,
PATENT OR TRADEMARK NO.	DATE OF PATENT 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 ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

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

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/947,294	09/14/2021	11121222	GRTD60-35294	6907

25883 7590 08/25/2021
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 Data Management (ODM) at (571)-272-4200.

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

GREENTHREAD, LLC, Dallas, TX;
G.R. Mohan Rao, Allen, 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.

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 08/11/2021
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.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD60-35294	6907

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	11/12/2021

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/SB/122) attached.

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

2. For printing on the patent front page, list

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

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

1 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 ☐ 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. 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 /Gregory M. Howison, Reg. #30646/

Date August 11, 2021

Typed or printed name GREGORY M. HOWISON

Registration No. 30,646

Electronic Patent Application Fee Transmittal

Application Number:	16947294			
Filing Date:	27-Jul-2020			
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS			
First Named Inventor/Applicant Name:	G.R. Mohan Rao			
Filer:	Gregory Michael Howison/Anna Nguyen			
Attorney Docket Number:	GRTD60-35294			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

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

EFS ID:	43481763
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	25883
Filer:	Gregory Michael Howison
Filer Authorized By:	
Attorney Docket Number:	GRTD60-35294
Receipt Date:	11-AUG-2021
Filing Date:	27-JUL-2020
Time Stamp:	15:54:14
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$ 1200
RAM confirmation Number	E20218AF55164564
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 1.17 (Patent application and reexamination processing fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	GRT35294IssueFeeTransmittal.pdf	1235057	no	1
			bcc7d713d5093b3da2ca0714325c11158a3f3e9		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	40279	no	2
			89ee78f80675f92f2bffa0fbbabba28b7b353f		
Warnings:					
Information:					
Total Files Size (in bytes):			1275336		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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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NOTICE OF ALLOWANCE AND FEE(S) DUE

25883 7590 08/11/2021
MUNCK WILSON MANDALA L.L.P.
P.O. Drawer 800889
DALLAS, TX 75380

EXAMINER

ARORA, AJAY

ART UNIT

PAPER NUMBER

2892

DATE MAILED: 08/11/2021

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD60-35294	6907

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	11/12/2021

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

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 08/11/2021
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.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD60-35294	6907

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	11/12/2021

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/SB/122) attached.

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

2. For printing on the patent front page, list

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

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.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD60-35294	6907
25883	7590	08/11/2021	EXAMINER	
MUNCK WILSON MANDALA L.L.P			ARORA, AJAY	
P.O. Drawer 800889			ART UNIT	
DALLAS, TX 75380			PAPER NUMBER	
			2892	
DATE MAILED: 08/11/2021				

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.

Notice of Allowability	Application No. 16/947,294	Applicant(s) Rao, G.R. Mohan	
	Examiner AJAY ARORA	Art Unit 2892	AIA (FITF) Status 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 7/27/2020.
☐ 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 1-44. 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 or send an inquiry to 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. ☒ Notice of References Cited (PTO-892) 2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date <u>9/29/2020 & 6/30/2021</u> . 3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____. 4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____.	5. ☐ Examiner's Amendment/Comment 6. ☒ Examiner's Statement of Reasons for Allowance 7. ☐ Other _____.
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/AJAY ARORA/
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 1-44 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 a semiconductor device, comprising:

a substrate (312 – see para 29) of a first doping type (i.e. parts 312 and 21 of the substrate have n-type doping, see para 29) at a first doping level having 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 21-38 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.

Similarly, claims 39-40 are allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of base claim 30 that requires “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 or second active region to at least one substrate area where there is no active region” (see last 3 lines). Again, the closest reference is Hong.

Similarly, claim 41 is allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of “at least one graded dopant acceptor concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region” (see last 3 lines). Again, the closest reference is Hong.

Similarly, claim 42 is allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of “at least one graded donor dopant concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region” (see last 3 lines). Again, the closest reference is Hong.

Similarly, claim 43 is allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of “at least one graded acceptor dopant concentration and one graded donor dopant concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region” (see last 3 lines). Again, the closest reference is Hong.

Similarly, claim 44 is allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of “a second static

unidirectional electric drift field to aid the movement of carriers from the surface layer to the area of the substrate where there are no active regions” (see last 3 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 on 9 AM - 5 PM.

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

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

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <https://ppair->

Art Unit: 2892

my.uspto.gov/pair/PrivatePair. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/AJAY ARORA/

Primary Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 16/947,294		Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan	
	Examiner AJAY ARORA		Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date 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					
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	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date 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.

<i>Index of Claims</i> 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 2892

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS										
☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM			DATE							
Final	Original	07/31/2021								
	1	=								
	2	=								
	3	=								
	4	=								
	5	=								
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	42	=								

<i>Index of Claims</i> 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 2892

CLAIM			DATE							
Final	Original	07/31/2021								
	43	=								
	44	=								

<i>Search Notes</i> 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 2892

CPC - Searched*		
Symbol	Date	Examiner
H01L 29/1095	07/31/2021	AKA

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner
257	25	07/31/2021	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	07/31/2021	AKA
Assignee search	07/31/2021	AKA
All references for parent applications considered	07/31/2021	AKA
.clm. interference search	07/31/2021	AKA
EAST search history report	07/31/2021	AKA

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
H01L	29/1095	07/31/2021	AKA
257	25	07/31/2021	AKA

/AJAY ARORA/ Primary Examiner, Art Unit 2892	
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Issue Classification 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 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 (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 44	
/AJAY ARORA/ Primary Examiner, Art Unit 2892 (Primary Examiner) _____ (Date) _____		31 July 2021 (Date)	O.G. Print Claim(s) 1 O.G. Print Figure 5B

Issue Classification 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 2892

INTERNATIONAL CLASSIFICATION			
CLAIMED			
H01L29/10	/	29	/ 10
NON-CLAIMED			
/	/		

US ORIGINAL CLASSIFICATION	
CLASS	SUBCLASS
257	25

CROSS REFERENCES(S)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	44	
/AJAY ARORA/ Primary Examiner, Art Unit 2892 (Primary Examiner)	31 July 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 5B

Issue Classification 	Application/Control No. 16/947,294	Applicant(s)/Patent Under Reexamination Rao, G.R. Mohan
	Examiner AJAY ARORA	Art Unit 2892

☒ Claims renumbered in the same order as presented by applicant
 ☐ CPA
 ☐ T.D.
 ☐ R.1.47

CLAIMS															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
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	2		11		20		29		38						
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	4		13		22		31		40						
	5		14		23		32		41						
	6		15		24		33		42						
	7		16		25		34		43						
	8		17		26		35		44						
	9		18		27		36								

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	44	
/AJAY ARORA/ Primary Examiner, Art Unit 2892 (Primary Examiner)	31 July 2021 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 5B

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	16/947,294	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/07/31 19:23
L2	3	16/717,950	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/07/31 19:23
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L13	1,070	((Mohan) near2 (Rao)).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/07/31 19:27
L14	29,186	H01L29/1095.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/07/31 19:27
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L16	10	I13 and drift	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2021/07/31 19:28
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L50	1	("20070045682").PN.	US-PGPUB; USPAT	OR	OFF	2021/07/31 20:42

7/31/2021 9:53:28 PM

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Doc code: IDS

PTO/SB/08a (02-18)

Doc description: Information Disclosure Statement (IDS) Filed

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

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

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

Application Number	16947294
Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	NA
Attorney Docket Number	GRTD.01.01.DV7

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Art Unit		2892
Examiner Name	NA	
Attorney Docket Number		GRTD.01.01.DV7

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Art Unit		2892
Examiner Name	NA	
Attorney Docket Number		GRTD.01.01.DV7

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**INFORMATION DISCLOSURE
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Application Number		16947294
Filing Date		2020-07-27
First Named Inventor	G.R. Mohan Rao	
Art Unit		2892
Examiner Name	NA	
Attorney Docket Number		GRTD.01.01.DV7

7	20020134419	A1	2002-09-26	Macris	
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14	20070045682	A1	2007-03-01	Hong	
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18	20030183856	A1	2003-10-02	Wieczorek
19	20080142899	A1	2008-06-19	Morris

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ²	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
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NON-PATENT LITERATURE DOCUMENTS

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	1	P.D. Moor, Advanced CMOS-based pixel sensors, https://indico.cern.ch/event/122027/contributions/88236/attachments/69340/99377/FEEimecPdM.pdf , 2011, 41 pages	
	2	E. Parton, CMOS Sensors, Laser Focus World, http://www.laserfocusworld.com/articles/print/volume-49/issue-10/features/cmos-sensors-cmos-based-specialty-imagers-reach-new-performance-levels.html , Oct. 14, 2013, 5 pages	
	3	Z. Cao, Design of Pixel for High Speed CMOS Image Sensors, http://www.imagesensors.org/Past%20Workshops/2013%20Workshop/2013%20Papers/07-11_072-Cao_papers.pdf , 4 pages	
	4	M. Tanenbaum, BSTJ: Diffused Emitter and Base Silicon Transistors, The Bell System Technical Journal, Jan. 1956, 22 pages, vol. XXXV, https://archive.org/details/bstj35-1-1	

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7	W. Murray Bullis and W. R. Runyan, Influence of Mobility and Lifetime Variations on Drift-Field Effects in Silicon-Junction Devices, IEEE Transactions on Electron Devices, vol. Ed-14, No. 2, Feb. 1967
8	Berinder Brar et al., Herb's Bipolar Transistors, IEEE Transactions on Electron Devices, vol. 48, No. 11, Nov. 2001

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EXAMINER SIGNATURE

Examiner Signature	/AJAY ARORA/	Date Considered	07/31/2021
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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).

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☒ 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	/Bill R. Naifeh, Reg. No. 44962/	Date (YYYY-MM-DD)	2020-09-29
Name/Print	Bill R. Naifeh	Registration Number	44962

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.**

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Application Number	16947294
Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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	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.	
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	7	6025237	A	2000-02-15	Choi	
	8	6384431	B1	2002-05-07	Takahashi et al.	

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9	6465862	B1	2002-10-15	Harris
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	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	20080142899	A1	2008-06-19	Morris et al.	
	5	20170243876	A1	2017-08-24	Rao	

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	1	2003051551	JP	A	2003-02-21	Miyamoto et al.		×

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Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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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	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	
	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	

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Attorney Docket Number	GRTD60-35294

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
16	IPR2020-00288-Patent Owner Sur Reply
17	IPR2020-00288-Petition

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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
27	PR2020-00289-Patent Owner Pre Resp
28	PR2020-00289-Patent Owner Sur reply

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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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39	PR2020-00291-Exhibit 1021-S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons, 2nd Ed., 2002 ("Sze '02")

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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)
49	PR2020-00292-Patent Owner Preliminary Response

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Signature	/Gregory M. Howison, Reg. #30646/	Date (YYYY-MM-DD)	2021-06-24
Name/Print	Gregory M. Howison	Registration Number	30646

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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.

Bibliographic Data

Application No: 16/947,294

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.
07/27/2020	257	2892	GRTD60-35294
RULE			

APPLICANTS

GREENTHREAD, LLC, Dallas, TX, UNITED STATES

INVENTORS

G.R. Mohan Rao, Allen, TX, UNITED STATES

CONTINUING DATA

This application is a CON of 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**

08/03/2020

STATE OR COUNTRY

UNITED STATES

ADDRESS

MUNCK WILSON MANDALA L.L.P

P.O. Drawer 800889

DALLAS, TX 75380

UNITED STATES

FILING FEE RECEIVED

\$2,985



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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD60-35294

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

CONFIRMATION NO. 6907
POA ACCEPTANCE LETTER



Date Mailed: 07/23/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/20/2021.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

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.

/s/ibrahim/



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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD.01.01.DV7

CONFIRMATION NO. 6907

POWER OF ATTORNEY NOTICE



OC000000127152011

Date Mailed: 07/23/2021

40672
BILL R. NAIFEH
PO BOX 803423
DALLAS, TX 75380

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/20/2021.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

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.

