SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is a Divisional of U.S. application Ser. No. 10/934,915, filed on September 3, 2004, which application is incorporated herein by reference.

FIELD OF INVENTION

[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 OF INVENTION

[0003] Bipolar Junction transistors (BJT) are minority carrier devices as the principle device conduction mechanism. However, majority carriers also a small yet 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. 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 a 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 conductions 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 the case of an n-channel IGBT) require 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 SRAM's and visual quality in imaging circuits. FIG. 3(a) shows a typical CMOS VLSI device employing a twin well substrate, on which active devices are subsequently fabricated. FIGS. 3(b), 3(c), and 3(d) illustrate device cross sections, as practiced today. `Retrograde' and `halo' wells have also been attempted to improve refresh time in DRAM's (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 form 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 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] FIGURE 1 illustrates the relative doping profiles of emitter, base, and collector, for the two most popular bipolar junction transistors: namely, A - uniform base, and B - graded base;

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

[0008] FIGURES 3(a), 3(b), 3(c), 3(d) illustrate cross sections commonly used CMOS silicon substrate 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) - typical IC, EEPROM using tunnel insulator, DRAM and NAND flash;

[0009] FIGURE 4 illustrates the cross section of a IGBT, using one embodiment of the invention described here, where the dopant is optimally graded in the eptaxial drift region; and

[0010] FIGURES 5(a), 5(b), 5(c) illustrate the cross sections of a MOS 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 OF THE INVENTION

[0011] The relative doping concentrations of emitter and collector regions varies from 10^{18} to $10^{20}/cm^3$, where as the base region is 10^{14} to $10^{16}/cm^3$ depending on the desired characteristics of the BJT. In graded base p-n-p transistors, the donor dopant concentration may be 10 to l00X at the emitter-base junction, relative to the base-collector junction (1 X). 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 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 2x-5x.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^t 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 base region are not compromised. By sweeping the carriers towards the n` buffer region two advantages are obtained - the frequency of operation (combination of t_{on} and t_{off} as is known in the IGBT commercial nomenclature) can be enhanced. More importantly, during t_{off}, holes can be recombined much quicker at the n^t buffer layer, compared to a uniformly doped n^-epitaxial drift region by

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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. Epitaxy enhances lifetime, but, epitaxy is not mandatory. Different layers of dopan 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.

The following paragraph, beginning on page 5, line 6, and ending on page 11, line 28, is amended as indicated in the marked up version below:

[0013] As illustrated in FIGS. 5(a), 5(b), 5(c), 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 IC'S. These unwanted carriers can discharge dynamically-held ‘actively held high’ nodes. Statically held nodes (with V_{cc}) can not be affected, in most cases. Degradation of refresh time in DRAM's is one of the results, because the capacitor holds charge dynamically. Similarly, degradation of CMOS digital images, in digital imaging IC's is another result of the havoc caused by minority carriers. Pixel and color resolution can be significantly enhanced in imaging IC's with the embodiments described here. Creating ‘Sub Terrain’ 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 has been described here by creating a drift field to sweep these unwanted minority carriers into the substrate as quickly as possible, from the active circuitry at the surface. In a preferred embodiment, the subterrain 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. The n-well and p-well also can be graded or retrograded in dopants, as desired, 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. In nonvolatile memory devices, to decrease programming time, 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 pinchoff" is controlled by a graded channel instead of a uniformly doped channel (as practiced in 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, as well triple-well CMOS fabrication techniques can also be optimized to incorporate these embodiments, individually and collectively. Any modifications of such embodiments (described here) fall within the spirit and scope of the invention. Hence, they fall within the scope of the claims described below

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

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

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WHAT IS CLAIMED IS:

1. A semiconductor device with graded dopant concentration in the active region, to aid carrier movement from emitter to collector.

2. A semiconductor device with graded dopant concentration in the active region, to aid carrier movement from source to drain.

3. A semiconductor device with graded dopant concentration in the well regions, to aid carrier movement away from the active surface regions, towards the substrate.

4. A semiconductor device with graded dopant concentration in the substrate region to aid carrier movement away from the active surface regions, deeper towards the substrate.

5. A semiconductor device with at least one each of dopant concentration of both donor and acceptor, to optimize the operating performance of the device.

6. A semiconductor device with at least one graded dopant concentration fabricated with ion implantation, to provide an aiding or retarding electric field locally in a monolithic integrated circuit.

7. A semiconductor device with at least one graded dopant concentration in an epitaxial layer.

8. A semiconductor device where one layer of dopant from one wafer, is transferred to another wafer having either same polarity or different polarity dopant through wafer bonding or similar processes.

ABSTRACT

[0017] 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 DRAM's, 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 JFET's, and a host of other applications.

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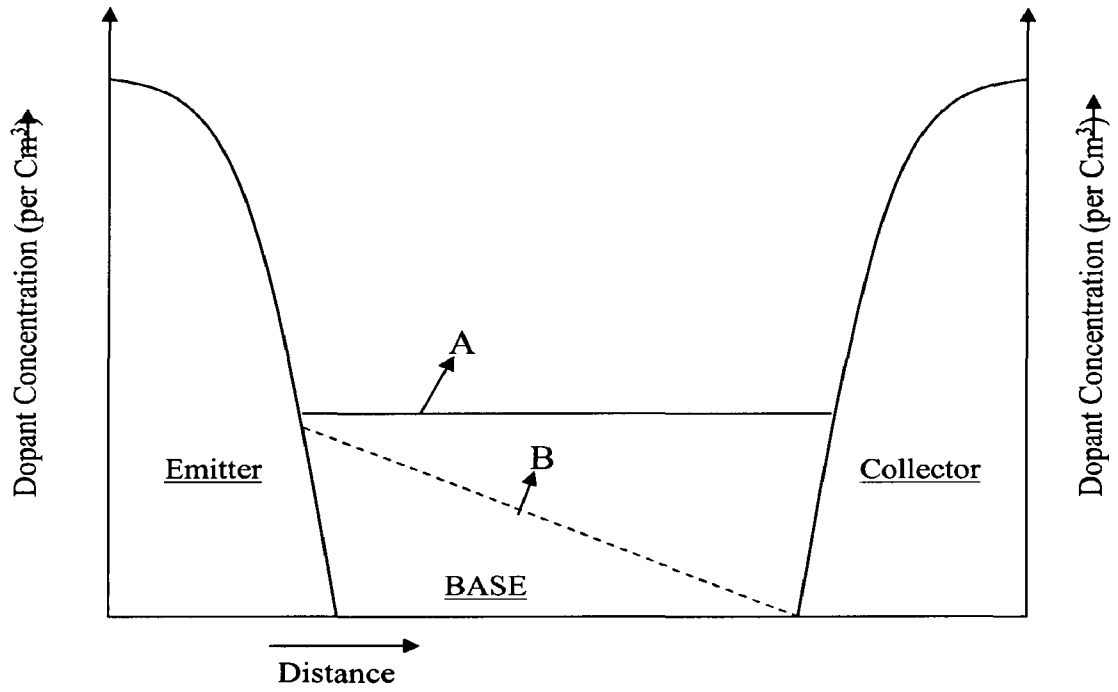