/sibrahim/

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/AIA/82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	16/947,294
Filing Date	2020-07-27
First Named Inventor	R Mohan Rao G
Title	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Art Unit	
Examiner Name	
Attorney Docket Number	GRTD60-35294

SIGNATURE of Applicant or Patent Practitioner

Signature	/GregoryMHowison#30646/	Date (Optional)	2021-07-15
Name	Gregory M. Howison	Registration Number	30646
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 _____ 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.

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
16/947,294	2020-07-27

(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: 25883

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)

2021-07-15

Name

Phil John

Title

President

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 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 36 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.

POWER OF ATTORNEY BY APPLICANT

No more than ten (10) patent practitioners total may be appointed as set forth below by name and registration number. This page need not be submitted if appointing the Patent Practitioner(s) associated with a Customer Number (see form PTO/AIA/82B):

Name	Registration Number

Electronic Acknowledgement Receipt

EFS ID:	43300849
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Gregory Michael Howison
Filer Authorized By:	
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	20-JUL-2021
Filing Date:	27-JUL-2020
Time Stamp:	17:44:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	GRTDREVPOA.pdf	2993357	no	3
			a0530366f1da6b2c29b1cbd912dbdaae5d0555a9		

Warnings:

Information:	
Total Files Size (in bytes):	2993357
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: G.R. Mohan RAO
Serial No.: 16/947,294
Confirmation No.: 6907
Filed: July 27, 2020
Group: 2892
Examiner: Ajay ARORA
For: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

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

Dear Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. 1.97

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. A copy of each listed document is enclosed herewith.

Information related to IPRs 2020-00288, 00289, 00290, 00291 has been submitted in the attached Form SB/08a. Additionally, the related patent family to these IPRS was the subject matter of District Court Action styled *Greenthread, LLC v. Samsung Electronics Co., Ltd., et al.*, Case No. 2:19-CV-147-JRG, Dkt. 1 (Apr. 30, 2019). All relevant information related to this District Court case is included in the IPR submitted document.

Applicant request that this information disclosure statement be considered and that a copy of the Form PTO SB/08 be returned to the undersigned indicating the consideration of each document listed.

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

/Gregory M. Howison, Reg. #30,646/
Gregory M. Howison
Registration No. 30,646\

Filed pursuant to Rule 37 C.F.R. 1.34

GMH/jsr

P.O. Drawer 800889
Dallas, Texas 75380
Tel: 972-628-3600
Fax: 972-628-3616
June 30, 2021

Electronic Acknowledgement Receipt

EFS ID:	43141257
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Gregory Michael Howison/Joselyn Rodriguez
Filer Authorized By:	Gregory Michael Howison
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	30-JUN-2021
Filing Date:	27-JUL-2020
Time Stamp:	18:58:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	NPL_IPR202000288SurReply. pdf	188110 016c23a9a82847065976072391f03ad987a 03037	no	13

Warnings:

Information:					
2	Non Patent Literature	NPL_IPR202000292POPR.pdf	2474863	no	75
			10024da7c840175f6763f2b5999ed90b65def9e9		
Warnings:					
Information:					
3	Non Patent Literature	NPL292Exhibit2002Exhibit4toIn validityContentions.pdf	8383853	no	27
			44bb846f131c1ef304f556f69b4dc7e9d480bb5f		
Warnings:					
Information:					
4	Foreign Reference	WO2004049453A1.pdf	1000408	no	14
			2f402b8dfe42d2643aaf402eb7926ad15cd74abd		
Warnings:					
Information:					
5	Non Patent Literature	NPL_IPR202000288481POPR. pdf	2292379	no	84
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6	Non Patent Literature	NPL_00291Exhibit1020Sze.pdf	12801935	no	206
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7	Non Patent Literature	NPL_Ex_2013GlewDec.pdf	3369738	no	79
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8	Non Patent Literature	NPL_Ex_201300291_GlewDecla ration.pdf	1826545	no	47
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Information:					

9	Non Patent Literature	NPL_Ex2012_WolfVol4.pdf	3779059	no	52
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Information:					
10	Non Patent Literature	NPL_Ex2013_195GlewDec.pdf	2797823	no	69
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11	Non Patent Literature	NPL_IonImplantation.pdf	342865	no	4
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12	Non Patent Literature	NPL_Exhibit1011KhannaPart2.pdf	9657165	no	165
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13	Transmittal Letter	GRTD60-35294IDSTransmittal.pdf	96496	no	2
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Warnings:					
Information:					
Total Files Size (in bytes):			49011239		

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.

Electronic Acknowledgement Receipt

EFS ID:	43082725
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Gregory Michael Howison/Joselyn Rodriguez
Filer Authorized By:	Gregory Michael Howison
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	30-JUN-2021
Filing Date:	27-JUL-2020
Time Stamp:	18:56:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	NPL_Ex2014_AppendixA_10.pdf	8399723	no	38
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Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

2	Non Patent Literature	NPL_Exhibit_1003SmithDec.pdf	3310886	no	91
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Warnings:

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3	Non Patent Literature	NPL_Exhibit1010SizeSemiconductorDev.pdf	16415825	no	59
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4	Non Patent Literature	NPL_Exhibit1011Razavi.pdf	24641627	no	12
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Warnings:

Information:

6	Non Patent Literature	NPL_Exhibit1013Tango.pdf	5132483	no	18
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7	Non Patent Literature	NPL_Ex2001_INVAppendixC1Payne.pdf	20831381	no	42
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8	Non Patent Literature	NPL_Ex2001_INVContAppendixC1Payne.pdf	20831389	no	42
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9	Non Patent Literature	NPL_Ex2001_Morris_Appendix A1.pdf	12677622	no	40
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13	Non Patent Literature	NPL_Ex2009_Dkt1_Complaint_GreenthreadSamsung_Final.pdf	1405459	no	57
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16	Non Patent Literature	NPL_Ex2012ExcerptfromJointClaimConstructionChart.pdf	148700	no	6
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17	Non Patent Literature	NPL_Exhibit_1003_292SmithDec.pdf	3253090	no	82
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Information:					
18	Non Patent Literature	NPL_Exhibit1029ClaimConstructionMemorandumOpinion.pdf	545697	no	32
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19	Non Patent Literature	NPL_IPR2020_00289_PetitionforInterPartesReview.pdf	2174024	no	91
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Information:					
20	Non Patent Literature	NPL_IPR2020_00290_502Sur_Reply.pdf	188385	no	13
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Warnings:					
Information:					
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22	Non Patent Literature	NPL_IPR2020_00290POPR_502.pdf	3082465	no	93
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Information:					

23	Non Patent Literature	NPL_IPR2020_00291_070Sur_Reply.pdf	173642	no	10
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Warnings:					
Information:					
24	Non Patent Literature	NPL_IPR2020_00291_Petitioners_Reply.pdf	150617	no	11
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Information:					
25	Non Patent Literature	NPL_IPR2020_00291POPR_070.pdf	1744858	no	56
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Warnings:					
Information:					
26	Non Patent Literature	NPL_IPR2020-00288Petitioners_Reply.pdf	164126	no	14
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Information:					
27	Non Patent Literature	NPL_IPR202000288481POPR.pdf	2292379	no	84
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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.

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

Application Number	16947294
Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	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.	

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Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

9	6465862	B1	2002-10-15	Harris
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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	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	20080142899	A1	2008-06-19	Morris et al.	
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	1	2003051551	JP	A	2003-02-21	Miyamoto et al.		×

**INFORMATION DISCLOSURE
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Attorney Docket Number	GRTD60-35294

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 ⁵
	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	
	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	

**INFORMATION DISCLOSURE
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First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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
16	IPR2020-00288-Patent Owner Sur Reply
17	IPR2020-00288-Petition

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STATEMENT BY APPLICANT**
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Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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
27	PR2020-00289-Patent Owner Pre Resp
28	PR2020-00289-Patent Owner Sur reply

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First Named Inventor	G.R. Mohan Rao	
Art Unit		2892
Examiner Name	ARORA, AJAY	
Attorney Docket Number		GRTD60-35294

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
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")

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Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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)
49	PR2020-00292-Patent Owner Preliminary Response

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

Application Number	16947294
Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*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.

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

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Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	ARORA, AJAY
Attorney Docket Number	GRTD60-35294

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)	2021-06-24
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.**

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

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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

EFS ID:	43081214
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Gregory Michael Howison/Joselyn Rodriguez
Filer Authorized By:	Gregory Michael Howison
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	30-JUN-2021
Filing Date:	27-JUL-2020
Time Stamp:	18:55:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	GRT35294IDS.pdf	1055732	no	10
			cc674ed0f5a92e99f49716a1e1ca55e262dc a969		

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2	Foreign Reference	JP6482563.pdf	1365088	no	18
			bb0ae772df1736c1a8ff315d1fa06cbb81c6cd1f		
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3	Foreign Reference	JP2003218356.pdf	1689757	no	20
			b2d2e9585d815a8930520c49c4891158f6cd0e3c		
Warnings:					
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4	Foreign Reference	WO2004049453A1.pdf	1000408	no	14
			2f402b8dfe42d2643aaf402eb7926ad15cd74abd		
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5	Non Patent Literature	Exhibit1003SmithDec.pdf	2514721	no	94
			171acfb9b7b76961c2f73f9a242bab8f7124a115		
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6	Non Patent Literature	NPL_00288PetitionforInterPartesReview.pdf	2788021	no	86
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7	Non Patent Literature	NPL_00289PetitionerReply.pdf	159371	no	13
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8	Non Patent Literature	NPL_00290Exhibit1003SmithDec.pdf	2514695	no	94
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9	Non Patent Literature	NPL_00290Petition.pdf	2201393	no	88
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Warnings:					
Information:					
10	Non Patent Literature	NPL_00291Exhibit1003SmithDeclaration.pdf	5156981	no	99
			9c2b60a8c3f88ee131f520fdbdbdf0175babfc57		
Warnings:					
Information:					
11	Non Patent Literature	NPL_00291Exhibit1021Sze.pdf	16416583	no	59
			36258cacbbaa8a1e65f63281dfa9e582269b54		
Warnings:					
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12	Non Patent Literature	NPL_00291PetitionforInterPartesReview.pdf	12269004	no	89
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Information:					
13	Non Patent Literature	NPL_292PetitionIPR.pdf	3040763	no	72
			b7545a02977b86c0cc58e98fe200f8e64837d057		
Warnings:					
Information:					
14	Non Patent Literature	NPL_195SurReply.pdf	186970	no	13
			475b0cf6146a0ed8831deca31e0ac2d13e3d16b5		
Warnings:					
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15	Non Patent Literature	NPL_00289_195POPR.pdf	3068054	no	90
			12db128c316f9fba6257d828dc091c186182d211		
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16	Non Patent Literature	NPL_292Ex2001_Exhibit1toAppendixBofInvalidityContentions.pdf	8248720 56981352871aec56973edf077c9508f52085b5b3	no	26
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17	Foreign Reference	JP2003051551.pdf	2039729 73c9797aaddf11c233e4f992d1dcccac6285b136	no	31
Warnings:					
Information:					
18	Non Patent Literature	NPL_Ex2001_Exhibit2toAppendixBofInvalidityContentions_Hattori.pdf	11039131 20f733cb60533121c09578b8d066e18aa6080267	no	33
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD.01.01.DV7	6907
40672	7590	02/12/2021	EXAMINER	
BILL R. NAIFEH PO BOX 803423 DALLAS, TX 75380				
			ART UNIT	PAPER NUMBER
			2892	
			NOTIFICATION DATE	DELIVERY MODE
			02/12/2021	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):

patents@naifeh.com



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In re Application of :
Rao, G.R. Mohan :
Application No. 16/947,294 : **DECISION ON PETITION**
Filed: 27 Jul 2020 :
For: SEMICONDUCTOR DEVICES WITH :
GRADED DOPANT REGIONS :

This is a notice regarding your renewed request filed January 22, 2021, for acceptance of a fee deficiency submission under 37 CFR 1.28(c).

The Office no longer investigates or rejects original or reissue applications under 37 CFR 1.56. **1098 Off. Gaz. Pat. Office 502 (January 3, 1989)**. Therefore, nothing in this Notice is intended to imply that an investigation was done.

Your fee deficiency submission under 37 CFR 1.28(c) is hereby **ACCEPTED**.

Accordingly, status as a small entity has been removed and any future fee(s) submitted must be paid at the undiscounted rate.

Inquiries related to this communication should be directed to the undersigned at (571) 272-1058.

/Angela Walker/
Angela Walker
Paralegal Specialist
Office of Petitions



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :C41722

Sale Accounting Date:02/09/2021

Sale Item Reference Number

16947294

Effective Date

09/28/2020

Document Number

I202129F04190768

Fee Code

1461

Fee Code Description

1.28(C) SUBMISSIONS - APPLIC
FILE FEE

Amount Paid

\$3,135.00

Payment Method

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	G.R. Mohan Rao	§	Confirmation	6907
		§	No.	
		§		
Serial No:	16/947,294	§	Group Art Unit:	2812
		§		
Filed:	July 27, 2020	§	Examiner:	N/A
		§		

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

Via EFS-Web

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313

RESPONSE TO DECISION ON PETITION AND
RENEWED NOTIFICATION OF LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS

Dear Sir:

In response to the Decision on Petition mailed January 15, 2021, Applicant hereby submits the following itemization:

<u>Type of Fee Paid</u>	<u>Amount of Fee Paid</u>	<u>Date Paid</u>	<u>Deficiency Owed</u>
Basic filing fee	\$75.00	9/25/2020	\$225.00
Surcharge	\$80.00	9/25/2020	\$80.00
Search fee	\$330.00	9/25/2020	\$330.00
Exam Fee	\$380.00	9/25/2020	\$380.00
Additional claims fees	\$2,120.00	9/25/2020	\$2,120.00
Total Deficiency Payment Owed and Paid			\$3,135.00

Applicant hereby notifies the Office of its loss of entitlement to small entity status.

On September 25, 2020, Applicant submitted payment of fees in the amount of \$2,985.00 in response to the Notice to File Missing Parts.

On September 28, 2020, Applicant filed a Notification of Loss of Entitlement to Small Entity Statement and submitted payment of \$3,135.00 via Credit Card. On October 5, 2020, the Patent Office charged the Credit Card in the amount of \$3,135.00 for the deficiency fee payment owed. Therefore, no further fees are due.

Applicant hereby requests acceptance of this Response and Renewed Notification of Loss Entitlement to Small Entity Status.

Respectfully submitted,

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

Bill R. Naifeh
Registration No. 44,962

Law Office of Bill Naifeh
P.O. Box 803423
Dallas, TX 75380
972-726-9500
214-550-2542 (fax)

Electronic Acknowledgement Receipt

EFS ID:	41719937
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Bill Naifeh/April Reasoner
Filer Authorized By:	Bill Naifeh
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	22-JAN-2021
Filing Date:	27-JUL-2020
Time Stamp:	14:57:01
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Notification of loss of entitlement to small entity status	ResponsetoDecision.pdf	19938	no	2
			78cd0f143b6a8a8f55848a65adc2cd020b2db564		

Warnings:

Information:	
Total Files Size (in bytes):	19938
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD.01.01.DV7	6907
40672	7590	01/15/2021	EXAMINER	
BILL R. NAIFEH PO BOX 803423 DALLAS, TX 75380				
			ART UNIT	PAPER NUMBER
			2892	
			NOTIFICATION DATE	DELIVERY MODE
			01/15/2021	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):

patents@naifeh.com



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Commissioner for Patents
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www.uspto.gov

In re Application of :
Rao, G.R. Mohan :
Application No. 16/947,294 : **DECISION ON PETITION**
Filed: July 27, 2020 :
For: SEMICONDUCTOR DEVICES WITH :
GRADED DOPANT REGIONS :

This is a notice in response to the request filed on September 28, 2020, a request for acceptance of a fee deficiency submission under 37 CFR 1.28(c).

The Office no longer investigates or rejects original or reissue applications under 37 CFR 1.56. **1098 Off. Gaz. Pat. Office 502 (January 3, 1989)**. Therefore, nothing in this Notice is intended to imply that an investigation was done.

The fee deficiency submission under 37 CFR 1.28(c) is **NOT ACCEPTED**.

Applicant should note that 37 CFR 1.28(c) states in part: If status as a small entity is established in good faith, and fees as a small entity are paid in good faith, in any application or patent, and it is later discovered that such status as a small entity was established in error, or that through error the Office was not notified of a loss of entitlement to small entity status as required by § 1.27(g)(2), the error will be excused upon compliance with the separate submission and itemization. See 37 CFR 1.28(c)(2)(ii).

The itemization must include the following information:

- (A) Each particular type of fee that was erroneously paid as a small entity, (e.g., basic statutory filing fee, two-month extension of time fee) along with the current fee amount for a non-small entity;
- (B) The small entity fee actually paid, and when. This will permit the Office to differentiate, for example, between two one-month extension of time fees erroneously paid as a small entity but on different dates;
- (C) The deficiency owed amount (for each fee erroneously paid); and
- (D) The total deficiency payment owed, which is the sum or total of the individual deficiency owed amounts set forth in paragraph (c)(2)(ii)(C) of this section.

An itemization chart was not included with the request. Any renewed request must include the information in item(s) A-D above.

Applicant is given **ONE MONTH** to submit a complete listing of all the fees erroneously paid as a small entity and the total fee deficiency to avoid non acceptance of the present fee deficiency paper. This time period is not extendable under 37 CFR 1.136(a).

Further correspondence with respect to this matter should be addressed as follows:

By Mail: Mail Stop PETITION
 Commissioner for Patents
 P. O. Box 1450
 Alexandria, VA 22313-1450

By FAX: (571) 273-8300
 ATTN: Office of Petitions

By Hand: U. S. Patent and Trademark Office
 Customer Service Window, Mail Stop Petitions
 Randolph Building
 401 Dulany Street
 Alexandria, VA 22314

By Internet: EFS-Web¹

Telephone inquiries regarding this matter should be directed to undersigned at (571) 272-1058.

/Angela Walker/
Angela Walker
Paralegal Specialist
Office of Petitions

¹ www.uspto.gov/ebs/efs_help.html (for help using EFS-Web call the Patent Electronic Business Center at (866) 217-9197)



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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD.01.01.DV7

CONFIRMATION NO. 6907

PUBLICATION NOTICE



OC000000122504813

40672
BILL R. NAIFEH
PO BOX 803423
DALLAS, TX 75380

Title:SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Publication No.US-2021-0005716-A1

Publication Date:01/07/2021

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.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Public Records Division. The Public Records Division can be reached by telephone at (571) 272-3150 or (800) 972-6382, by facsimile at (571) 273-3250, by mail addressed to the United States Patent and Trademark Office, Public Records Division, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <https://portal.uspto.gov/pair/PublicPair>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



United States Patent and Trademark Office

Office of the Chief Financial Officer

Document Code:WFEE

User :67142

Sale Accounting Date:10/05/2020

Sale Item Reference Number

16947294

Effective Date

09/28/2020

Document Number

I202005B53483009

Fee Code

1599

Fee Code Description

MAINTENANCE/PETITION
INTERNAL FEE CODE

Amount Paid

\$3,135.00

Payment Method

Credit Card

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number		16947294
	Filing Date		2020-07-27
	First Named Inventor	G.R. Mohan Rao	
	Art Unit	2892	
	Examiner Name	NA	
	Attorney Docket Number	GRTD.01.01.DV7	

U.S.PATENTS						Remove
Examiner Initial*	Cite No	Patent Number	Kind Code ¹	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4001864	A	1997-01-04	Gibbons	
	2	4160985	A	1979-07-10	Kamins et al.	
	3	4347654	A	1982-09-07	Allen et al.	
	4	4481522	A	1984-11-06	Jastrzebski et al.	
	5	4866000	A	1989-09-12	Okita	
	6	5029277	A	1991-07-02	Kane	
	7	5130262	A	1992-07-14	Masquelier et al.	
	8	5213988	A	1993-05-25	Yamauchi et al.	

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STATEMENT BY APPLICANT**
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First Named Inventor	G.R. Mohan Rao	
Art Unit		2892
Examiner Name	NA	
Attorney Docket Number		GRTD.01.01.DV7

9	5262345	A	1993-11-16	Nasser et al.	
10	5329144	A	1994-07-12	Luryi	
11	5448087	A	1995-09-05	Streit et al.	
12	5480816	A	1996-01-02	Uga et al.	
13	5496746	A	1996-03-05	Matthews	
14	5517052	A	1996-05-14	Ishaque	
15	5569612	A	1996-10-29	Frisina et al.	
16	5575862	A	1996-11-19	Nishida	
17	5637898	A	1997-06-10	Baliga	
18	5797999	A	1998-08-25	Sannomiya et al.	
19	5888857	A	1999-03-30	Zhang et al.	

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20	5973575	A	1999-10-26	Kamogawa et al.	
21	6211028	B1	2001-04-03	Tsai et al.	
22	6310366	B1	2001-10-30	Rhodes et al.	
23	RE37441	E	2001-11-13	Yamazaki	
24	6452086	B1	2002-09-17	Muller	
25	6465862	B1	2002-10-15	Harris	
26	6472715	B1	2002-10-29	Liu et al.	
27	6670544	B2	2003-12-30	Kibbel et al	
28	6683343	B2	2004-01-27	Matsudai et al.	
29	6696314	B2	2004-02-24	Rhodes	
30	6706550	B2	2004-03-16	Lee et al.	

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Attorney Docket Number		GRTD.01.01.DV7

31	6713813	B2	2004-03-30	Marchant	
32	6720622	B1	2004-04-13	Yu	
33	6737722	B2	2004-05-18	Yamamoto et al.	
34	6744117	B2	2004-06-01	Dragon et al.	
35	6747883	B2	2004-06-08	Yasumura	
36	6753202	B2	2004-06-22	Chen et al.	
37	6754093	B2	2004-06-22	Lien	
38	6756616	B2	2004-06-29	Rhodes	
39	6780713	B2	2004-08-24	Bromberger et al.	
40	6831292	B2	2004-12-14	Currie et al.	
41	6878603	B2	2005-04-12	Bromberger et al.	

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Attorney Docket Number		GRTD.01.01.DV7

42	6921946	B2	2005-07-26	Kenney et al.	
43	6933215	B2	2005-08-23	Bromberger et al.	
44	7064385	B2	2006-06-20	Dudek et al.	
45	7115925	B2	2006-10-03	Rhodes	
46	7233044	B2	2007-06-19	Dudek	
47	7307327	B2	2007-12-11	Bahl et al.	
48	7504692	B2	2009-03-17	Dudek et al.	
49	8164124	B2	2012-04-24	Liu et al.	
50	8421195	B2	2013-04-16	Rao	
51	9190502	B2	2015-11-17	Rao	
52	9647070	B2	2017-05-09	Rao	

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Examiner Name	NA
Attorney Docket Number	GRTD.01.01.DV7

53	10510842	B2	2019-12-17	Rao
54	10734481	B2	2020-08-04	Rao
55	4684971	A	1987-08-04	Payne

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Examiner Initial*	Cite No	Publication Number	Kind Code ¹	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1	20010040622	A1	2001-11-15	Maruyama	
	2	20020056883	A1	2002-05-16	Baliga	
	3	20020074585	A1	2002-06-20	Tsang et al.	
	4	20020084430	A1	2002-07-04	Bamji et al.	
	5	20020093281	A1	2002-07-18	Cathey	
	6	20020102783	A1	2002-08-01	Fujimoto et al.	