Figure 1 Prior Art

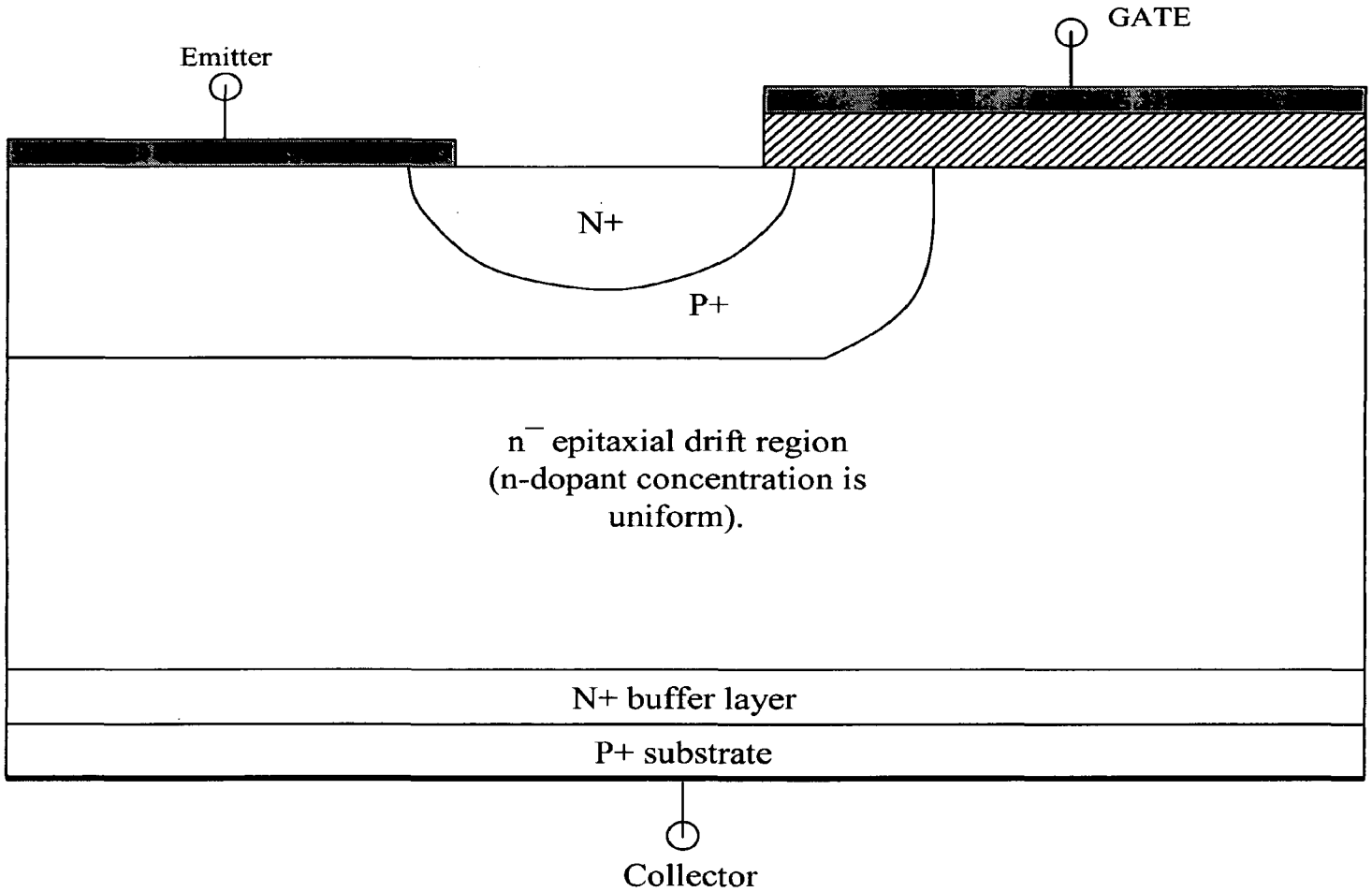

FIGURE 2 Prior art

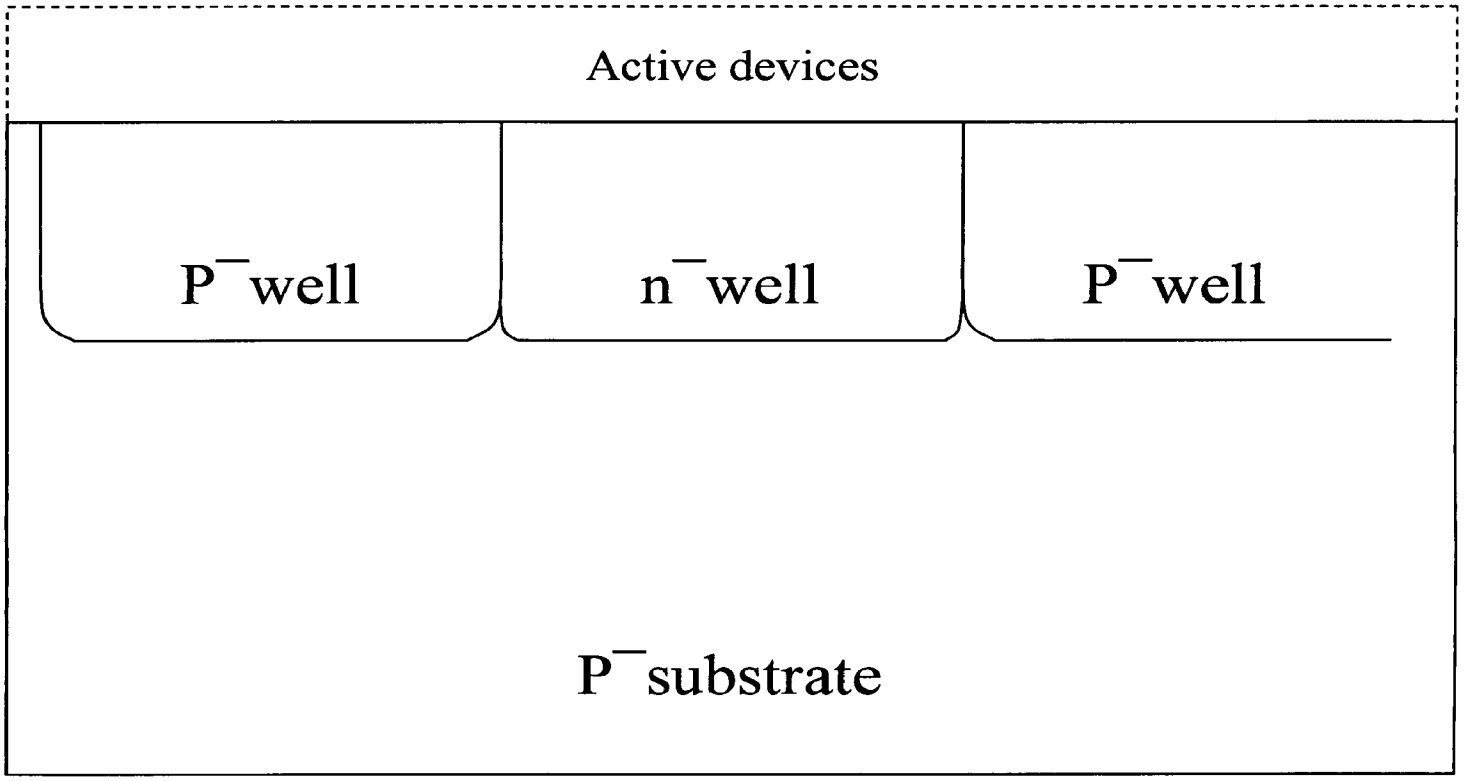

FIGURE 3(a) Prior art (Twin well CMOS) for a CMOS integrated circuit

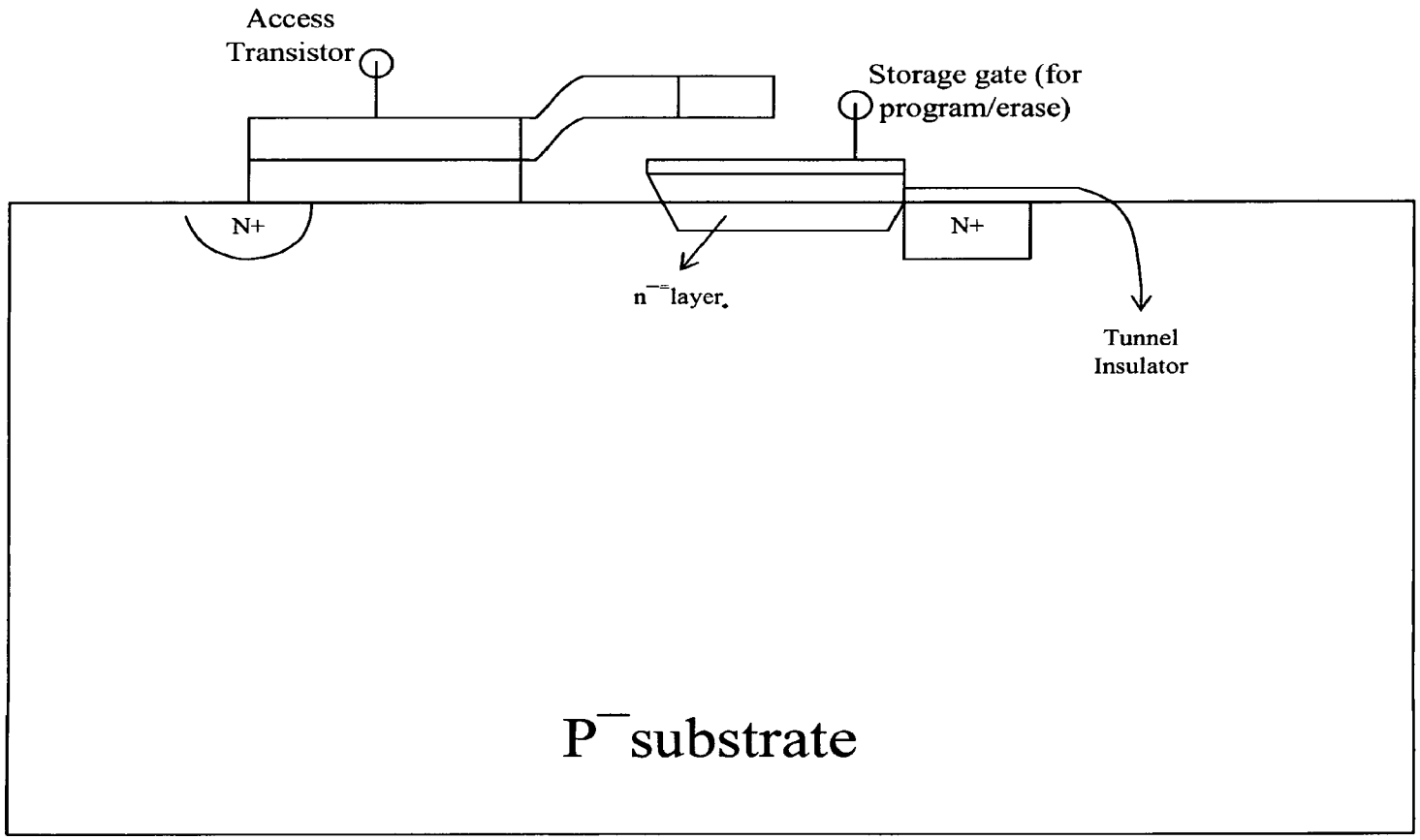

FIGURE 3(b) Prior art for a two-device EEPROM memory cell

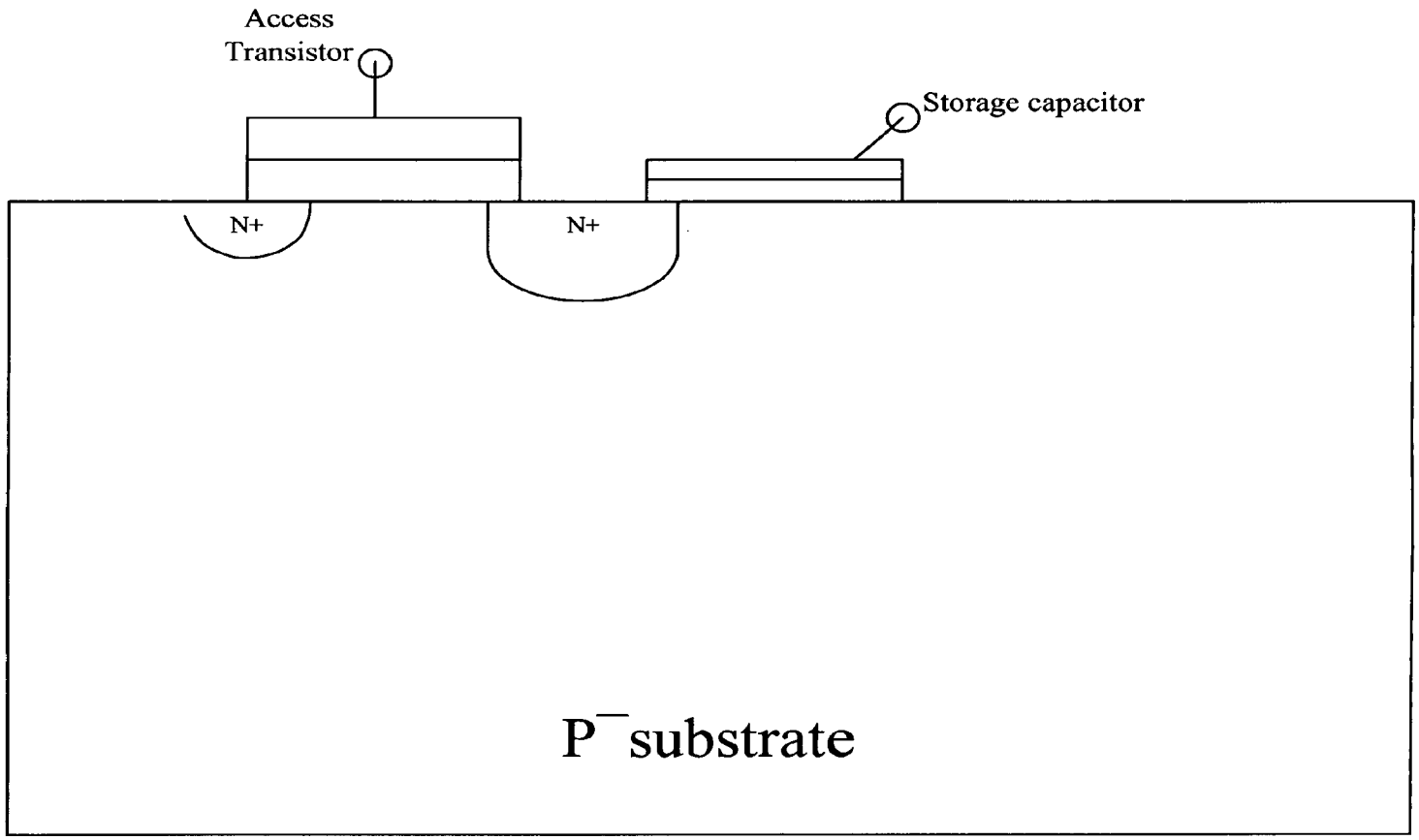

FIGURE 3(c) Prior art for a 1T-1C DRAM memory cell

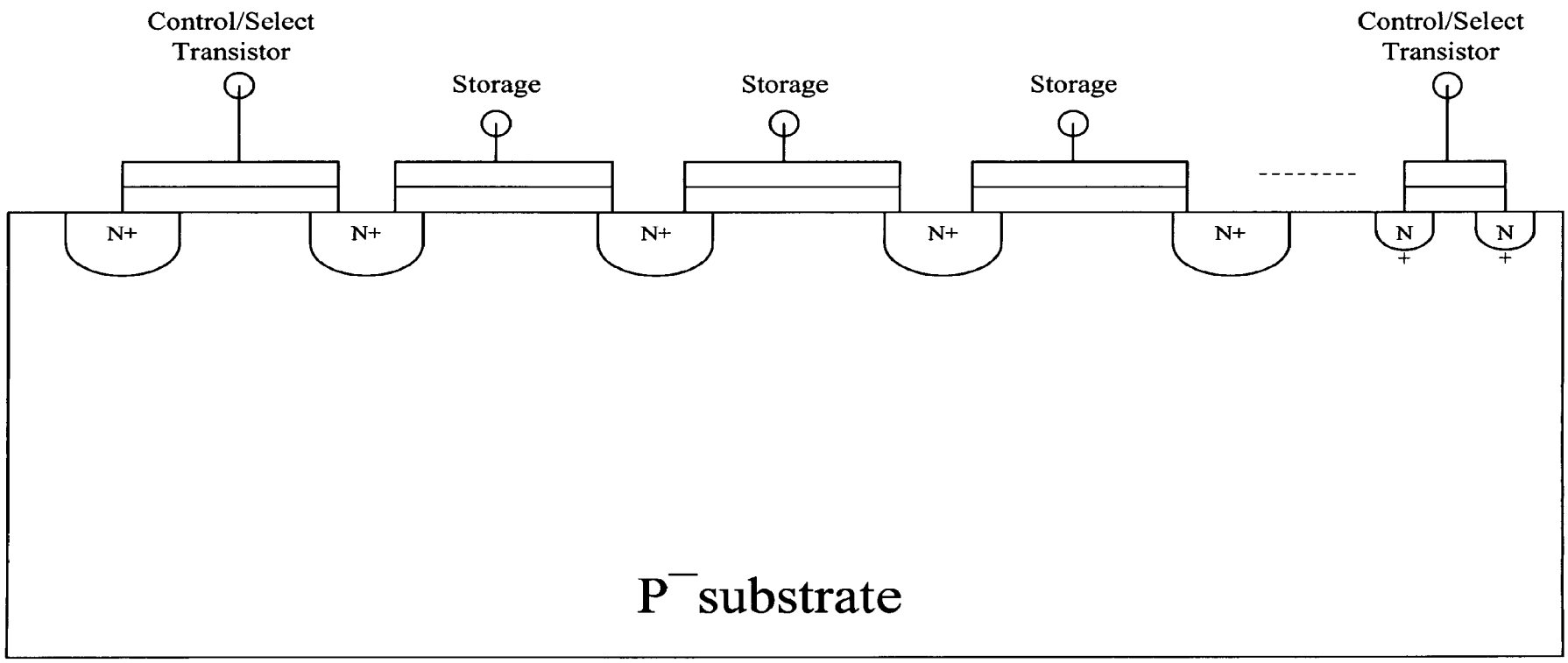

FIGURE 3(d) Prior art for a NAND flash memory cell

Note: Control/ Sect transistors have a single insulator - traditional MOS transistor.
Storage nodes have a stacked gate structure, typically with a floating gate and control gate comprising the stack.