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7	20020134419	A1	2002-09-26	Macris	
8	20030026126	A1	2003-02-06	Uemura	
9	20030030488	A1	2003-02-13	Huetling et al.	
10	20030042511	A1	2003-03-06	Rhodes	
11	20040027753	A1	2004-02-12	Friedrichs et al.	
12	20040063288	A1	2004-04-01	Kenney et al.	
13	20060113592	A1	2006-06-01	Pendharkar et al.	
14	20070045682	A1	2007-03-01	Hong	
15	20120048462	A1	2013-02-28	Lee	
16	20130001661	A1	2013-01-03	Mao et al.	
17	20150200314	A1	2015-07-16	Webster	

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Attorney Docket Number	GRTD.01.01.DV7

18	20030183856	A1	2003-10-02	Wieczorek
19	20080142899	A1	2008-06-19	Morris

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Examiner Initial*	Cite No	Foreign Document Number ³	Country Code ² i	Kind Code ⁴	Publication Date	Name of Patentee or Applicant of cited Document	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	T ⁵
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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 ⁵
	1	P.D. Moor, Advanced CMOS-based pixel sensors, https://indico.cern.ch/event/122027/contributions/88236/attachments/69340/99377/FEEimecPdM.pdf , 2011, 41 pages	
	2	E. Parton, CMOS Sensors, Laser Focus World, http://www.laserfocusworld.com/articles/print/volume-49/issue-10/features/cmos-sensors-cmos-based-specialty-imagers-reach-new-performance-levels.html , Oct. 14, 2013, 5 pages	
	3	Z. Cao, Design of Pixel for High Speed CMOS Image Sensors, http://www.imagesensors.org/Past%20Workshops/2013%20Workshop/2013%20Papers/07-11_072-Cao_papers.pdf , 4 pages	
	4	M. Tanenbaum, BSTJ: Diffused Emitter and Base Silicon Transistors, The Bell System Technical Journal, Jan. 1956, 22 pages, vol. XXXV, https://archive.org/details/bstj35-1-1	

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First Named Inventor	G.R. Mohan Rao
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Examiner Name	NA
Attorney Docket Number	GRTD.01.01.DV7

5	IMEC Image Sensors and Vision Systems, http://www2.imec.be/content/user/File/Brochures/cmos%20imagers%20brochure-april26.pdf , Apr. 2014, 2 pages
6	A.S. Grove, Physics and Technology of Semiconductor Devices, John Wiley Sons, Inc., New York, Nov. 1967.
7	W. Murray Bullis and W. R. Runyan, Influence of Mobility and Lifetime Variations on Drift-Field Effects in Silicon-Junction Devices, IEEE Transactions on Electron Devices, vol. Ed-14, No. 2, Feb. 1967
8	Berinder Brar et al., Herb's Bipolar Transistors, IEEE Transactions on Electron Devices, vol. 48, No. 11, Nov. 2001

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	
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*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.

¹ See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. ² Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). ³ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁴ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. ⁵ 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	16947294
Filing Date	2020-07-27
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	NA
Attorney Docket Number	GRTD.01.01.DV7

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	/Bill R. Naifeh, Reg. No. 44962/	Date (YYYY-MM-DD)	2020-09-29
Name/Print	Bill R. Naifeh	Registration Number	44962

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.**

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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

EFS ID:	40710276
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Bill Naifeh/April Reasoner
Filer Authorized By:	Bill Naifeh
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	29-SEP-2020
Filing Date:	27-JUL-2020
Time Stamp:	19:14:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	GRTD-DV7_IDSTransmittal.pdf	27181	no	2
			1f312cbb6f77ba05029806fa02232cdc5fd8156		

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	GRTD-DV7_IDS.pdf	1037133	no	11
			1ab985a09accd3003de06dfb996d83bf703c0a2b		
Warnings:					
Information:					
Total Files Size (in bytes):			1064314		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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.					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	G.R. Mohan Rao	§	Conf. No.	6907
		§		
Serial No:	16/947,294	§	Group Art Unit:	2892
		§		
Filed:	July 27, 2020	§	Examiner:	NA
		§		

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

Via EFS

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313.1450

INFORMATION DISCLOSURE STATEMENT (IDS)

Dear Sir:

Pursuant to 37 C.F.R. §§ 1.56, 1.97, and 1.98, the attention of the United States Patent and Trademark Office is hereby directed to the references listed on the attached Form PTO/SB/08. It is respectfully requested that the information be expressly considered during the prosecution of the above-identified application, and that the references be made of record therein and appear among the "References Cited" on any patent to issue therefrom.

In accordance with 37 C.F.R. § 1.97(g), the filing of this Information Disclosure Statement shall not be construed as a representation that a search has been made. In accordance with 37 C.F.R. § 1.97(h), the filing of this Information Disclosure Statement shall not be construed to be an admission that the information cited in this Information Disclosure Statement is, or is considered to be, material to patentability as defined in 37 C.F.R. § 1.56(b).

Applicant has not submitted copies of each cited U.S. patent and U.S. patent application in accordance with 37 C.F.R. § 1.98(a)(2).

Applicant has not submitted copies of each cited non-patent literature document listed in the attached Information Disclosure Statement in accordance with 37 C.F.R. 1.98(d). Copies of the non-patent literature documents were submitted to the Office in earlier Application No. 16/717,950, which is relied on for an earlier effective filing date.

This Information Disclosure Statement is made pursuant to 37 C.F.R. § 1.97(b)(3), before the mailing of a first Office Action on the merits.

It is submitted that the Information Disclosure Statement is in compliance with 37 C.F.R. § 1.98, and the Examiner is respectfully requested to consider the listed references.

Respectfully submitted,

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

Bill R. Naifeh
Registration No. 44,962

Bill R. Naifeh
Law Office of Bill Naifeh
P.O. Box 803423
Dallas, TX 75380
972-726-9500
214-550-2542 (fax)

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/947,294				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A				
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	44	minus 20 = * 24	x 50 =	1200	OR					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	7	minus 3 = * 4	x 230 =	920						
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).			0.00						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00						
				TOTAL		TOTAL				
				2905						
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** 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 found in the appropriate box in column 1.										



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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/947,294	07/27/2020	2812	2985	GRTD.01.01.DV7	44	7

40672
BILL R. NAIFEH
PO BOX 803423
DALLAS, TX 75380

CONFIRMATION NO. 6907
UPDATED FILING RECEIPT



Date Mailed: 09/29/2020

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 40672

Domestic Priority data as claimed by applicant

This application 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: 08/03/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/947,294**

Projected Publication Date: 01/07/2021

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

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 countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER
Title 35, United States Code, Section 184
Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

SelectUSA

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 U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop

technology, manufacture products, deliver services, and grow your business, visit <http://www.SelectUSA.gov> or call +1-202-482-6800.

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SEP 28 2020

Customer No. 000040672
Attorney Docket No. GRTD.01.01.DV7**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Inventor:	G.R. Mohan Rao	§	Confirmation	6907
		§	No.	
		§		
Serial No:	16/947,294	§	Group Art Unit:	2812
		§		
Filed:	July 27, 2020	§	Examiner:	N/A
		§		

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

Via Facsimile
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313

Certificate of Facsimile Transmission

I hereby certify that this correspondence is being submitted to the U.S. Patent Office via facsimile transmission to (571) 273-8300 on September 28, 2020.

/April Reasoner/

April Reasoner, Paralegal

2020 OCT - 1 PM 12:33

USPTO
RECEIPTS ACCOUNTING
DIVISION**NOTIFICATION OF LOSS OF ENTITLEMENT TO SMALL ENTITY STATUS**

Dear Sir:

Applicant hereby notifies the Office of its loss of entitlement to small entity status.

On September 25, 2020, Applicant submitted payment of fees in the amount of \$2985 in response to the Notice to File Missing Parts.

Applicant hereby submits payment of the additional fees due in the amount of \$3135 as follows:

Basic filing fee	\$ 300
Surcharge	\$ 160
Search Fee	\$ 660
Exam Fee	\$ 760
<u>Additional claim fees</u>	<u>\$4240</u>
Total Fees	\$6120
<u>Amount Paid</u>	<u>- \$2985</u>
Total Amount Due	\$3135

Customer No. 000040672
Attorney Docket No. GRTD.01.01.DV7

Attached is Form PTO-2038 Credit Card Payment Form for payment of the additional fees.

Respectfully submitted,

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

Registration No. 44,962

Law Office of Bill Naifeh
P.O. Box 803423
Dallas, TX 75380
972-726-9500
214-550-2542 (fax)

RECEIVED
CENTRAL FAX CENTER 161

SEP 28 2020

FAX COVER SHEET

TO	USPTO
COMPANY	
FAX NUMBER	15712738300
FROM	Bill Naifeh
DATE	2020-09-29 01:12:06 GMT
RE	Entity Status and Payment of Fees

COVER MESSAGE

Dear Sir:

Attached is a Notification of Loss of Entitlement to Small Entity Status, along with a cc authorization form for payment of the additional fees due.

Regards,
April Reasoner

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor:	G.R. Mohan Rao	§	Confirmation	6907
		§	No.	
		§		
Serial No:	16/947,294	§	Group Art Unit:	2812
		§		
Filed:	July 27, 2020	§	Examiner:	N/A
		§		

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

Via EFS

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

RESPONSE TO NOTICE TO FILE MISSING PARTS

Dear Sir:

In Response to the Notice to File Missing Parts, mailed October 5, 2020, in the above application, Applicant hereby submits payment of the following fees:

Basic filing fee	\$ 75
Surcharge	\$ 80
Search fee	\$ 330
Examination fee	\$ 380
<u>Additional claim fees</u>	<u>\$2120</u>
Total Filing Fees	\$2985

Respectfully submitted,

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

Bill R. Naifeh
Registration No. 44,962

Law Office of Bill Naifeh
P.O. Box 803423
Dallas, TX 75380
972-726-9500
214-550-2542 (fax)

Electronic Patent Application Fee Transmittal

Application Number:	16947294			
Filing Date:	27-Jul-2020			
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS			
First Named Inventor/Applicant Name:	G.R. Mohan Rao			
Filer:	Bill Naifeh/April Reasoner			
Attorney Docket Number:	GRTD.01.01.DV7			
Filed as Small Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
UTILITY FILING FEE (ELECTRONIC FILING)	4011	1	75	75
UTILITY SEARCH FEE	2111	1	330	330
UTILITY EXAMINATION FEE	2311	1	380	380
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	2202	24	50	1200
INDEPENDENT CLAIMS IN EXCESS OF 3	2201	4	230	920
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
LATE FILING FEE FOR OATH OR DECLARATION	2051	1	80	80
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				2985

Electronic Acknowledgement Receipt

EFS ID:	40672359
Application Number:	16947294
International Application Number:	
Confirmation Number:	6907
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	40672
Filer:	Bill Naifeh/April Reasoner
Filer Authorized By:	Bill Naifeh
Attorney Docket Number:	GRTD.01.01.DV7
Receipt Date:	25-SEP-2020
Filing Date:	27-JUL-2020
Time Stamp:	14:43:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	\$2985
RAM confirmation Number	E202090E43553297
Deposit Account	
Authorized User	

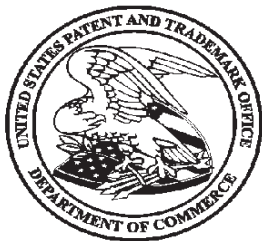
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	GRTD-DV7_PayFees.pdf	239654	no	1
			6d5cb8beba15c7f385591146570e3692a0698df		
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	40542	no	2
			d2a29a44d26086dd0df61801748cf9e5e4dcd744		
Warnings:					
Information:					
Total Files Size (in bytes):			280196		
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. <u>New Applications Under 35 U.S.C. 111</u> 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. <u>National Stage of an International Application under 35 U.S.C. 371</u> 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. <u>New International Application Filed with the USPTO as a Receiving Office</u> 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
COMMISSIONER FOR PATENTS
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ALEXANDRIA VA 22313-1451

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BILL R. NAIFEH
PO BOX 803423
DALLAS, TX 75380



**Courtesy Reminder for
Application Serial No: 16/947,294**

Attorney Docket No: GRTD.01.01.DV7
Customer Number: 40672
Date of Electronic Notification: 08/05/2020

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:
patents@naifeh.com

To view your correspondence online or update your email addresses, please visit us anytime at **<https://ppair-my.uspto.gov/pair/PrivatePair>**.
If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 16/947,294				
APPLICATION AS FILED - PART I										
(Column 1)		(Column 2)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY				
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)		RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75		N/A				
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	44	minus 20 = * 24	x 50 =	1200	OR					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	7	minus 3 = * 4	x 230 =	920						
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).			0.00						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00						
				TOTAL		TOTAL				
				2905						
* If the difference in column 1 is less than zero, enter "0" in column 2.										
APPLICATION AS AMENDED - PART II										
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OR OTHER THAN SMALL ENTITY		
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)		RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x	=	OR	x	=
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x	=	OR	x	=
	Application Size Fee (37 CFR 1.16(s))							OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** 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 found in the appropriate box in column 1.										



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
16/947,294	07/27/2020	2812	0.00	GRTD.01.01.DV7	44	7

CONFIRMATION NO. 6907

FILING RECEIPT

40672
BILL R. NAIFEH
PO BOX 803423
DALLAS, TX 75380



000000011894484

Date Mailed: 08/05/2020

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 40672

Domestic Priority data as claimed by applicant

This application 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: 08/03/2020

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/947,294**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

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

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this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/947,294	07/27/2020	G.R. Mohan Rao	GRTD.01.01.DV7

CONFIRMATION NO. 6907

FORMALITIES LETTER



OC000000118944485

Date Mailed: 08/05/2020

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NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. 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 statutory basic filing fee is missing.
- The application search fee must be submitted.
- The application examination fee must be submitted.
- Additional claim fees of \$ **2120** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- Surcharge as set forth in 37 CFR 1.16(f) must be submitted.

The surcharge is due for any one of:

- late submission of the basic filing fee, search fee, or examination fee,
- late submission of inventor's oath or declaration,
- filing an application that does not contain at least one claim on filing, or
- submission of an application filed by reference to a previously filed application.

SUMMARY OF FEES DUE:

The fee(s) required within **TWO MONTHS** from the date of this Notice to avoid abandonment is/are itemized below. Small entity discount is in effect. If applicant is qualified for micro entity status, an acceptable Certification of Micro Entity Status must be submitted to establish micro entity status. (See 37 CFR 1.29 and forms PTO/SB/15A and 15B.)

- \$ **75** basic filing fee.
- \$ **80** surcharge.
- \$ **330** search fee.
- \$ **380** examination fee.
- \$ **920** for **4** independent claims over 3.
- \$ **1200** for **24** total claims over 20.

- \$(0) previous unapplied payment amount.
- **\$ 2985** TOTAL FEE BALANCE DUE.

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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Commissioner for Patents
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<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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/ltan/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

**AUTHORIZATION TO COMMUNICATE
VIA THE INTERNET AND EMAIL**

Recognizing that Internet communications are not secure, I hereby authorize 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 or electronic mail. I understand that a copy of these communications will be made of record in the application file.

Respectfully submitted,

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

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972-726-9500
214-550-2542 (fax)