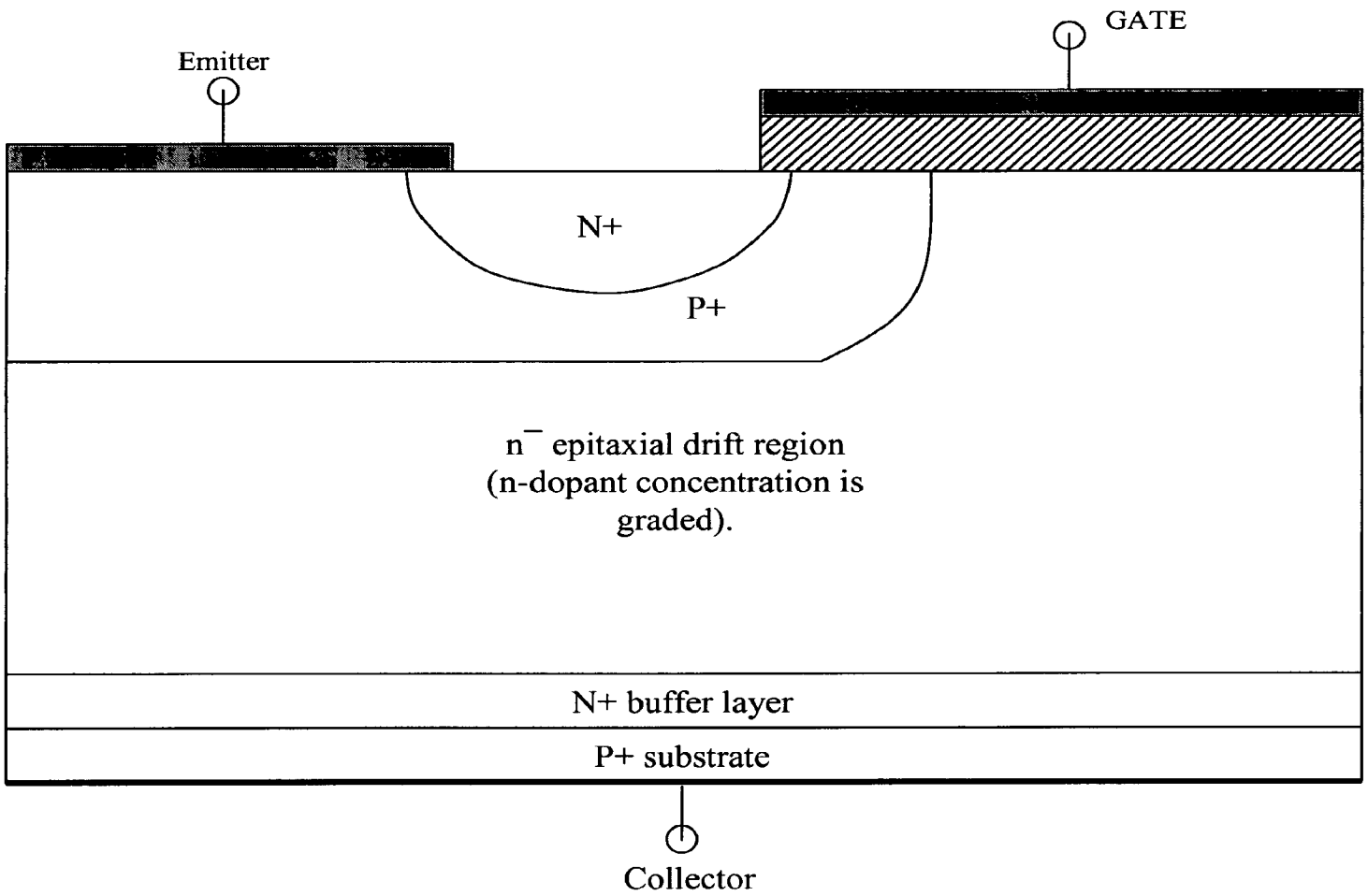

FIGURE 4 A dopant - concentration grinded drift region in a IGBT

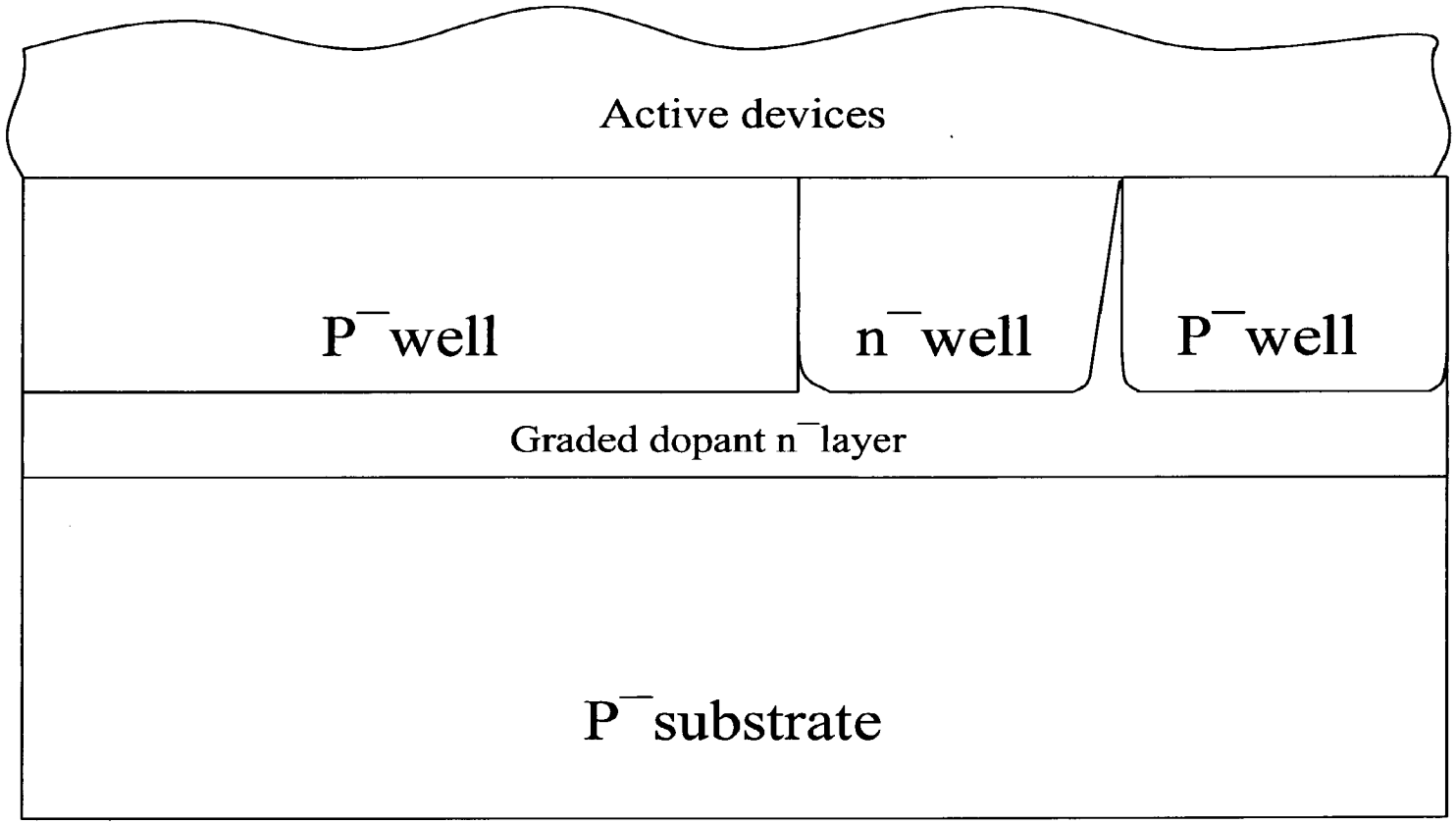

FIGURE 5(a) A CMOS Substrate for digital, mixed, signal, and senors IC's

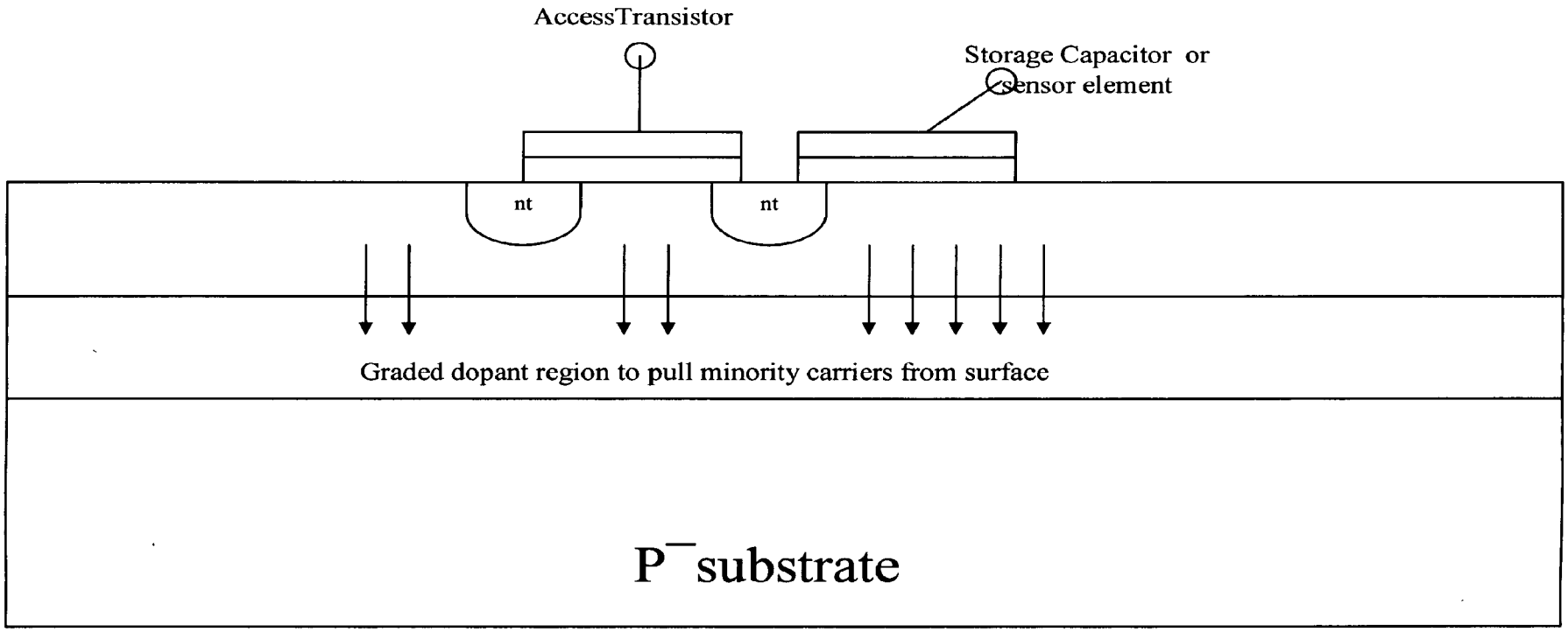

FIGURE 5(b) CMOS Substrate for a DRAM or image sensor, with one embodiment of the invention

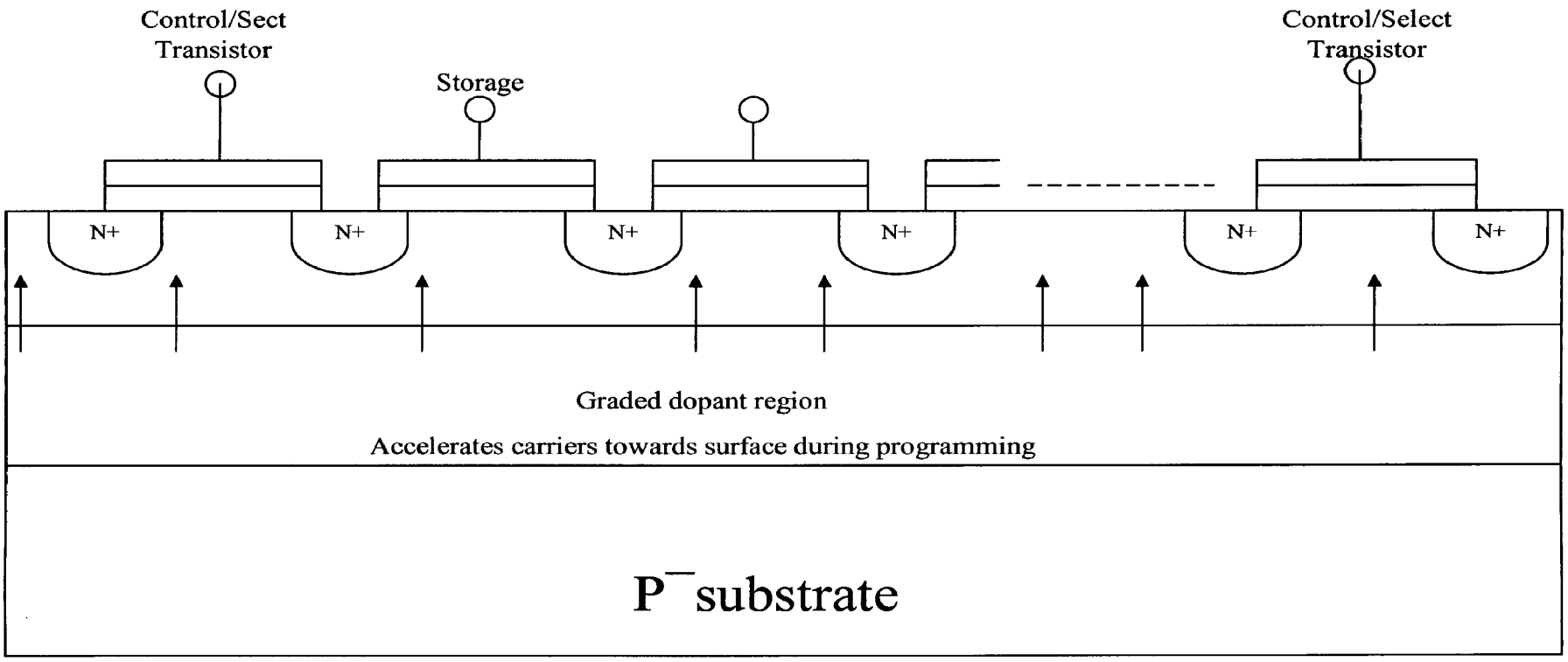

FIGURE 5(c) CMOS Substrate for a NAND flash device to improve programming times

Express Mail Label
No. EV 507 272 815 US

PTO/SB/01 (08-03)
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☑ Declaration Submitted With Initial Filing *OR* ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	43218-P001US
First Named Inventor	G.R. Mohan Rao
COMPLETE IF KNOWN	
Application Number	
Filing Date	
Art Unit	
Examiner Name	

I hereby declare that:

Each inventor's residence, mailing address, and citizenship are as stated below next to their name.

I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

(Title of the Invention)

the specification of which

☑ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) _____ as United States Application Number or PCT International Application Number _____ and was amended on (MM/DD/YYYY) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? Yes	No
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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 1.14. This collection is estimated to take 21 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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DECLARATION — Utility or Design Patent Application

Direct all correspondence to: ☐ Customer Number:		OR ☑ Correspondence address below	
Name Winstead Sechrest & Minick P.C.			
Address P.O. Box 50784			
City Dallas	State Texas	ZIP 75201	
Country US	Telephone 214.745.5370	Fax 214.745.5390	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

NAME OF SOLE OR FIRST INVENTOR:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any]) G.R. Mohan		Family Name or Surname Rao	
Inventor's Signature GRMohanRao			Date September 1, 2004
Residence: City McKinney	State Texas	Country US	Citizenship US
Mailing Address 1404 Westmont Drive			
City McKinney	State Texas	ZIP 75070	Country US

NAME OF SECOND INVENTOR:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle [if any])		Family Name or Surname	
Inventor's Signature			Date
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	ZIP	Country

☐ Additional inventors or a legal representative are being named on the _____ supplemental sheet(s) PTO/SB/02A or 02LR attached hereto.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	Baxter Ward Banowsky.
Attorney Docket Number:	1388-03

Filed as Small Entity

Utility Filing Fees

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	250	250
Utility Examination Fee	2311	1	100	100
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**425**

Electronic Acknowledgement Receipt

EFS ID:	1434580
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-03
Receipt Date:	12-JAN-2007
Filing Date:	
Time Stamp:	10:16:26
Application Type:	Utility

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$425
RAM confirmation Number	1177
Deposit Account	503886
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)	Multi Part /.zip	Pages (if appl.)
1	Specification	specification.pdf	83116	no	7
Warnings:					
Information:					
2	Claims	claims.pdf	72618	no	1
Warnings:					
Information:					
3	Abstract	abstract.pdf	72564	no	1
Warnings:					
Information:					
4	Drawings	drawings.pdf	115914	no	10
Warnings:					
Information:					
5	Oath or Declaration filed	Oath.pdf	105074	no	2
Warnings:					
Information:					
6	Fee Worksheet (PTO-06)	fee-info.pdf	8378	no	2
Warnings:					
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<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.

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 11/622,496

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))				75			300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))				250			500
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))				100			200
TOTAL CLAIMS (37 CFR 1.16(i))	8 minus 20 =		X$ 25		OR	X$50	250
INDEPENDENT CLAIMS (37 CFR 1.16(h))	8 minus 3 =	5	X$100	500		X$200	1200
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			180			360	
			TOTAL	925		TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDI-TIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI-TIONAL FEE ($)
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))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					180		OR	360	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDI-TIONAL FEE ($)	OR	RATE ($)	ADDI-TIONAL FEE ($)
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))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T 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 number found in the appropriate box in column 1.

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

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

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	DRAWINGS	TOT CLAIMS	IND CLAIMS
11/622,496	01/12/2007	2811	425	43218-P001US	10	8	8

CONFIRMATION NO. 3086

Winstead Sechrest & Minick P.C.
P.O. Box 50784
Dallas, TX75201

FILING RECEIPT

Date Mailed: 02/08/2007

Receipt is acknowledged of this regular Patent Application. It will be considered in its order and you will be notified as to the results of the examination. Be sure to provide the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION when inquiring about this application. 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 mail to the Commissioner for Patents P.O. Box 1450 Alexandria Va 22313-1450. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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 (if appropriate).**

Applicant(s)

G.R. Mohan Rao, McKinney, TX;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 10/934,915 09/03/2004

Foreign Applications

If Required, Foreign Filing License Granted: 02/08/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US11/622,496**

Projected Publication Date: 05/17/2007

Non-Publication Request: No

Early Publication Request: No

** SMALL ENTITY **

Title

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Preliminary Class

257

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.

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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 (1-866-999-4158).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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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 AssetsControl, 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).

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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
11/622,496	01/12/2007	G.R. Mohan Rao	43218-P001US

CONFIRMATION NO. 3086

Winstead Sechrest & Minick P.C.
P.O. Box 50784
Dallas, TX 75201

FORMALITIES LETTER

Date Mailed: 02/08/2007

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 and pay any fees required 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).

- Additional claim fees of **$500** 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.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$500** for a small entity

- Total additional claim fee(s) for this application is **$500**
  - **$500** for **5** independent claims over 3.

Replies should be mailed to: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
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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Office of Initial Patent Examination (571) 272-4000, or 1-800-PTO-9199, or 1-800-972-6382

PART 3 - OFFICE COPY

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MAR 26 2007
IAP26
PATENT & TRADEMARK OFFICE

Attorney Docket No. **1388-03**
Customer No. **61400**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	§	
	§	
RAO, G.R. MOHAN	§	Confirmation No. **3086**
	§	
Serial No. **11/622,496**	§	Group Art Unit: **2811**
	§	
Filed: **12 JANUARY 2007**	§	
	§	
For: **SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS**	§	

TRANSMITTAL

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

Sir:

Please file the following documents in the subject application:

1. This transmittal with Certificate of Mailing;

2. Power of Attorney and Correspondence Address Indication Form;

3. Check No. 94, in the amount of $500.00, to cover the fees associated with the above referenced application for including 5 independent claims over 3; and

4. A return postcard which I would appreciate you date stamping and returning to me.

You are hereby authorized and requested to charge any additional fees or underpayment of fees related to this application to deposit account no. 50-3886. Please credit any over payment of fees to such deposit account as well.

03/27/2007 FMETEKI1 00000016 11622496
01 FC:2201 500.00 OP

Respectfully submitted,

Date: 3/20/07

Baxter W. Banowsky
Registration No: 58,170

BANOWSKY & LEVINE, P.C.
12001 N. Central Expressway
Suite 790
Dallas, Texas 75243
(214) 871-1300
(214) 871-0038 (facsimile)
Customer No. **61400**

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on 3-20-07.

Jackie L. Jenkins
Printed Name

Jackie L. Jenkins
Signature

OIPE
MAR 26 2007
PATENT & TRADEMARK OFFICE

PTO/SB/81 (01-06)
Approved for use through 12/31/2008. OMB 0651-0035
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POWER OF ATTORNEY and CORRESPONDENCE ADDRESS INDICATION FORM

Application Number	11/622,496
Filing Date	01/12/2007
First Named Inventor	ROA, G. R. Mohan
Title	Semiconductor Devices with Graded
Art Unit	
Examiner Name	
Attorney Docket Number	1388-04

I hereby revoke all previous powers of attorney given in the above-identified application.

I hereby appoint:

☑ Practitioners associated with the Customer Number: 61400

OR

☐ Practitioner(s) named below:

Name	Registration Number

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Please recognize or change the correspondence address for the above-identified application 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/Inventor.

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

SIGNATURE of Applicant or Assignee of Record

Signature	G R Mohan Rao	Date	March 13, 2007
Name	RAO, G. R. Mohan	Telephone	972-231-4550 ext 1.
Title and Company	Green Thread LLC, Dallas, Texas.		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 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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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04

CONFIRMATION NO. 3086

OC000000023487076

61400
BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX 75243

Date Mailed: 04/20/2007

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/26/2007.

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.

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APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04

CONFIRMATION NO. 3086

61400
BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX75243

Title: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Publication No. US-2007-0158790-A1
Publication Date: 07/12/2007

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/.

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Pre-Grant Publication Division, 703-605-4283

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APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04

CONFIRMATION NO. 3086

61400
BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX75243

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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
11/622,496	01/12/2007	2811	925	1388-04	8	8

CONFIRMATION NO. 3086

UPDATED FILING RECEIPT

OC000000026392551

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SUITE 790
DALLAS, TX 75243

Date Mailed: 10/25/2007

Receipt is acknowledged of this non-provisional 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 APPLICANT, 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 write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections 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**

Applicant(s)

G.R. Mohan Rao, McKinney, TX;

Power of Attorney: The patent practitioners associated with Customer Number 61400

Domestic Priority data as claimed by applicant

This application is a DIV of 10/934,915 09/03/2004 ABN

Foreign Applications

If Required, Foreign Filing License Granted: 02/08/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/622,496**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No
**** SMALL ENTITY ****

Title

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Preliminary Class

257

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 04/15/2008
BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX 75243

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
04/15/2008	PAPER

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.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) *1-8* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. This application contains claims directed to the following patentably distinct species :

- Embodiment 1 of Figure 4
- Embodiment 2 of Figure 5a
- Embodiment 3 of Figures 5b and 5c

The species are independent or distinct because claims to the different species recite the mutually exclusive characteristics of such species. In addition, these species are not obvious variants of each other based on the current record.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, no claims are generic.

There is an examination and search burden for these patentably distinct species due to their mutually exclusive characteristics. The species require a different field of search (e.g., searching different classes/subclasses or electronic resources, or employing different search queries); and/or the prior art applicable to one species would not likely be applicable to another species; and/or the species are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a species to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected species**, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

The election of the species may be made with or without traverse. To preserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the election of species requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable on the elected species.

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the species unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other species.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which depend from or otherwise require all the limitations of an allowable generic claim as provided by 37 CFR 1.141.

Conclusion

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/A. K. A./ /Thao X Le/

Examiner, Art Unit 2892

Supervisory Patent Examiner, Art Unit 2892

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	04/08/2008								
	1	÷								
	2	÷								
	3	÷								
	4	÷								
	5	÷								
	6	÷								
	7	÷								
	8	÷								

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	§	
	§	
RAO, G.R. MOHAN	§	Confirmation No. **3086**
	§	
Serial No. **11/622,496**	§	Group Art Unit: **2892**
	§	
Filed: **12 JANUARY 2007**	§	Examiner: **AJAY K. ARORA**
	§	
For: **SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS**	§ §	

ELECTION UNDER 35 U.S.C. § 121

This paper is in response to the restriction requirement set forth in the Office Action mailed April 15, 2008, having a one month shortened statutory period for response, wherein the Examiner required restriction between the following embodiments:

Embodiment 1 - Figure 4

Embodiment 2 - Figure 5(a)

Embodiment 3 - Figures 5(b) and 5(c)

Applicant elects Embodiment 3 for initial prosecution on the merits. Applicant identifies Claims 3 through 8 as encompassing the elected species.

Applicant notes that the examiner has determined that no claims are generic. Applicant respectfully traverses this finding and asserts that claims 3-8 are generic as to all embodiments. Initially, Applicant notes that this is a division application of Application Serial No. 10/934,915. In Application Serial No. 10/934,915 the Office issued an election/restriction requirement similar to the present office action. In that office action, dated March 28, 2006, the office asserted that claim 8 in the present application (claim 9 in Application Serial No. 10/934,915)

was generic as to all species. Additionally, the office asserted that claim 7 in the present application (claim 8 in Application Serial No. 10/934,915) was generic as to embodiments 1 and 3.

With the exception of Fig. 4 and the references to it in the specification, the balance of the specification and illustrations are of CMOS technology. A CMOS device has both p-ch and n-ch transistors (and both p and n wells). Accordingly, graded dopant concentrations have to be "optimized" for both donors and acceptors. Further, sweeping away minority carriers with donor gradient is generic to all of the embodiments as set forth in paragraph 12 of the specification with respect to IGBT and paragraph 13 with respect to CMOS. Additionally, although the epitaxial layer is only illustrated in Fig. 4, it is referred to in paragraph 13 as being applicable to the CMOS devices of Figs. 5(a), (b) and (c).

To the extent that the examiner agrees with Applicant that claims 3 through 8 are generic, then this election may be considered without traverse.

Applicant reserves the right to file one or more Divisional Applications for the non-elected inventions which the Examiner has indicated are patentably distinct.

Applicant does not believe that any extension of time or any additional fees are necessary for the consideration of the present paper. However, in the event that an extension of time or any additional fees are necessary for consideration of the present paper, I authorize the Commissioner to charge such fees, including fees for extension of time, to Deposit Account No. 50-3886.

Respectfully submitted,

Date: May 13, 2008

/s/ Baxter W. Banowsky
Baxter W. Banowsky
Registration No: 58,170

BANOWSKY & LEVINE, P.C.
12001 N. Central Expressway
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Dallas, Texas 75243
(214) 871-1300
(214) 871-0038 (facsimile)
Customer No. **61400**

Electronic Acknowledgement Receipt

EFS ID:	3293940
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-04
Receipt Date:	13-MAY-2008
Filing Date:	12-JAN-2007
Time Stamp:	10:54:17
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	Response to Election / Restriction Filed	election.pdf	82764 712fac00bdb00669b974700556a19ee705446d44	no	3

Warnings:

Information:

Total Files Size (in bytes):	82764

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 07/28/2008
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12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX 75243

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
07/28/2008	PAPER

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.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) *1 and 2* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *3-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

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2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Election/Restrictions

1. Applicant's election of embodiment 3, claims 3-8 in the reply filed on 05/13/2008 is acknowledged. Because examiner agrees that claims 3-8 are generic to all embodiments as stated by applicant on page 2, lines 12-13 of applicant's response, as a condition for election without traverse, and applicant did not distinctly and specifically point out any additional supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 3 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Rhodes (US 2003/0042511), hereinafter Rhodes.

Regarding claim 3, Rhodes (refer to Figures 5-14) teaches a semiconductor device with graded dopant concentration (page 4, para 0046, 1st sentence) in the well regions (160, 170, 180) to aid carrier movement away from the active surface regions, towards the substrate (page 6, para 0061; page 4, para 0045 & 0049).

Regarding claim 6, Rhodes (US 2003/0042511) (refer to Figures 5-14) teaches a semiconductor device with at least one graded dopant concentration (page 4, para 0046, 1st sentence) fabricated with ion implantation (page 4, para 0047, last sentence), to provide an aiding or retarding electric field locally in a monolithic integrated circuit.

Note that claim 6 is a product claim but recites a method of steps therein, i.e. “fabricated with ion implantation”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.*

4. Claim 4 is rejected under 35 U.S.C. 102(b) as being anticipated by Cathey (US 2002/0093281), hereinafter Cathey.

Regarding claim 4, Cathey teaches a semiconductor device with graded dopant concentration in the substrate (page 2, para 0027) region to aid carrier movement away from the active surface regions, deeper towards the substrate (page 3, claims 1, 5 and 6).

5. Claim 5 is rejected under 35 U.S.C. 102(b) as being anticipated by Kane (US 5,029,277), hereinafter Kane.

Regarding claim 5, Kane teaches a semiconductor device with at least one each of dopant concentration of both donor and acceptor, to optimize the operating performance of the device (Col. 5, lines 5-40).

6. Claim 7 is rejected under 35 U.S.C. 102(b) as being anticipated by Baliga (US 5,637,898), hereinafter Baliga.

Regarding claim 7, Baliga (US 5,637,898) teaches a semiconductor device with at least one graded dopant concentration in an epitaxial layer (Col. 4, lines 15-21and Col. 3, lines 45-50).