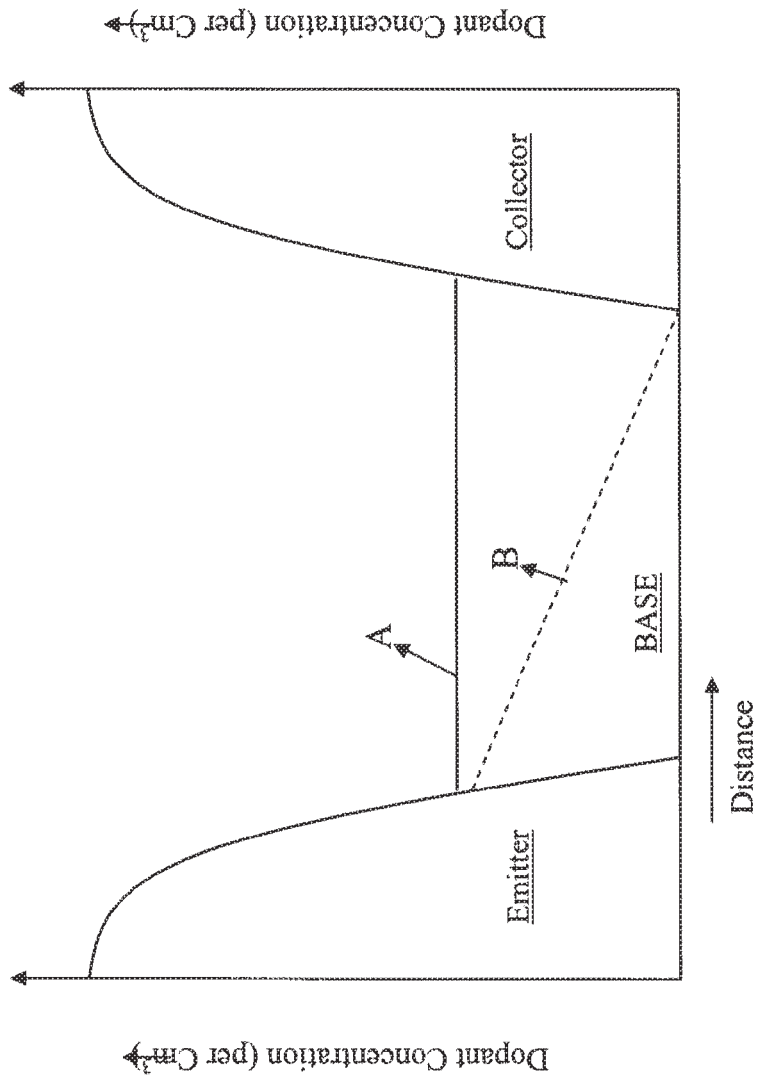


Figure 1 Prior Art

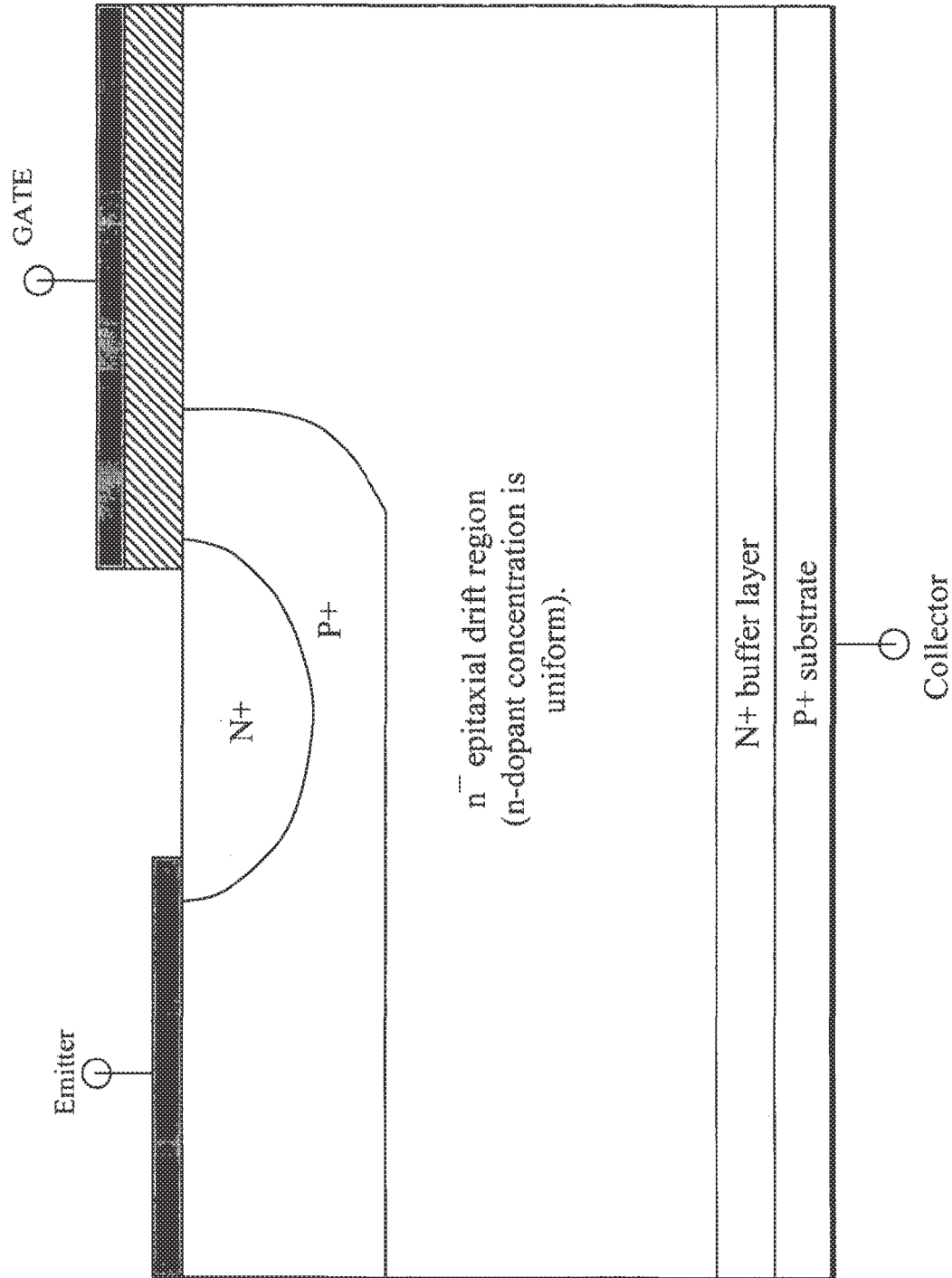


FIGURE 2 Prior art

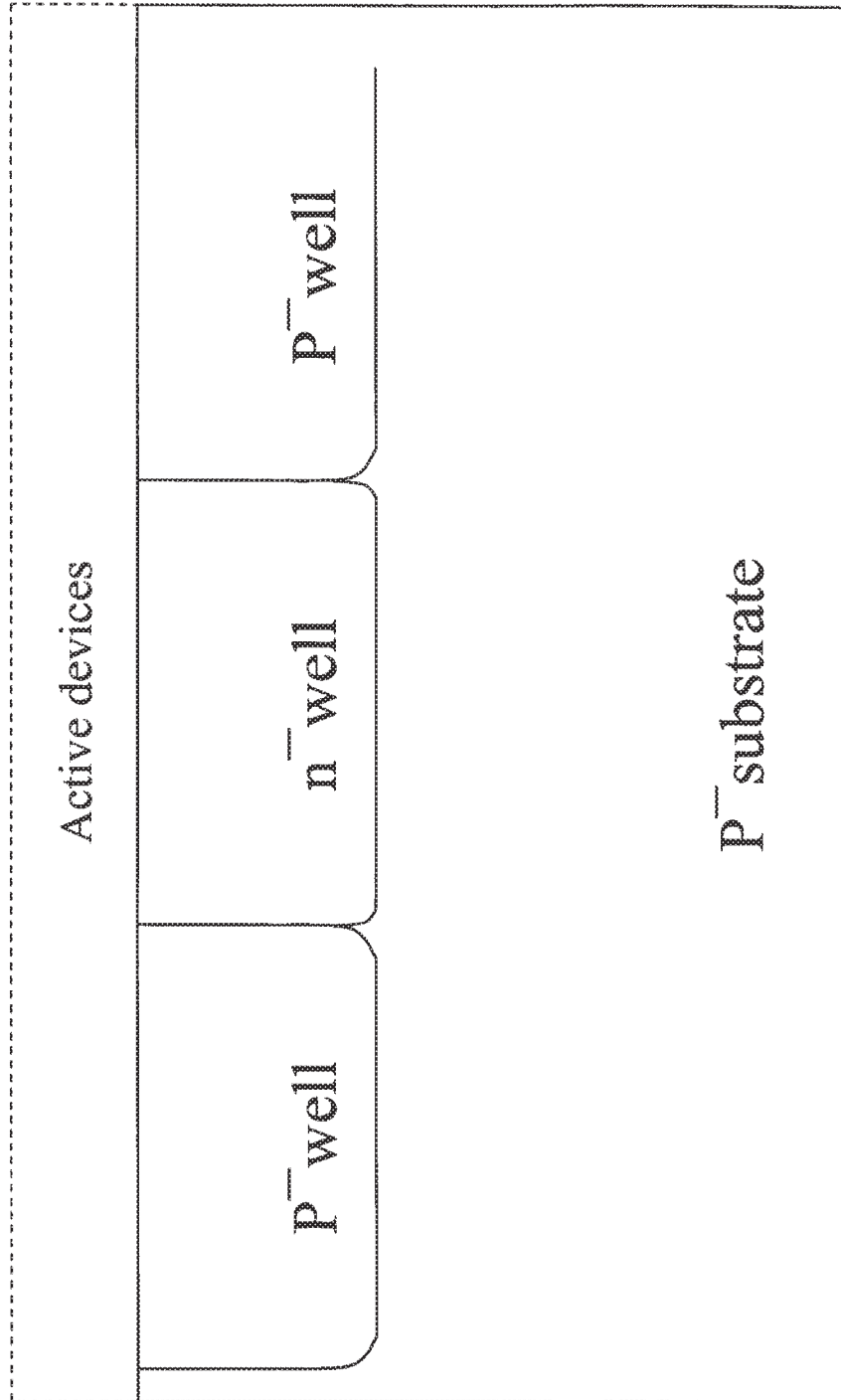


FIGURE 3A Prior art (Twin well CMOS) for a CMOS integrated circuit

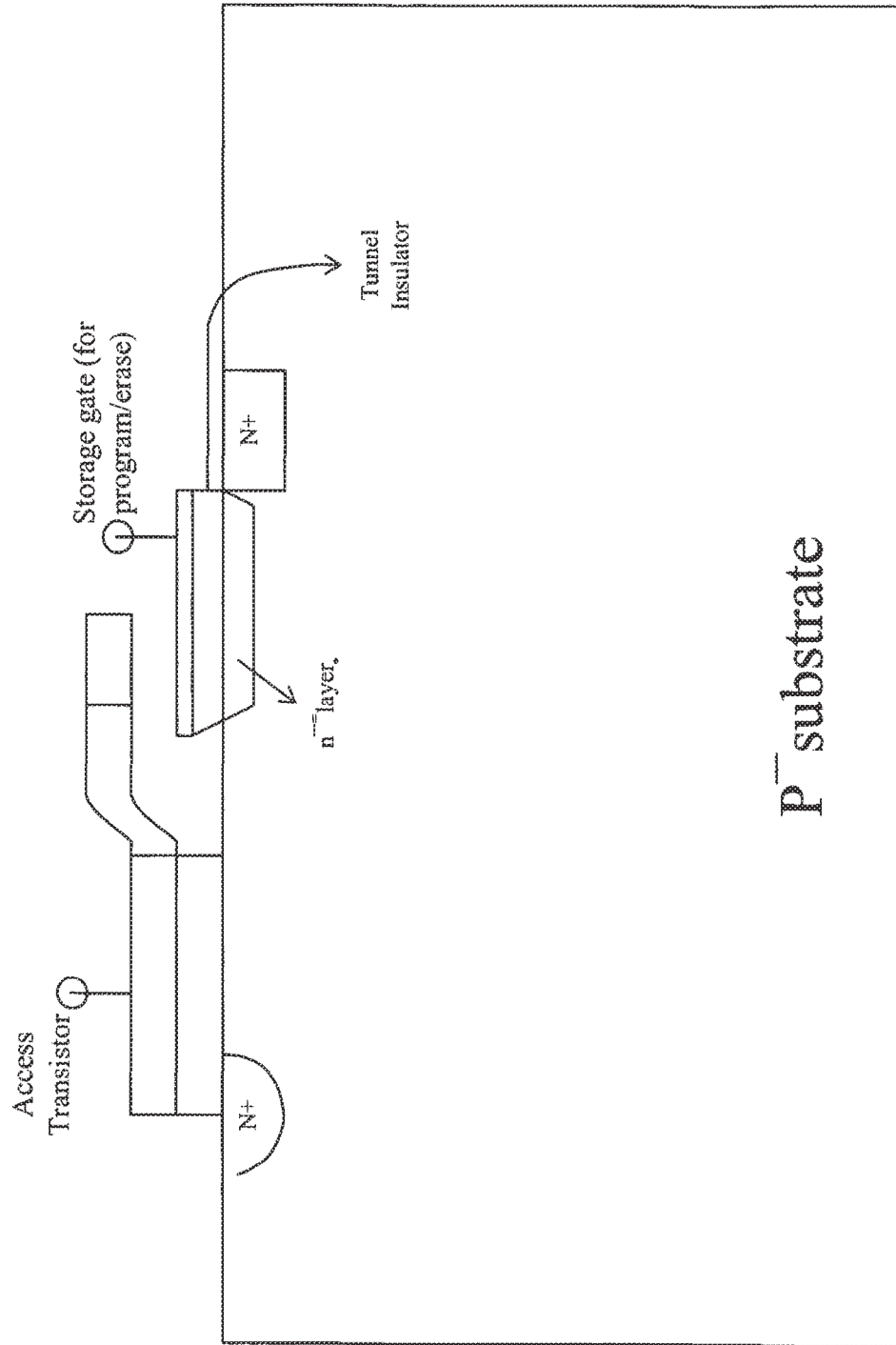


FIGURE 3B Prior art for a two-device EEPROM memory cell

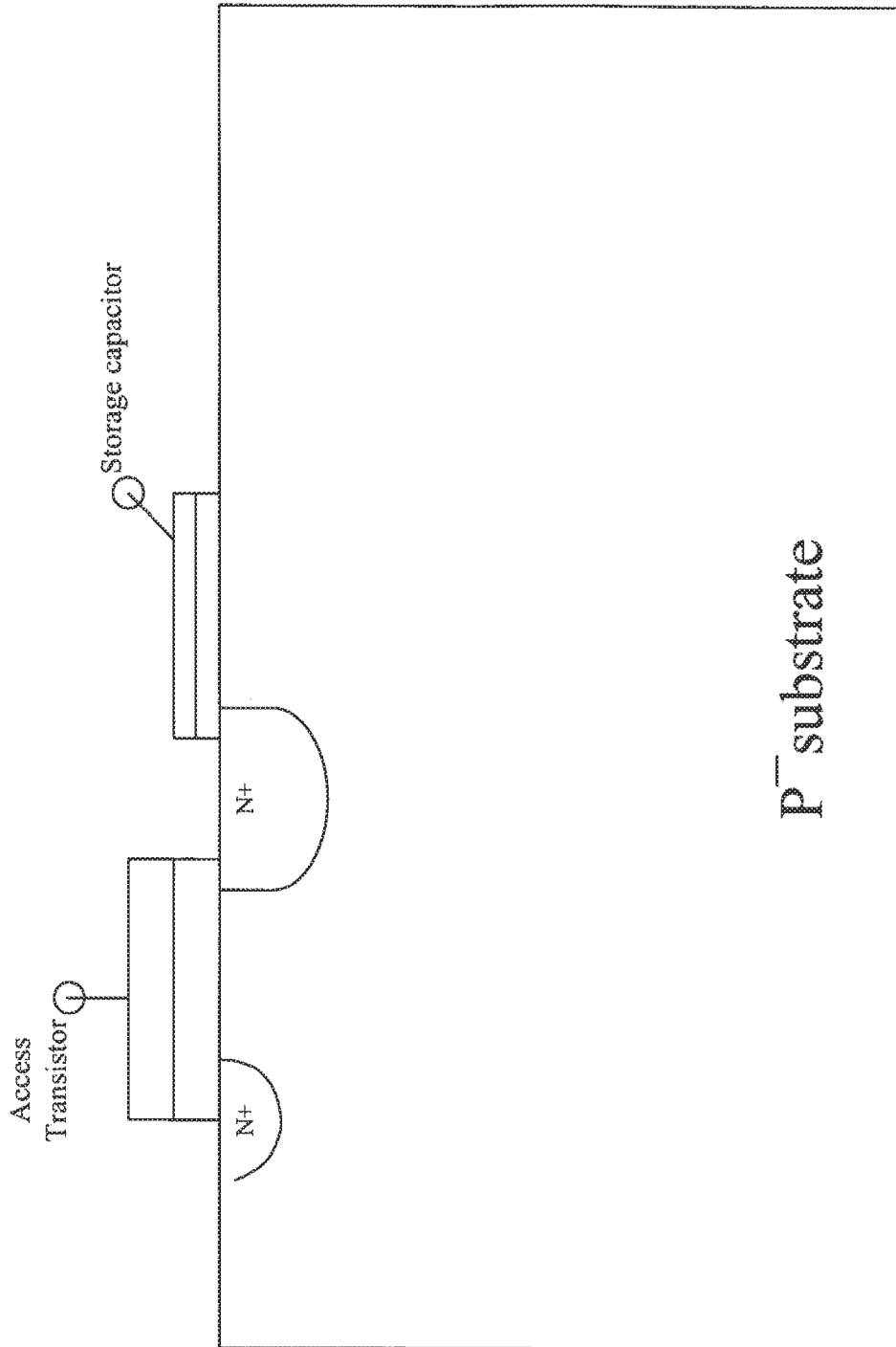


FIGURE 3C Prior art for a 1T-1C DRAM memory cell

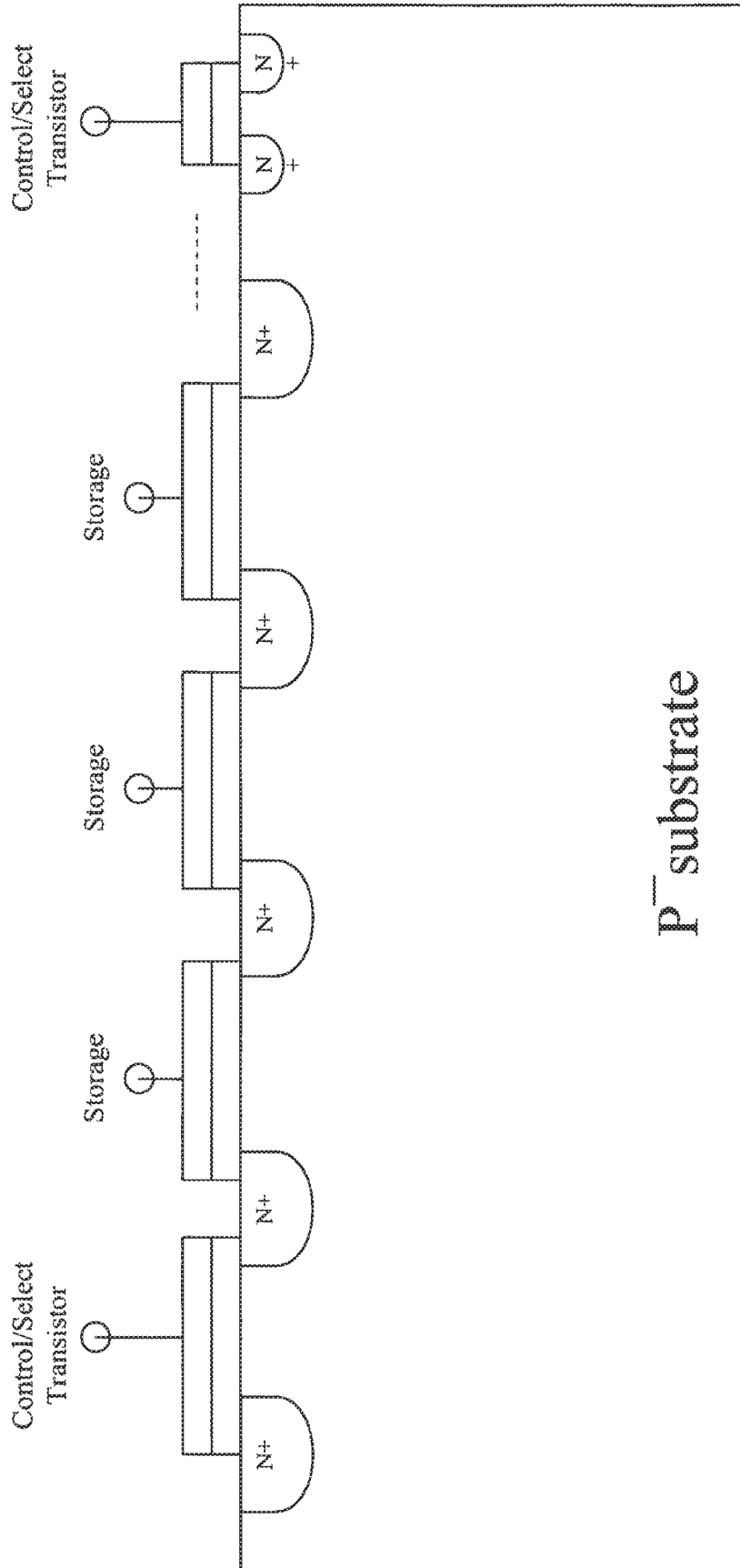


FIGURE 3D Prior art for a NAND flash memory cell

Note: Control/ Select 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.