7. Claim 8 is rejected under 35 U.S.C. 102(b) as being anticipated by Macris (US 2002/0134419), hereinafter Macris.

Regarding claim 8, Macris teaches a semiconductor device where one layer of dopant from one wafer, is transferred to another wafer having either same polarity or different polarity dopant through wafer bonding or similar processes (page 4, para 0076).

Note that claim 8 is a product claim but recites a method of steps therein, i.e. “one layer of dopant from one wafer, is transferred to another wafer” and “wafer bonding or similar processes”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.*

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8am to 4:30pm.

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/A. K. A./
Examiner, Art Unit 2892

/Thao X Le/
Supervisory Patent Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 11/622,496	Applicant(s)/Patent Under Reexamination RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0042511	03-2003	Rhodes, Howard E.	257/232
*	B	US-2002/0093281	07-2002	Cathey, David A.	313/336
*	C	US-5,029,277	07-1991	Kane, Robert C.	250/214C
*	D	US-5,637,898	06-1997	Baliga, Bantval J.	257/330
*	E	US-2002/0134419	09-2002	Macris, Chris	136/204
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	07/24/2008								
	1	N								
	2	N								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655, 269	7/24/2008	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	7/24/2008	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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BIB DATA SHEET

CONFIRMATION NO. 3086

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/622,496	01/12/2007 **RULE**	257	2892	1388-04

APPLICANTS
G.R. Mohan Rao, McKinney, TX;

**** CONTINUING DATA ***************************
This application is a DIV of 10/934,915 09/03/2004 ABN

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
02/08/2007

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/AJAY ARORA/ Examiner's Signature ☐ Met after Allowance Initials	TX	10	8	8

ADDRESS

BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX 75243
UNITED STATES

TITLE

SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

FILING FEE RECEIVED		
925	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	579	(257/655,269).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/24 09:14
S1	2	("20070158790").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/04/08 11:10
S2	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:19
S3	1096	(graded OR gradation) WITH (dopant OR doping) WITH concentration	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:47
S4	805	S3 AND ("257" OR "438").clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:47
S5	253	(graded OR gradation) WITH (dopant OR doping) WITH concentration WITH (semiconductor OR silicon)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:49

S6	7	S5 SAME (carrier WITH (movement OR mobility))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:51
S7	48	S5 AND (((carrier OR electron OR hole) WITH (movement OR mobility)) SAME ((emitter WITH collector) OR (source WITH drain)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:55
S8	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441"). PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:16
S9	13	S8 AND ("dopant concentration" OR "concentratino of dopant")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:16
S10	13	S8 AND ("dopant concentration" OR "concentration of dopant")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:17
S11	0	S8 AND (dop$3 WITH (concentrat$3 OR amount OR quantity) WITH (variable OR varying OR grad$3)) AND ((doping OR dopant) WITH well) AND ((carrier OR charge) WITH (moving OR movement OR mobile OR mobility))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:22

S12	1136	(graded OR gradation) WITH (dopant OR doping) WITH concentration	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:22
S13	86	S12 AND (dop$3 WITH (concentrat$3 OR amount OR quantity) WITH (variable OR varying OR grad$3)) AND ((doping OR dopant) WITH well) AND ((carrier OR charge) WITH (moving OR movement OR mobile OR mobility))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:22
S14	29	("20020068409" | "6303450" | "6437406" | "6458665" | "6483158" | "6489223" | "6509241"). PN. OR ("6743684"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2008/07/18 13:13
S15	34	uniform$2 WITH dop$3 WITH drift WITH epitaxial	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:19
S16	2	("5637898").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 15:26
S17	0	(non-uniform$2 OR nonuniform$2 OR grad43 OR grading OR gradient) WITH (dopant OR doping) WITH well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:40

S18	4	(non-uniform$2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping) WITH well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:40
S19	4	("4001864").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 15:43
S20	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441"). PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:57
S21	92	S15 S19 S20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:58
S22	39	S21 AND ((non-uniform $2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:58
S23	60	S21 AND well	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:59

S24	39	S22 AND well	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:59
S25	2	S22 AND (well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 16:00
S26	3	S22 AND (well WITH (carrier OR movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 16:00
S27	2	("20030042511").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 16:05
S28	2	S21 AND (substrate WITH carrier WITH away WITH ((active WITH surface) OR (towards NEAR2 substrate) OR (direction NEAR4 substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:17
S29	3	S21 AND (substrate WITH (carrier OR holes OR electron OR majority OR charge) WITH away WITH ((active WITH surface) OR (towards NEAR2 substrate) OR (direction NEAR4 substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:18
S30	30	S21 AND ((non-uniform $2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:26

S31	253	(grad$3 OR grading OR gradient) NEAR2 (dopant OR doping) NEAR4 substrate	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:33
S32	5	dopant WITH concentration WITH donor WITH acceptor WITH optimiz$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:02
S33	2	10/182,784	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:06
S34	0	S20 AND (dopant WITH concentration WITH donor WITH acceptor)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:22
S35	0	S20 AND (dopant WITH donor WITH acceptor)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:22
S36	5	(dopant WITH donor WITH acceptor WITH optimiz$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:26
S37	5	(dopant WITH donor WITH acceptor WITH (optimiz$ OR optimization OR optimal))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:27
S38	487	(donor WITH acceptor WITH (optimiz$ OR optimization OR optimal))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:27

S39	14	S38 AND semiconductor. ab.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:28
S40	0	(layer WITH dopant WITH wafer WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond $3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:49
S41	0	(dopant WITH wafer WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond $3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:49
S42	0	(dopant WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:50
S43	0	(dopant WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:50
S44	14807	wafer NEAR1 bond$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:51
S45	33	S44 AND (dopant WITH transfer$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:51

7/24/2008 9:26:20 AM
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Attorney Docket No. **1388-04**
Customer No. **000061400**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	§	
	§	
RAO, G.R. MOHAN	§	**Confirmation No. 3086**
	§	
Serial No. 11/622,496	§	**Group Art Unit: 2892**
	§	
Filed: 12 JANUARY 2007	§	**Examiner: ARORA, AJAY**
	§	
For: SEMICONDUCTOR DEVICES	§	
WITH GRADED DOPANT REGIONS	§	

AMENDMENT AND RESPONSE
TO OFFICE ACTION MAILED JULY 28, 2008

I. INTRODUCTORY COMMENTS:

The present paper is submitted as a complete response to the non-final Office Action mailed July 28, 2008 having a shortened statutory period of response of three months. Applicant does not believe that any extension of time or any additional fees are necessary for the consideration of the present paper. However, in the event that an extension of time or any additional fees are necessary for consideration of the present paper, I authorize the Commissioner to charge such fees, including fees for extension of time, to Deposit Account No. 50-3886.

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 3 of this paper.

II. AMENDMENTS TO THE CLAIMS:

The text of all claims under examination is submitted, and the status of each is identified. This listing of claims replaces all prior versions and listings in the application.

Listing of Claims

Claims 1-2 (Cancelled)

3. (currently amended) A VLSI digital semiconductor device with graded dopant concentration in the well regions, to aid carrier movement away from the active surface regions, towards the substrate.

4. (currently amended) A VLSI digital semiconductor device with graded dopant concentration in the substrate region to aid carrier movement away from the active surface regions, deeper towards the substrate.

5. (currently amended) A VLSI digital semiconductor device with at least one each of dopant concentration of both donor and acceptor, to optimize the operating performance of the device.

6. (currently amended) A VLSI digital semiconductor device with at least one graded dopant concentration fabricated with ion implantation, to provide an aiding or retarding electric field locally in a monolithic integrated circuit.

7. (currently amended) A VLSI digital semiconductor device with at least one graded dopant concentration in an epitaxial layer.

8. (currently amended) A VLSI digital semiconductor device where one layer of dopant from one wafer, is transferred to another wafer having either same polarity or different polarity dopant through wafer bonding or similar processes.

III. REMARKS:

Claims 3 through 8 are pending herein.

Claims 1-2 have been cancelled without prejudice or disclaimer. Claims 3-8 have been amended, more particularly, to point out the claimed subject matter. It is respectfully submitted that Claims 3-8 are in full compliance with the broad dictates of 35 U.S.C. § 112. Favorable consideration of Claims 3-8 are respectfully requested.

Claims 3-8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by various references more particularly described below. Insofar as these references may be applied against the present claims, this rejection is respectfully traversed.

Each of claims 3-8 have been amended to clarify that the claimed invention relates to the field of VLSI digital semiconductor devices. By definition, a VLSI semiconductor device means a device consisting of at least one million active elements (an active element is a semiconductor transistor or gate consisting of at least two trnasistors) that can be active when a voltage (or current) is applied. By contrast, SSI (small scale integration) is 1 to 1,000 active elements, MSI (medium scale integration) is up to 100,000 active elements and LSI (large scale integration) is 100,000 to 1,000,000 active elements. As is more fully set forth below, each of the cited references pertains to non-VSLI non-digital technology.

Claims 3 and 6 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Rhodes (US 2003/0042511), hereinafter Rhodes. Rhodes discloses a semiconductor based CMOS imaging device. Rhodes does not disclose or anticipate a VLSI digital semiconductor device.

Rhodes describes a CMOS image sensor- but, his sensor elements only uses electrons (a CMOS gate, by strict text book definition has a n-channel transistor that conducts electrons and a p-channel transistor that conducts holes). The "graded dopant" as described by Rhodes, is only in the "sensing element." Rhodes may have one million sensors (he may have a few CMOS trnasistors in periphery on non image sensing function). However, that does not make the device in Rhodes VLSI and certainly not CMOS VLSI.

In the present VLSI digital invention, every one of this 1 million (+) gates, albeit CMOS, has graded dopant for electrons as well as holes. Additionally, the present invention also allows more than one gradient for electrons and more than one gradient for holes. Neither Rhodes nor, for that matter, any of the other cited prior art show this novelty.

Claim 4 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Cathey (US 2002/0093281), hereinafter Cathey. Cathey discloses an electron field emitter for use in computer or other display devices. Cathey does not disclose or anticipate a VLSI digital semiconductor device.

Claim 5 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Kane (US 5,029,277), hereinafter Kane. Kane discloses a method for temperature compensation of a bipolar transistor junction through optically-induced carrier density enhancement. Kane does not disclose or anticipate a VLSI digital semiconductor device.

Claim 7 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Baliga (US 5,637,898), hereinafter Baliga. Baliga discloses a to semiconductor switching device for high power applications. Baliga does not disclose or anticipate a VLSI digital semiconductor device.

Claim 8 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Macris (US 2002/0134419), hereinafter Macris. Macris discloses a heat sink. Macris does not disclose or anticipate a VLSI digital semiconductor device.

Accordingly, for the foregoing reasons, it is respectfully submitted that the cited references do not disclose or suggest the claimed VLSI digital semiconductor device. The rejection of claim 3-8 under 35 U.S.C. §102(b) as anticipated by the cited references should therefore be withdrawn. When read in light of the specification, Applicant submits that none of the foregoing amendments narrow the claims with regard to the claimed semiconductor device.

For all the foregoing reasons, it is respectfully submitted that claims 3-8 are in condition for allowance. Favorable reconsideration and allowance of claims 3-8 is respectfully requested.

Respectfully submitted,

Date: October 28, 2008

/Baxter W. Banowsky/
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Electronic Acknowledgement Receipt

EFS ID:	4187673
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-04
Receipt Date:	28-OCT-2008
Filing Date:	12-JAN-2007
Time Stamp:	12:38:01
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		OA07_28_08_rsp.pdf	95157 946d28a7cd361b68ab61b5db9f538127f395c268	yes	5

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Extension of Time	1	1
	Claims	2	2
	Applicant Arguments/Remarks Made in an Amendment	3	5
Warnings:			
Information:			
	Total Files Size (in bytes):	95157	

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 10/28/2008

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 6	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 6	Minus	***8	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/ERIC DANTZLER/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 01/06/2009
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EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
01/06/2009	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 28 October 2008.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 3-8 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) 3-8 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 3 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Rhodes (US 2003/0042511) of prior record, hereinafter Rhodes.

Regarding claim 3, Rhodes (refer to Figures 5-14) teaches a semiconductor device with graded dopant concentration (page 4, para 0046, 1st sentence) in the well regions (160, 170, 180) to aid carrier movement away from the active surface regions, towards the substrate (page 6, para 0061; page 4, para 0045 & 0049).

Regarding claim 6, Rhodes (US 2003/0042511) (refer to Figures 5-14) teaches a semiconductor device with at least one graded dopant concentration (page 4, para 0046, 1st sentence) fabricated with ion implantation (page 4, para 0047, last sentence), to provide an aiding or retarding electric field locally in a monolithic integrated circuit.

Note that claim 6 is a product claim but recites a method of steps therein, i.e. “fabricated with ion implantation”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.*

3. Claim 4 is rejected under 35 U.S.C. 102(b) as being anticipated by Cathey (US 2002/0093281) of prior record, hereinafter Cathey.

Regarding claim 4, Cathey teaches a semiconductor device with graded dopant concentration in the substrate (page 2, para 0027) region to aid carrier movement away from the active surface regions, deeper towards the substrate (page 3, claims 1, 5 and 6).

4. Claim 5 is rejected under 35 U.S.C. 102(b) as being anticipated by Kane (US 5,029,277) of prior record, hereinafter Kane.

Regarding claim 5, Kane teaches a semiconductor device with at least one each of dopant concentration of both donor and acceptor, to optimize the operating performance of the device (Col. 5, lines 5-40).

5. Claim 7 is rejected under 35 U.S.C. 102(b) as being anticipated by Baliga (US 5,637,898) of prior record, hereinafter Baliga.

Regarding claim 7, Baliga (US 5,637,898) teaches a semiconductor device with at least one graded dopant concentration in an epitaxial layer (Col. 4, lines 15-21and Col. 3, lines 45-50).

6. Claim 8 is rejected under 35 U.S.C. 102(b) as being anticipated by Macris (US 2002/0134419) of prior record, hereinafter Macris.

Regarding claim 8, Macris teaches a semiconductor device where one layer of dopant from one wafer, is transferred to another wafer having either same polarity or different polarity dopant through wafer bonding or similar processes (page 4, para 0076).