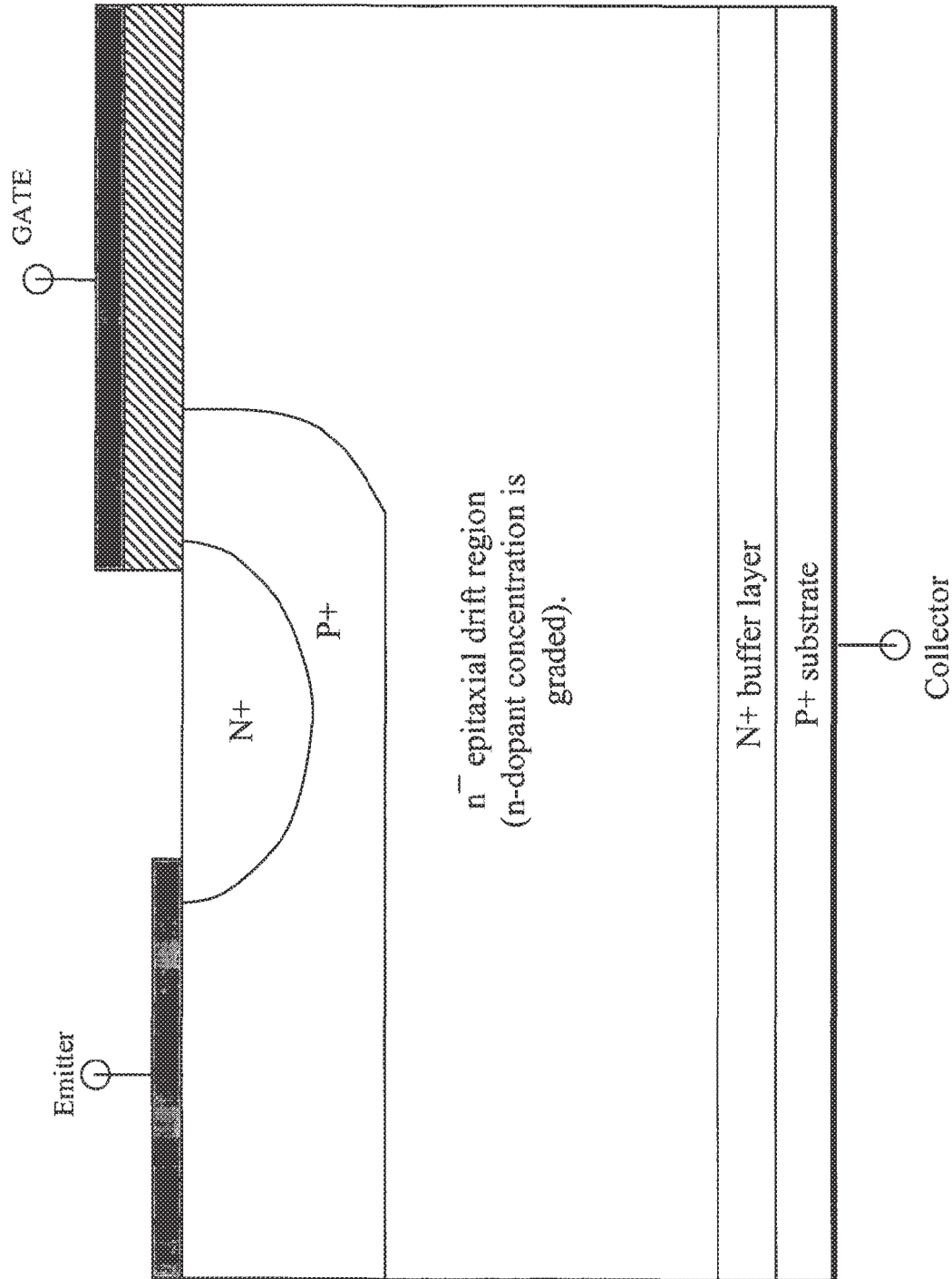


FIGURE 4 A dopant - concentration graded drift region in a IGBT

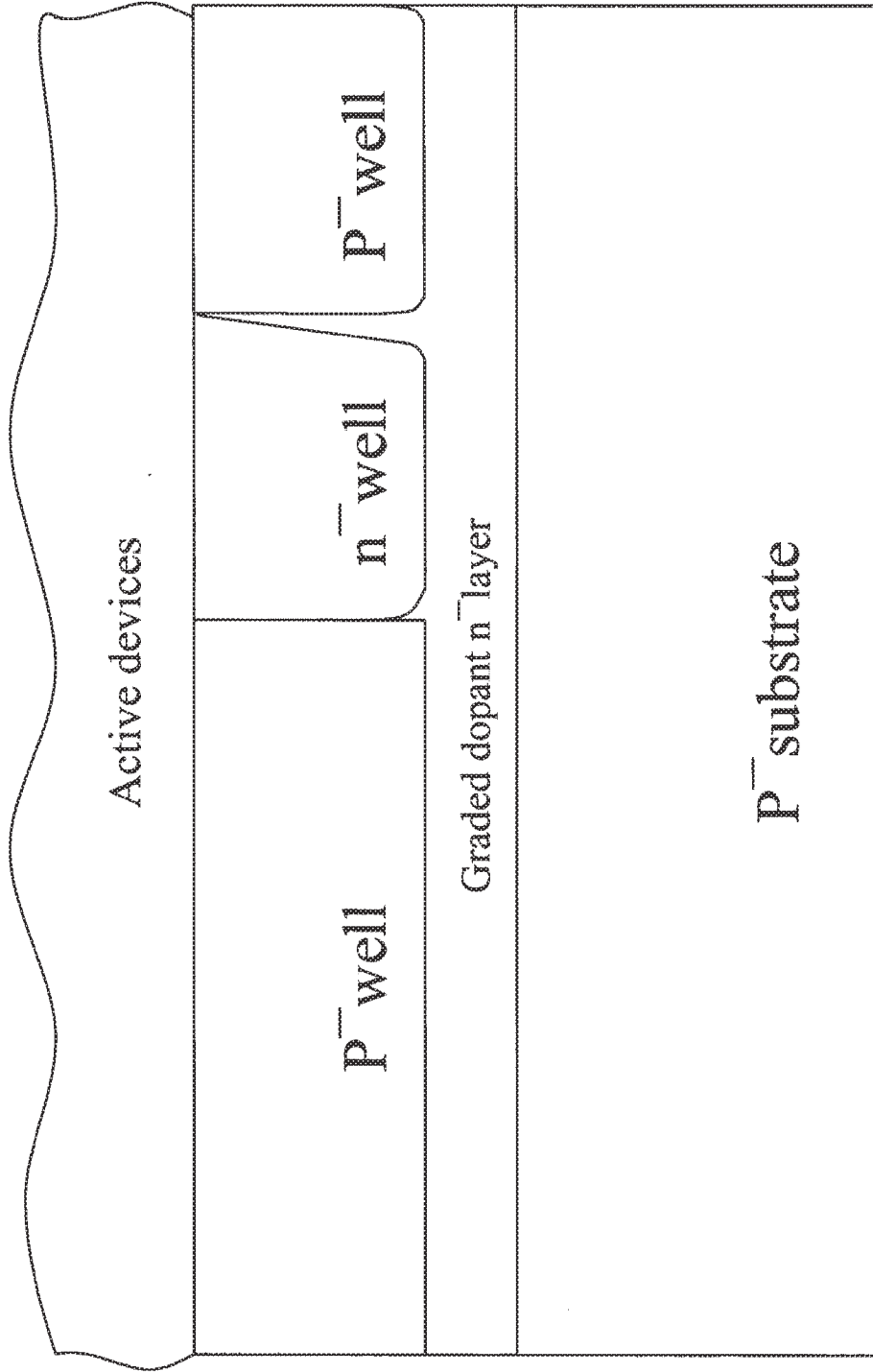


FIGURE 5A A CMOS Substrate for digital, mixed, signal, and sensors IC's

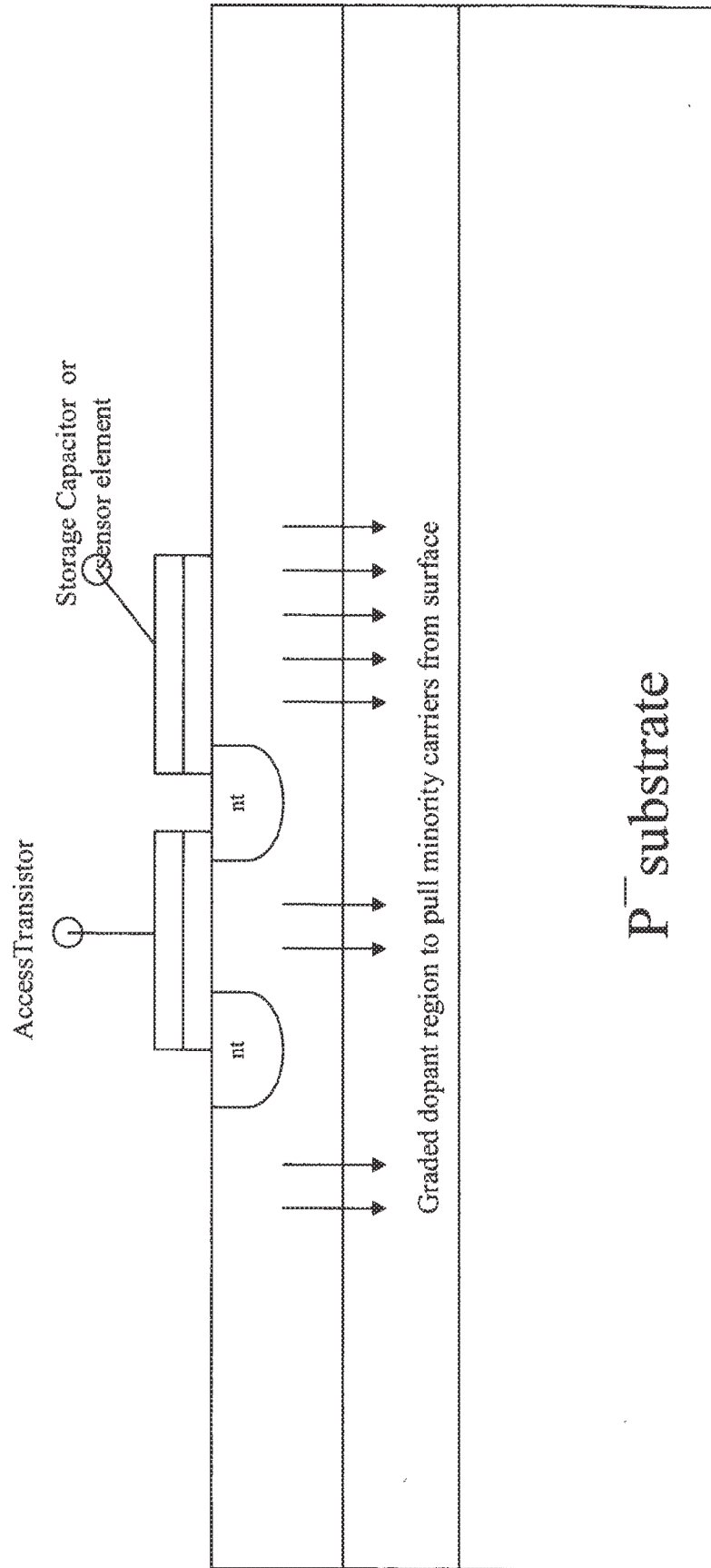


FIGURE 5B CMOS Substrate for a DRAM or image sensor, with one embodiment of the invention