Note that claim 8 is a product claim but recites a method of steps therein, i.e. “one layer of dopant from one wafer, is transferred to another wafer” and “wafer bonding or similar processes”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of*

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

Response to Arguments

7. Applicant's arguments filed 10/28/2008 have been fully considered but they are not persuasive.

8. In response to applicant's arguments, the recitation “A VLSI digital semiconductor device” (see claims 3-8) has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

9. In response to applicant's argument that the references fail to show certain features of applicant’s invention, it is noted that the features upon which applicant relies

(i.e., “every one of this 1 million (+) gates, albeit CMOS, has graded dopant for electrons as well as holes" - see page 4, 2nd paragraph, of applicant's response) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

10. Other arguments presented by the applicant on page 4-5 are similar to the above addressed arguments.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/A. K. A./
Examiner, Art Unit 2892

/Thao X Le/
Supervisory Patent Examiner, Art Unit 2892

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	539	(257/655). CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/01/02 21:01

1/2/2009 9:08:30 PM
C:\Documents and Settings\aarora\My Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	01/02/2009								
	1	-								
	2	-								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	1/2/2009	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	7/24/2008	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

/A. K. A./ Examiner.Art Unit 2892	

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

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

Application Number	11/622,496	Filing Date	2007-01-12	Docket Number (if applicable)	1388-04	Art Unit	2892
First Named Inventor	RAO, G.R. MOHAN			Examiner Name	ARORA, AJAY		

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

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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

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

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

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

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 503886

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature
☐ Applicant Signature

Signature of Registered U.S. Patent Practitioner			
Signature	/Baxter W. Banowsky/	Date (YYYY-MM-DD)	2009-04-10
Name	Baxter W. Banowsky	Registration Number	58170

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

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

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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.

Attorney Docket No. **1388-04**
Customer No. **000061400**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	§	
	§	
RAO, G.R. MOHAN	§	**Confirmation No. 3086**
	§	
Serial No. 11/622,496	§	**Group Art Unit: 2892**
	§	
Filed: 12 JANUARY 2007	§	**Examiner: ARORA, AJAY**
	§	
For: SEMICONDUCTOR DEVICES	§	
WITH GRADED DOPANT REGIONS	§	

AMENDMENT AND RESPONSE
TO OFFICE ACTION MAILED JANUARY 6, 2009

I. INTRODUCTORY COMMENTS:

The present paper is submitted as a complete response to the final Office Action mailed January 6, 2009, having a shortened statutory period of response of three months. Applicant believes that a one month extension of time and the corresponding fees are necessary for the consideration of the present paper, such fees being paid contemporaneously with the filing of this paper. However, in the event that a further extension of time or any additional fees are necessary for consideration of the present paper, I authorize the Commissioner to charge such fees, including fees for extension of time, to Deposit Account No. 50-3886.

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 4 of this paper.

II. AMENDMENTS TO THE CLAIMS:

The text of all claims under examination is submitted, and the status of each is identified. This listing of claims replaces all prior versions and listings in the application.

Listing of Claims

Claims 1-2 (Cancelled)

3. (currently amended) A VLSI digital semiconductor device with graded dopant concentration in the well regions and the active channel regions, to aid carrier movement away from the active surface regions, towards the substrate.

4. (currently amended) A VLSI digital semiconductor device with graded dopant concentration in the active channel regions, the well regions and the substrate region to aid carrier movement away from the active surface regions, deeper towards the substrate.

5. (currently amended) A VLSI digital semiconductor device with at least one each of dopant concentration of both donor and acceptor in both the well and channel regions, to optimize the operating performance of the device.

6. (currently amended) A VLSI digital semiconductor device with at least one graded dopant concentration fabricated with ion implantation, to provide an aiding or retarding electric field locally, in both well and channel regions, in a monolithic integrated circuit.

7. (currently amended) A VLSI digital semiconductor device with at least one graded dopant concentration in an epitaxial layer where the epitaxial layer forms the substratum for well and channel regions.

8. (currently amended) A VLSI digital semiconductor device where one layer consisting of dopant gradients in both well and channel regions from one wafer, is transferred to another wafer having either same polarity or different polarity dopant through wafer bonding or similar processes.

III. REMARKS:

Claims 3 through 8 are pending herein.

Claims 1-2 have been cancelled without prejudice or disclaimer. Claims 3-8 have been amended, more particularly, to point out the claimed subject matter. It is respectfully submitted that Claims 3-8 are in full compliance with the broad dictates of 35 U.S.C. § 112. Favorable consideration of Claims 3-8 are respectfully requested.

Claims 3-8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by various references more particularly described below. Insofar as these references may be applied against the present claims, this rejection is respectfully traversed.

Each of claims 3-8 have been amended to clarify that the claimed invention relates to the field of VLSI digital semiconductor devices which include graded dopant concentrations in both the active and well regions. By definition, a VLSI semiconductor device means a device consisting of at least one million active elements (an active element is a semiconductor transistor or gate consisting of at least two trnasistors) that can be active when a voltage (or current) is applied. By contrast, SSI (small scale integration) is 1 to 1,000 active elements, MSI (medium scale integration) is up to 100,000 active elements and LSI (large scale integration) is 100,000 to 1,000,000 active elements. As is more fully set forth below, each of the cited references pertains to non-VSLI non-digital technology.

Claims 3 and 6 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Rhodes (US 2003/0042511), hereinafter Rhodes. Rhodes discloses a semiconductor based CMOS imaging device. Rhodes does not disclose or anticipate a VLSI digital semiconductor device.

Rhodes describes a CMOS image sensor- but, his sensor elements only uses electrons (a CMOS gate, by strict text book definition has a n-channel transistor that conducts electrons and a p-channel transistor that conducts holes). The "graded dopant" as described by Rhodes, is only in the "sensing element." Rhodes may have one million sensors (he may have a few CMOS trnasistors in periphery on non image sensing function). However, that does not make the device in Rhodes VLSI and certainly not CMOS VLSI.

Further, Rhodes does not teach a graded dopant layer in both active and well regions.

In the present VLSI digital invention, every one of this 1 million (+) gates, albeit CMOS, has graded dopant for electrons as well as holes. Additionally, the present invention also allows more than one gradient for electrons and more than one gradient for holes. Neither Rhodes nor, for that matter, any of the other cited prior art show this novelty.

Claim 4 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Cathey (US 2002/0093281), hereinafter Cathey. Cathey discloses an electron field emitter for use in computer or other display devices. Cathey does not disclose or anticipate a VLSI digital semiconductor device with graded dopant concentrations in both the active and well regions.

Claim 5 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Kane (US 5,029,277), hereinafter Kane. Kane discloses a method for temperature compensation of a bipolar transistor junction through optically-induced carrier density enhancement. Kane does not disclose or anticipate a VLSI digital semiconductor device with graded dopant concentrations in both the active and well regions.

Claim 7 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Baliga (US 5,637,898), hereinafter Baliga. Baliga discloses a to semiconductor switching device for high power applications. Baliga does not disclose or anticipate a VLSI digital semiconductor device with graded dopant concentrations in both the active and well regions.

Claim 8 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Macris (US 2002/0134419), hereinafter Macris. Macris discloses a heat sink. Macris does not disclose or anticipate a VLSI digital semiconductor device with graded dopant concentrations in both the active and well regions.

Accordingly, for the foregoing reasons, it is respectfully submitted that the cited references do not disclose or suggest the claimed VLSI digital semiconductor device with graded dopant concentrations in both the active and well regions. The rejection of claim 3-8 under 35 U.S.C. §102(b) as anticipated by the cited references should therefore be withdrawn. When read in light of the specification, Applicant submits that none of the foregoing amendments narrow the claims with regard to the claimed semiconductor device.

For all the foregoing reasons, it is respectfully submitted that claims 3-8 are in condition for allowance. Favorable reconsideration and allowance of claims 3-8 is respectfully requested.

Respectfully submitted,

Date: April 10, 2009

/Baxter W. Banowsky/
Baxter W. Banowsky
Registration No: 58,170

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Customer No. **000061400**

Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	Baxter Ward Banowsky.
Attorney Docket Number:	1388-04

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	100 2251	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	405	405
		Total in USD ($)		**470**

Electronic Acknowledgement Receipt

EFS ID:	5133457
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-04
Receipt Date:	10-APR-2009
Filing Date:	12-JAN-2007
Time Stamp:	11:52:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$470
RAM confirmation Number	6840
Deposit Account	503886
Authorized User	BANOWSKY,BAXTER W.

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 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	Request for Continued Examination (RCE)	rce.pdf	625825 393e3a85b87ee332e01026ccefb3d6ba8f936eb3	no	3
Warnings:					
Information:					
2		OA_01-06-09_rsp.pdf	78798 9558007e9641fe4bcc3b3d9484fd7117181b7053	yes	7

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	3
Applicant Arguments/Remarks Made in an Amendment	4	7

Warnings:					
Information:					
3	Fee Worksheet (PTO-06)	fee-info.pdf	32429 534d940d05a3666e878a90c3c2a414c3d2f40b6c	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	737052	

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:	5133457
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-04
Receipt Date:	10-APR-2009
Filing Date:	12-JAN-2007
Time Stamp:	11:52:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$470
RAM confirmation Number	6840
Deposit Account	503886
Authorized User	BANOWSKY,BAXTER W.

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

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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Charge any Additional Fees required under 37 C.F.R. Section 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	Request for Continued Examination (RCE)	rce.pdf	625825 393e3a85b87ee332e01026ccefb3d6ba8f936eb3	no	3
Warnings:					
Information:					
2		OA_01-06-09_rsp.pdf	78798 9558007e9641fe4bcc3b3d9484fd7117181b7053	yes	7

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	3
Applicant Arguments/Remarks Made in an Amendment	4	7

Warnings:					
Information:					
3	Fee Worksheet (PTO-06)	fee-info.pdf	32429 534d940d05a3666e878a90c3c2a414c3d2f40b6c	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	737052	

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	04/10/2009									
	Total (37 CFR 1.16(i))	* 6	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
	Independent (37 CFR 1.16(h))	* 6	Minus	***8	= 0	X $110 =	0	OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
	☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/Theresa Dawkins/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 05/27/2009
BANOWSKY &LEVINE, P.C
12001 N. CENTRAL EXPRESSWAY
SUITE 790
DALLAS, TX 75243

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
05/27/2009	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 April 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04/10/2009 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 5 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Amended claim 5 recites “with at least one each of dopant

concentration of both donor and acceptor in both the well and channel regions" (emphasis added), which does not comply with the written description requirement.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claims 3-8 are rejected under 35 U.S.C. 102(a) as being anticipated by Currie (US 6,831,292), hereinafter Currie.

Regarding claim 3, Currie (US 6,831,292) (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device, which may included VLSI (Col. 1, lines 24-27), with graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) in the well regions and the active channel regions (Col. 7, lines 12-13) which can aid carrier movement away from the active surface regions, towards the substrate.

Regarding claim 4, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), with graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) in the active channel

regions, the well regions and the substrate region (Col. 7, lines 12-13), which can aid carrier movement away from the active surface regions, deeper towards the substrate.

Regarding claim 5, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), with at least one each of dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) of both donor and acceptor (Col. 6, lines 15-25) in both the well and channel regions (Col. 7, lines 12-13), to optimize the operating performance of the device.

Regarding claim 6, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), with at least one graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) fabricated with ion implantation (Col. 6, lines 53-57), which can provide an aiding or retarding electric field locally in both well and channel regions, in a monolithic integrated circuit.

Even though a rejection is provided above, it is noted that claim 6 is a product claim but recites a method of steps therein, i.e. “fabricated with ion implantation”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product*

was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.

Regarding claim 7, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), with at least one graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) in an epitaxial layer (Col. 5, lines 6-12) where the epitaxial layer (124 of Figures 1 and 2) forms the substratum for well and channel regions.

Regarding claim 8, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), where one layer consists of dopant gradients in both well and channel regions (Col. 5, lines 36-41 and Col. 6, lines 32-37).

Note that claim 8 is a product claim but recites a method of steps therein, i.e. “one layer of dopant from one wafer, is transferred to another wafer” and “wafer bonding or similar processes”. Therefore, claim 8 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even*

though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.

Response to Arguments

6. Applicant's arguments with respect to claims 3-8 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/A. K. A./
Examiner, Art Unit 2892

/Chuong A Luu/
Primary Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 11/622,496	Applicant(s)/Patent Under Reexamination RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,831,292	12-2004	Currie et al.	257/19
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	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.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	05/24/2009								
	1	-								
	2	-								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	5/24/2009	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	5/24/2009	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

/A. K. A./ Examiner.Art Unit 2892	

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L9	551	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 12:52
L8	2	("5029277").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 12:17
L7	2	("6831292").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 11:36
L4	4	("4001864").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 11:10
L3	4	L1 AND (well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:06
L2	62	L1 AND (((carrier OR electron OR hole) WITH (movement OR mobility)) SAME ((emitter WITH collector) OR (source WITH drain)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:05

L1	695	VLSI AND ((graded OR gradation OR gradient) WITH (dopant OR doping OR impurit $3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:04

5/24/2009 1:01:49 PM
C:\Documents and Settings\aarora\My Documents\EAST\Workspaces\11622496.wsp

Attorney Docket No. **1388-04**
Customer No. **000061400**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of	§	
	§	
RAO, G.R. MOHAN	§	**Confirmation No. 3086**
	§	
Serial No. 11/622,496	§	**Group Art Unit: 2892**
	§	
Filed: 12 JANUARY 2007	§	**Examiner: ARORA, AJAY**
	§	
For: SEMICONDUCTOR DEVICES	§	
WITH GRADED DOPANT REGIONS	§	

AMENDMENT AND RESPONSE
TO OFFICE ACTION MAILED MAY 27, 2009

I. INTRODUCTORY COMMENTS:

The present paper is submitted as a complete response to the non-final Office Action mailed May 27, 2009, having a shortened statutory period of response of three months. Applicant does not believe that any extension of time or any additional fees are necessary for the consideration of the present paper. However, in the event that an extension of time or any additional fees are necessary for consideration of the present paper, I authorize the Commissioner to charge such fees, including fees for extension of time, to Deposit Account No. 50-3886.