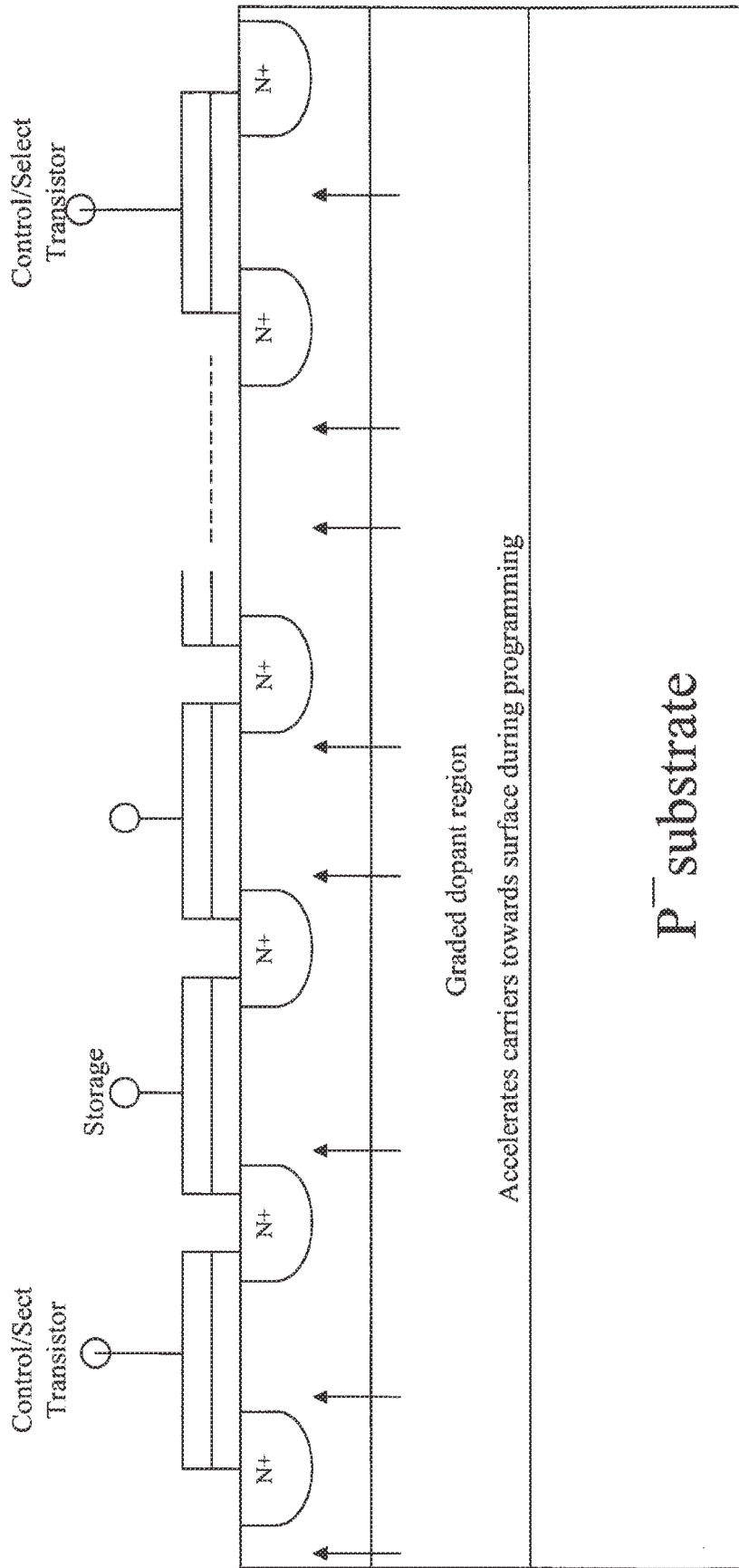


FIGURE 5C CMOS Substrate for a NAND flash device to improve programming times

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation of U.S. Patent Application No. 16/717,950, filed December 17, 2019, which is a Continuation of U.S. Patent Application No. 15/590,282, filed May 9, 2017, which is a Continuation of U.S. Patent Application No. 14/931,636, filed November 3, 2015, which is a Continuation of U.S. Patent Application No. 14/515,584, filed October 16, 2014, which is a Continuation of U.S. Patent Application No. 13/854,319 filed April 1, 2013, which is a Continuation of 11/622,496, filed January 12, 2007, 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⁻ well in which p-channel transistors are subsequently fabricated and one p⁻ 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× at the emitter-base junction, relative to the base-collector junction (1×). 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×-5×. 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.

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;
 - 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. 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 nonepitaxial 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.

31. The VLSI semiconductor device of Claim 21, wherein dopants of the graded dopant region in the well region are both p-type and n-type.
32. The VLSI semiconductor device of Claim 21, wherein the graded dopant is fabricated with an ion implantation process.
33. The VLSI semiconductor device of Claim 21, wherein the substrate is a complementary metal oxide semiconductor (CMOS) device.
34. The VLSI semiconductor device of Claim 21, wherein the device is a flash memory.
35. The VLSI semiconductor device of Claim 21, wherein the device is a logic device with capacitors in at least some of the first or second active regions.
36. The VLSI semiconductor device of Claim 21, wherein the device is central processing unit.
37. The VLSI semiconductor device of Claim 21, wherein the device is an image sensor.
38. The VLSI semiconductor device of Claim 21, wherein each of the first and second active regions are in the lateral or vertical direction.
39. A semiconductor device, comprising:
 a substrate of a first doping type at a first doping level;
 a first active region disposed adjacent to a surface of the substrate 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; and

at least a portion of at least one of the first and second active regions having at least one graded dopant concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region.

40. The semiconductor device of claim 39 further comprising at least one well region adjacent to the first or second active region and containing at least one graded dopant region, the graded dopant region to aid carrier movement from any region in the well to the substrate area where there is no well.

41. A semiconductor device, comprising:

- a substrate of a first doping type at a first doping level;

- a first active region disposed adjacent to a surface of the substrate 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; and

- at least a portion of at least one of the first and second active regions having at least one graded dopant acceptor concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region.

42. A semiconductor device, comprising:

- a substrate of a first doping type at a first doping level;

- a first active region disposed adjacent to a surface of the substrate 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; and

at least a portion of at least one of the first and second active regions having at least one graded donor dopant concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region.

43. A semiconductor device, comprising:

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

a first active region disposed adjacent to a surface of the substrate 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; and

at least a portion of at least one of the first and second active regions having at least one graded acceptor dopant concentration and one graded donor dopant concentration to aid carrier movement from the first or second active region to at least one substrate area where there is no active region.

44. A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

an active region including a source and a drain, disposed on one surface of the surface layer;

a single drift layer disposed between the other surface of the surface layer and the substrate, the drift layer having a graded concentration of dopants extending between the surface layer and the substrate, the drift layer further having a first static unidirectional electric drift field to aid the movement of carriers from

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

at least one well region disposed in the single drift layer, the well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of carriers from the surface layer to the area of the substrate where there are no active regions.

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.

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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-2038 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-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTORInventor: 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.

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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:

40672

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

Philip W. John, Jr.

Title

PRESIDENT

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 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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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

AFFIRMATIVE RECESSION OF PREVIOUS DISCLAIMER

This Application is a continuation or continuation-in-part of previous applications and patents.

Except as explicitly set forth in the prosecution of this application, to the extent any amendments, characterizations, or other assertions made (in this or in any related patent applications or patents, including any parent, sibling, or child) with respect to any art, prior or otherwise, could be construed as a disclaimer of any subject matter supported by the present disclosure of this application, Applicant hereby rescinds and retracts such disclaimer. Applicant also respectfully submits that any prior art considered in any related patent applications or patents, including any parent, sibling, or child, may need to be re-visited.

New claims in this Application may be broader than the claims previously allowed in parent or related applications.

Respectfully submitted,

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

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		Application Number	
Title of Invention	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS		
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. 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.			

Secrecy Order 37 CFR 5.2:

☐	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.)
--------------------------	---

Inventor Information:

Inventor	1				Remove	
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						
City	Allen	State/Province	TX	Country of Residence	US	
Mailing Address of Inventor:						
Address 1	1611 Willingham Drive					
Address 2						
City	Allen	State/Province	TX			
Postal Code	72013	Country	US			
All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the Add button.						

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).			
☐ An Address is being provided for the correspondence information of this application.			
Customer Number	40672		
Email Address	patents@naifeh.com	Add Email	Remove Email

Application Information:

Title of the Invention	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS		
Attorney Docket Number	GRTD.01.01.DV7	Small Entity Status Claimed	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	10	Suggested Figure for Publication (if any)	

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		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.

Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)
Customer Number	40672		

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	Remove	
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	16717950	2019-12-17

Application Data Sheet 37 CFR 1.76		Attorney Docket Number		GRTD.01.01.DV7	
		Application Number			
Title of Invention		SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS			

Prior Application Status		Patented		Remove	
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	2019-11-26

Prior Application Status		Patented		Remove	
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		Remove	
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		Remove	
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		Remove	
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		Remove	
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 Add button.				Add	
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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)ⁱ 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).

Remove			
Application Number	Country ⁱ	Filing Date (YYYY-MM-DD)	Access Code ⁱ (if applicable)

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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		Application Number	
Title of Invention	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS		

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ 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.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		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.

Applicant	1	Remove
------------------	---	---------------------------------------

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.

☒ 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:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	GREENTHREAD, LLC
-------------------	------------------

Mailing Address Information For Applicant:

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.

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.

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		Application Number	
Title of Invention	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS		

Assignee	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.				
				Remove
If the Assignee or Non-Applicant Assignee is an Organization check here.				☐
Prefix	Given Name	Middle Name	Family Name	Suffix
Mailing Address Information For Assignee including Non-Applicant Assignee:				
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Address 2				
City		State/Province		
Country ⁱ		Postal Code		
Phone Number		Fax Number		
Email Address				
Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.				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.

Signature	/Bill R. Naifeh, Reg No. 44962/		Date (YYYY-MM-DD)	2020-07-27
First Name	Bill R.	Last Name	Naifeh	Registration Number
				44962
Additional Signature may be generated within this form by selecting the Add button.				Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	GRTD.01.01.DV7
		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.**

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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.
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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.
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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

APPLICATION #
16/947,294

RECEIPT DATE / TIME
07/27/2020 08:36:19 PM ET

ATTORNEY DOCKET #
GRTD.01.01.DV7

Title of Invention

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Application Information

APPLICATION TYPE Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION # 6907

FILED BY April Reasoner

PATENT CENTER # 60059993

FILING DATE -

CUSTOMER # 40672

FIRST NAMED
INVENTOR G.R. Mohan Rao

CORRESPONDENCE
ADDRESS -

AUTHORIZED BY Bill Naifeh

Documents

TOTAL DOCUMENTS: 9

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
03_Drawings.pdf	10	Drawings-only black and white line drawings	480 KB
04_Declaration.pdf	1	Oath or Declaration filed	100 KB
05_POA-Greenthread.pdf	1	Power of Attorney	2920 KB
07_RecessionDisclaimer.pdf	1	Miscellaneous Incoming Letter	97 KB
01_ADS.pdf	9	Application Data Sheet	1227 KB
02_ContinuationAppDV7.pdf	16	-	1931 KB
02_ContinuationAppDV7- (1-7)	7	Specification	905 KB

SPEC.pdf

02_ContinuationAppDV7-CLM.pdf	(8-15)	8	Claims	811 KB
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02_ContinuationAppDV7-ABST.pdf	(16-16)	1	Abstract	58 KB
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06_EmailAuthorization.pdf		1	Internet Communications Authorized	62 KB
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Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
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06_EmailAuthorization.pdf	C087053DDA153A6AD99D8DD2C066D62F9D002C8A9F2CE2D3 683B00A585EC5B450A6B18805E854F877CA7DF35FEE8CFE0E 8FA1C2F3FF0179EF8D649D1798359CE

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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 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.