Amendments to the Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 6 of this paper.

II. AMENDMENTS TO THE CLAIMS:

The text of all claims under examination is submitted, and the status of each is identified. This listing of claims replaces all prior versions and listings in the application.

Listing of Claims

Claims 1-2 (Cancelled)

3. (currently amended) ~~A VLSI digital semiconductor device with graded dopant concentration in the well regions and the active channel regions, to aid carrier movement away from the active surface regions, towards the substrate.~~

A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

a graded dopant concentration in either the channel region or the well region to aid carrier movement away from the surface region towards the substrate.

4. (currently amended) ~~A VLSI digital semiconductor device with graded dopant concentration in the active channel regions, the well regions and the substrate region to aid carrier movement away from the active surface regions, deeper towards the substrate.~~

A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

graded dopant concentrations in the substrate, the channel region and the well region to aid carrier movement away from the active surface region, towards the substrate.

5. (currently amended) ~~A VLSI digital semiconductor device with at least one each of dopant concentration of both donor and acceptor in both the well and channel regions, to optimize the operating performance of the device.~~

A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

a graded dopant concentration of both donor and acceptor in both the channel region and the well region to optimize the operating performance of the device.

6. (currently amended) ~~A VLSI digital semiconductor device with at least one graded dopant concentration fabricated with ion implantation, to provide an aiding or retarding electric field locally, in both well and channel regions, in a monolithic integrated circuit.~~

A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

a graded dopant concentration fabricated with ion implantation in both the channel region and the well region to provide an aiding or retarding electric field locally, in both the well region and the channel region, in a monolithic integrated circuit.

7. (currently amended) ~~A VLSI digital semiconductor device with at least one graded dopant concentration in an epitaxial layer where the epitaxial layer forms the substratum for well and channel regions.~~

A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

wherein said substrate is an epitaxial layer comprising at least one graded dopant concentration.

8. (Cancelled)

9. (New) A VLSI Digital Semiconductor device comprising:

a surface region;

a substrate;

an active channel region capable of providing a localized drift electric field without the application of an external potential;

an isolation well region capable of providing a localized drift electric field without the application of an external potential; and

a graded dopant concentration in either the channel region or the well region to aid carrier movement toward the surface.

III. REMARKS:

Claims 3 through 7 are pending herein.

Claims 1, 2 and 8 have been cancelled without prejudice or disclaimer. Claims 3-7 have been amended, more particularly, to point out the claimed subject matter. Claim 9 is new. It is respectfully submitted that Claims 3-7 and 9 are in full compliance with the broad dictates of 35 U.S.C. § 112. Favorable consideration of Claims 3-7 and 9 is respectfully requested.

Claim 5 stands rejected under 35 U.S.C. § 112 as failing to comply with the written description requirement. Insofar as this reference may be applied against the claim 5 as currently amended, this rejection is respectfully traversed.

The limitation of claim 5, reciting "with at least one each of dopant concentration of <u>both</u> donor and receptor in <u>both</u> the well and channel regions" fully complies with the written description requirement. Paragraph 12 of the specification provides "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."

Likewise, paragraph 4 and figures 3(a), (b), (c) and (d) of the specification describe the prior art, upon which the current invention improves. "FIG. 3(a) shows a typical CMOS VLSI device employing a twin well substrate, on which active devices are subsequently fabricated. FIGS. 3(b), 3(c), and 3(d) illustrate device cross sections, as practiced today." Further, paragraph 8 of the specification provides that "FIGURES 3(a), 3(b), 3(c), 3(d) illustrate cross sections commonly used CMOS silicon substrate 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) - typical IC, EEPROM using tunnel insulator, DRAM and NAND flash." It is well known in the art that p-ch xstors are in n-well and vice versa in CMOS circuits. These references in the specification clearly show the concept of transistors in wells in connection with the prior art. The embodiments in the specification use the prior art described in paragraphs 4 and 8 and figures 3(a), (b), (c) and (d) and applies graded dopants to produce localized electric fields to improve performance. Accordingly, paragraph 10 of the specification describes Figures 5(a), (b) and (c) which depict how the invention would be applied to the prior art depicted in Figure 3, including the concept of transistors within wells.

It would have been clear to one skilled in the art that the invention described in the specification would be applicable to doped concentrations in <u>both</u> donor and receptor in <u>both</u> the well and channel regions.

Additionally, claims 3-7 stand rejected under 35 U.S.C. § 102(a) as being anticipated by Currie (US 6,831,292). Insofar as this reference may be applied against the present claims, this rejection is respectfully traversed.

Each of claims 3-7 have been amended to clarify that the claimed invention relates to the field of VLSI digital semiconductor devices which include graded dopant concentrations in regions capable of providing a localized drift electric field without the application of an external potential. The Currie reference discloses a strained layer of Si, Ge or SiGe (Column 3, lines 46-58). The Currie reference does not teach a graded dopant concentration in a material capable of providing a localized drift electric field. Silicon and Germanium each have four valence

electrons. Accordingly, a strained SiGe layer, by its physical nature, is not capable of providing a localized electric field without the application of an external potential.

The amendment to claims 3-7 is supported by the description of the invention contained in the specification. Specifically, paragraph 11 of the specification contains a description of the invention including the range of doping concentrations . Additionally, this paragraph discloses that "[t]he 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 field helps hole conduction, the current gain at a given frequency is enhanced, relative to a uniformly-doped-(base) BJT."

Additionally, Figures 5(a), (b) and (c) clearly illustrate how the current invention differs from the prior art, such as Currie.

Accordingly, for the foregoing reasons, it is respectfully submitted that the cited reference does not disclose or suggest the claimed VLSI digital semiconductor device with graded dopant concentrations in regions capable of providing a localized drift electric field without the application of an external potential. The rejection of claims 3-7 under 35 U.S.C. §102(a) as anticipated by the cited reference should therefore be withdrawn. When read in light of the specification, Applicant submits that none of the foregoing amendments narrow the claims with regard to the claimed semiconductor device.

For all the foregoing reasons, it is respectfully submitted that claims 3-7 and 9 are in condition for allowance. Favorable reconsideration and allowance of claims 3-7 and 9 is respectfully requested.

Respectfully submitted,

Date: August 26, 2009

/Baxter W. Banowsky/
Baxter W. Banowsky
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Electronic Acknowledgement Receipt

EFS ID:	5958155
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Baxter Ward Banowsky.
Filer Authorized By:	
Attorney Docket Number:	1388-04
Receipt Date:	26-AUG-2009
Filing Date:	12-JAN-2007
Time Stamp:	15:54:11
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		OA_05-27-09_rsp.pdf	82950 de6fa1bbf7a0f8c18785e6a55fd09d19cf1b2ec5	yes	9

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	9

Warnings:	
Information:	
Total Files Size (in bytes):	82950

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 08/26/2009

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 6	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 6	Minus	***8	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/VICTOR c. BARLOW/

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 09/29/2009
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EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
09/29/2009	PAPER

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.

PTOL-90A (Rev. 04/07)

Interview Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Baxter Banowsky*.

(2) *G.R. Mohan Rao*.

(3)*Ajay K. Arora*.

(4)_____.

Date of Interview: *13 August 2009*.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *3 and 5*.

Identification of prior art discussed: *Currie*.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *Applicant described how applicant's invention is different from the Currie reference. Examiner explained how some of the same aspects were also in the disclosure of Currie reference. Examiner pointed out that the features discussed by applicant were not recited in the claims and stressed that although claims are interpretted in light of the specification, limitations from the specification are not read into the claims*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Ajay K. Arora/ Examiner, Art Unit 2892	

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	1388-04	3086

61400 7590 12/30/2009
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EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
12/30/2009	PAPER

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.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 August 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *3-7 and 9* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *3-7 and 9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 5 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Amended claim 5 recites "a graded dopant concentration of both donor and acceptor in both the channel region and the well region" (emphasis added, see last 2 lines of claim 5), which does not comply with the written description requirement.

Claim Rejections - 35 USC § 103

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

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

4. Claims 3-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Currie (US 6,831,292) of prior record, hereinafter Currie, in view of Pendharkar, US 2006/0113592), hereinafter Pendharkar.

Regarding claim 3, Currie (refer to Figures 1-4 and in particular to Figure 2) teaches a semiconductor device , which may included VLSI (Col. 1, lines 24-27), comprising:

a surface region (all devices have a surface region);

a substrate (202 and 204);

an active channel region with graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37);

a graded dopant concentration in the channel region (Col. 5, lines 36-41 and Col. 6, lines 32-37) which can aid carrier movement away from the surface region towards the substrate.

However, creation of a "localized drift electric field" is a known physical effect of variation of dopant concentrations in a device region (for example, see Pendharkar, US 2006/0113592, page 4, para 0034), which also teaches an isolation well may be formed. It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Currie so that the device comprises an isolation well and doping concentrations and gradation are adjusted so that the active channel and the isolation well are capable of providing a localized drift electric field without the application of external electric field. Note that applicant has not claimed a specific magnitude of the drift electric field and hence any magnitude of drift electric field, however small, reads

on the claim. The ordinary artisan would have been motivated to modify Currie for at least the purpose of aiding carrier movement in a specific, desired direction.

Claim 4 recites similar limitations to claim 3,except that it requires “graded dopant concentrations in “the substrate, the channel region, and the well region”, which is taught by Currie (Col. 5, lines 36-41; Col. 6, lines 32-37 and Col. 7, lines 12-13).

Similarly, claim 5 is substantially similar to claims 3-4 except for the recitation "a graded dopant concentration of both donor and acceptor in both the channel region and the well region to optimize the operating performance of the device, which is taught by Currie (see Col. 6, lines 15-37; Col. 5, lines 36-41 and Col. 7, lines 12-13).

Claim 6 is similar to claims 3-4 except the requirement that the graded dopant concentration be “fabricated with ion implantation”. Currie teaches that graded dopant concentration (Col. 5, lines 36-41 and Col. 6, lines 32-37) may be fabricated with ion implantation (Col. 6, lines 53-57), which can provide an aiding or retarding electric field locally in both well and channel regions, in a monolithic integrated circuit.

Even though a rejection is provided above, it is noted that claim 6 is a product claim but recites a method of steps therein, i.e. “fabricated with ion implantation”. Therefore, claim 6 amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its*

method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.

Claim 7 is similar to claims 3-4 except that it requires that "the substrate is an epitaxial layer". The limitation of “epitaxial layer” is taught by Currie and the graded dopant concentration of substrate has already been discussed in claim 4.

All limitations of claim 9 have already been addressed in claims 3-4.

Response to Arguments

5. Applicant's arguments of 8/26/2009 have been considered but are moot in view of the new ground(s) of rejection.

6. However, arguments related to applicant’s response to the 35 U.S.C. 112 rejection of claim 5 (see page 6-7 of applicant's response), are still relevant. Applicant states that the disclosure in specification that "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". Whereas the above shows presence of electrons and holes (due to presence of dopants), it is silent about the associated <u>gradient in</u> dopant concentrations. In particular, it does not show that the dopant concentration <u>is graded</u> for <u>both</u> donor and acceptor in <u>both</u> channel region and the well region, as claimed.

Conclusion

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

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/Thao X Le/
Supervisory Patent Examiner, Art Unit 2892

/Ajay K. Arora/
Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 11/622,496	Applicant(s)/Patent Under Reexamination RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0113592	06-2006	Pendharkar et al.	257/335
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	12/22/2009	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	12/22/2009	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

/A. K. A./ Examiner.Art Unit 2892	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	564	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/12/22 10:12
L2	2	("6831292").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/12/22 10:14
L4	10	(US-20040072395-$ or US-20010046753-$ or US-20010050382-$ or US-20020093281-$ or US-20030042511-$).did. or (US-6743684-$ or US-5359221-$ or US-5637898-$ or US-5627092-$ or US-5029277-$).did. or (US-20020093281-A-$).did.	US-PGPUB; USPAT; DERWENT	OR	ON	2009/12/22 10:26
L5	0	L4 AND drift WITH aid$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/12/22 10:27
L6	7	(drift WITH aid$3) WITH dopant WITH concentration	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/12/22 10:27

EAST Search History (Interference)

<This search history is empty>

12/22/2009 11:30:00 AM
C:\Documents and Settings\aarora\My Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	12/22/2009								
	1	-								
	2	-								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	-								
	9	✓								

OPAP IAP6 MAR 15 2010 PATENT & TRADEMARK OFFICE

PTO/SB/31 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Docket Number (Optional): 1388-04

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on 03/10/2010

Signature

Typed or printed name: Baxter W. Banowsky

In re Application of: G.R. Mohan Rao

Application Number: 11/622,496 | Filed: 01/12/2007

For:

Art Unit: 2892 | Examiner: Arora, Ajay

Applicant hereby **appeals** to the Board of Patent Appeals and Interferences from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 510

- [x] Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ 255
- [x] A check in the amount of the fee is enclosed.
- [ ] Payment by credit card. Form PTO-2038 is attached.
- [ ] The Director has already been authorized to charge fees in this application to a Deposit Account.
- [x] The Director is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 50-3886.
- [ ] A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is enclosed.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

- [ ] applicant/inventor.
- [ ] assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- [x] attorney or agent of record. Registration number 58,170
- [ ] attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34.

Signature

Baxter W. Banowsky
Typed or printed name

214-871-1300
Telephone number

03/10/2010
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

- [x] *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 41.31. 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, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

03/16/2010 CCHAU1 00000028 503886 11622496
01 FC:2401 15.00 DA 255.00 OP

OPAP
MAR 15 2010
IAP6
PATENT & TRADEMARK OFFICE

12801 N. Central Expressway
Suite 1700
Dallas, Texas 75243

Phone: 214-871-1300
Facsimile: 214-871-0038
www.banowsky.com

Banowsky & Levine
A Professional Corporation
Attorneys and Counselors

March 10, 2010

Via First Class Mail
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RE: Docket No. 1388-04.

Dear Sir/Madam:

Enclosed please find the following documents:

1. Notice of Appeal From the Examiner to the Board of Patent Appeals and Interferences;

2. Check number 3018 in the amount of $255.00 representing the fee for the appeal; and,

3. A return postcard which I would appreciate you date stamping and returning to me.

If you have any questions regarding the above, please do not hesitate to contact me.

Best regards,

Baxter W. Banowsky

BWB:jlj
Enclosures

PTO/SB/81 (01-09)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	11/822408
Filing Date	January 12, 2007
First Named Inventor	G.R. Mohan Rao
Title	Semiconductor Devices with Graded Dopant Re
Art Unit	2892
Examiner Name	Ajay K. Arora
Attorney Docket Number	0299-0001

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 70653

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application 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/Inventor.

OR

☐ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	G R Mohan Rao	Date	APRIL 8, 2010
Name	G. R. MOHAN RAO	Telephone	214-578-2358
Title and Company	GREENTHREAD LLC, FOUNDER		

NOTE: Signature of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.31, 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.

Electronic Acknowledgement Receipt

EFS ID:	7375420
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	61400
Filer:	Konrad Val Sherinian/Amy Bills
Filer Authorized By:	Konrad Val Sherinian
Attorney Docket Number:	1388-04
Receipt Date:	08-APR-2010
Filing Date:	12-JAN-2007
Time Stamp:	12:47:10
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	Power of Attorney	POA.pdf	70239 7de5c4cd46ffa6f295ce3b2c50c58cc7fe2c47b2	no	1

Warnings:

Information:

Total Files Size (in bytes):	70239

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001

CONFIRMATION NO. 3086

POWER OF ATTORNEY NOTICE

70653
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

OC000000041105727

Date Mailed: 04/16/2010

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/08/2010.

- 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).

/ttkim/

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

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
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001

CONFIRMATION NO. 3086

POA ACCEPTANCE LETTER

70653
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

OC000000041105747

Date Mailed: 04/16/2010

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/08/2010.

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.

/ttkim/

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

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.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001	3086

70653 7590 05/11/2010
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
05/11/2010	PAPER

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.

PTOL-90A (Rev. 04/07)

Interview Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Eugene M. Cummings*.

(2) *Konrad Sherinian*.

(3)*Ajay K. Arora*.

(4)_____.

Date of Interview: *29 April 2010*.

Type: a)☐ Telephonic b)☐ Video Conference
c)☒ Personal [copy given to: 1)☐ applicant 2)☒ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *1*.

Identification of prior art discussed: *Currie and Pendharkar*.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *See Continuation Sheet*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Ajay K. Arora/ Examiner, Art Unit 2892	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Applicant explained the key differences between applicant's invention (with particular reference to Figure 5b of the specification) and showed how the structure was different from that of Currie and Pendharkar. Applicant presented new claims 10 and 11. Applicant explained that a critical feature of the invention is that the graded dopant region of Figure 5b disposed just above the P- substrate forms a distinct drift layer disposed between an active region and a substrate layer. Examiner agreed that above feature was not taught by Currie or Pendharkar but noted that the above feature is not recited in claim 1 or other currently pending claims and as such, new claim 10 which recites that above limitation, raises new issues that would require further consideration and/or search.

.

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	11/622,496
Filing Date	01-12-2007
First Named Inventor	G. R. Mohan Rao
Art Unit	2892
Examiner Name	Ajay Arora
Attorney Docket Number	0299-0001.01

This is a Request for Continued Examination (RCE) under 37 CFR 1 .114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

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

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☒ Enclosed

      i. ☒ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☒ Other Extension of Time (2 months)

2. Miscellaneous

   Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a

   a. ☐ period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   The Director is hereby authorized to charge the following fees any underpayment of fees or credit any overpayments to

   a. ☒ Deposit Account No. 50-4199

      i. ☒ RCE fee required under 37 CFR 1.17(e)

      ii ☒ Extension of time fee (37 CFR 1.136 and 1.17)

      iii ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature		Date	May 14, 2010
Name (Print/Type)	David M. Mundt	Registration No.	41,207

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below. Electronic Filing

Signature			
Name (Print/Type)	Francisca M.A. Hubbard	Date	May 14, 2010

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, 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.

American LegalNet, Inc.
www.FormsWorkFlow.com

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

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2009 *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) 0299-0001.01
Application Number 11/622,496	Filed 01-12-2007
For SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS	
Art Unit 2892	Examiner Ajay Arora

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$130	$65	$
☒	Two months (37 CFR 1.17(a)(2))	$490	$245	$ 245.00
☐	Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐	Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐	Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☒ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-4199.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the ☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 41,207

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____.

Signature	May 14, 2010 Date
David M. Mundt Typed or printed name	312-984-0144 Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of _____ forms are submitted.

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

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

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

REQUEST FOR CONTINUED EXAMINATION

AMENDMENT A

Sir:

In response to the Office Action of December 30, 2009, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (canceled)

2. (canceled)

3. (canceled)

4. (canceled)

5. (canceled)

6. (canceled)

7. (canceled)

8. (canceled)

9. (canceled)

10. (new) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said surface layer to said substrate.

11. (new) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (new) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration

follows an exponential gradient.

16. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration of dopants comprises solely donor dopants.

18. (new) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said substrate to said layer.

19. (new) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (new) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration of dopants comprises solely acceptor dopants.

REMARKS

Applicant wishes to thank Examiner Arora for the courtesy extended to Applicant's representatives Eugene Cummings and Konrad Sherinian during the office interview of April 29, 2010. During this interview a new claim set was presented that incorporated a distinct drift layer, which Applicant's contend is not present in the art of record. It was further agreed that Applicant would withdraw the pending notice of appeal, and file a request for continued examination, along with a new set of claims contained herein.

Applicant awaits a first action on these new claims, which Applicant believes are patentable over the known art.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required, Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. Although no additional fees are believed to be due at this time, the Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: May 14, 2010

By: _____
David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	David Michael Mundt/Francisca Hubbard
Attorney Docket Number:	0299-0001

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 2 months with $0 paid	2252	1	245	245

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	405	405
		Total in USD ($)		**650**

Electronic Acknowledgement Receipt

EFS ID:	7613062
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001
Receipt Date:	14-MAY-2010
Filing Date:	12-JAN-2007
Time Stamp:	12:19:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$650
RAM confirmation Number	8031
Deposit Account	504199
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 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	Request for Continued Examination (RCE)	RCE.pdf	95537 83a7001b6664b26e8cc6b1f5887e56cea8482970	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2	Extension of Time	ExtOfTime.pdf	79508 b068ebf90ba2770a3d21d7adca284f27cbbe8f6b	no	1
Warnings:					
Information:					
3	Amendment After Final	AmendmentA.pdf	187796 5a0f1decaae50b1ba1e4c00313e8df35cf1651b3	no	7
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	32354 0311a75122a1875e6f4002d6add25f0c7090d4e5	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	395195		

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 05/14/2010

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 16	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DONNA L. PRICE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

STATEMENT OF THE SUBSTANCE OF THE INTERVIEW

Sir:

Pursuant to MPEP § 713.04, Applicant submits this Statement of the Substance of the Interview. Foremost, Applicant wishes to thank Examiner Arora for the courtesy extended to Applicant's representatives Eugene Cummings and Konrad Sherinian during the office interview of April 29, 2010. During the interview, Applicant presented new claims 10 and 11 and explained that a critical feature of the invention is that the dopant region of Figure 5b disposed just above the P-substrate forms a distinct drift layer disposed between an active region and a substrate layer. Examiner agreed that the prior art of record did not teach such a feature and that further consideration and/or search would be necessary.

Applicant then filed an RCE under CFR 1.114 on May 14, 2010 to submit this new claim set as well as to withdraw the Notice of Appeal of March 10, 2010.

Although no additional fees are believed to be due at this time, the Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. 50-4199, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

EUGENE M. CUMMINGS, P.C.

By: _____

David M. Mundt, Reg. No. 41,207
1 North Wacker Drive
Suite 4130
Chicago, Illinois 60606
Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Acknowledgement Receipt

EFS ID:	7669247
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	24-MAY-2010
Filing Date:	12-JAN-2007
Time Stamp:	12:01:19
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	Applicant summary of interview with examiner	Statement.pdf	63076 20dcb5f07770eea0bbc9b8294794eaff27de0580	no	2

Warnings:

Information:

Total Files Size (in bytes):	63076

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 08/04/2010
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
08/04/2010	PAPER

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.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 May 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 05/14/2010 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 17 and 25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 17 and recites “said graded concentration of dopants comprises “solely donor dopants” (as recited in claim 17) and

"solely acceptor dopants" (as recited in claim 25). Whereas donors in general are described, they have not been described in conjunction with the configuration of claim 10, which appears to read on Figure 5b, and more specifically, not described as "solely donor dopants" or "solely acceptor dopants".

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 18-25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 18 recites "said layer" (see last two words of claim 18). However, it is not clear if "said layer" refers to "surface layer" (see line 2 of claim 18) or "drift layer" (see line 6 of claim 18). For the purpose of this office action, it will be assumed that "said layer" may refer to either the surface layer or the drift layer.

Claim Rejections - 35 USC § 103

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

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 10-11, 17, 19 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins (US 4,160,985), hereinafter Kamins, in view of Bamji (US 2002/0084430), hereinafter Bamji.

Regarding claim 10, Kamins (refer to Figures 2-3) teaches a semiconductor device comprising:

a surface layer (23);

s substrate (19);

an active region (comprising photodiodes 11, 13, 15 and 17 are formed), disposed on one surface (i.e. upper surface in Figure 2) of said surface layer (23); and

a drift layer (21) disposed between the other surface (i.e. lower surface in Figure 2) of said surface layer (23) and said substrate (19), said drift layer having a graded concentration of dopants (see Figure 3) extending between said surface layer and said substrate to create a drift field (Col. 2, line 64 - Col. 3, line 2) drawing minority carriers (Col. 2, lines 15-16) from said surface layer to said substrate (Col. 1, lines 38-46 and Col. 3, lines 8-11).

Whereas Kamins teaches photosensing elements like photodiodes and associated integrated circuit structures (Col. 2, lines 56-59), Kaminis does not teach that the semiconductor device is a “CMOS” semiconductor device and with the active region including “a source and a drain”. Bamji teaches that integrated circuit structures with photo detectors such as photodiodes may be arrays of CMOS devices (page 1, para

0004) wherein active regions may include a source and a drain (page 9, para 0098, 1st sentence). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the semiconductor device is a CMOS semiconductor device and with the active region includes a source and a drain. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using CMOS technology that is suitable for field effect devices with source and drain regions, as CMOS technology enables integration of images sensors on a single integrated circuit and reduction in power consumption (see Bamji, page 1, para 0002).

Claim 18 is similar to claim 10 (and hence the same rejection applies) except for the direction of drawing minority carriers. However, Kamins also teaches the direction of drawing minority carriers as in claim 18; i.e. drawing minority carriers (Col. 2, lines 15-16) may also be from said substrate to said layer (Col. 1, lines 38-46 and Col. 3, lines 6-18).

Regarding claims 11 and 19, Kamins teaches that said drift layer (21) is a deeply implanted layer (see Figures 2-3; also see Col. 2, lines 36-42).

Regarding claims 17, Kamins (refer to Figure 3) teaches that said graded concentration of dopants comprises solely of donor dopants (donors such as phosphorous atoms; see Col. 2, lines 45-56).

Regarding claim 25, the embodiment of Figures 2-3 of Kamnis teaches substantially the claimed structure but does not teach that said graded concentration of dopants comprises “solely acceptor dopants”. See rejection of claim 17 and also note that figures 2-3 of Kamins teach that the direction of electric field (ε) depends on type of doping (i.e. n-type or p-type) of various layers (19, 21, 23 of Figure 20 - electric field direction is shown by arrows in Figures 2 and 3 for n-type doping. Thus, it would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that said graded concentration of dopants comprises solely acceptor dopants (i.e. when layers 19, 21 and 23 are p-type). The ordinary artisan would have been motivated to modify Kamins for at least the purpose of creating a specific profile of the electric field that is suitable for a device that is formed in a p-type substrate.

8. Claims 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins and Bamji as applied to claims 10 and 18 above above, and further in view of Baliga (US 2002/0056883), hereinafter Baliga.

Regarding claims 12 and 20, Kamins (refer to Figures 2-3) teaches substantially the claimed structure but does not teach that the drift layer is an “epitaxial" layer. Baliga (US 2002/0056883) teaches that it is known in the art that a drift layer with graded dopant concentration may be an epitaxial layer (page 2, para 0008, 2nd and 3rd sentences and page 9, para 0063, especially 7th – 9th sentences). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the drift

layer is an epitaxial layer. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using a layer that has a uniform crystal structure which makes electrical properties more predictable and can also act as a base for further epitaxial layers in which devices may be formed.

9. Claims 13-16 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins and Bamji as applied to claims 10 and 18 above above, and further in view of Fujimoto (2002/0102783), hereinafter Fujimoto; and Ishaque (US 5,517,052), hereinafter Ishaque.

Regarding claims 13-16 and 21-24, Kamins (refer to Figure 3) teaches substantially the claimed structure but does not specifically state if the gradient is “linear”, “quasi-linear”, “exponential”; or "complimentary error function". Fujimoto teaches that an impurity region having a concentration gradient may have a profile that is linear, exponential,“or a combination thereof (page 3, para 0038). Further, Ishaque teaches that doping gradient is typically complementary error function or Gaussian if a deep diffusion process is used (Col. 3, line 49 to Col. 4, line 14). Given that Kamins teaches that a desired electric field is formed as a result of the gradient in doping (thus suggesting the gradient affects profile of the field) and various profiles of concentration gradient are known (as explained above in view of Fujimoto and Ishaque), it would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the gradient is linear, exponential; or alternatively other profiles such as “quasi-

linear" or "complimentary error function", which are essentially combinations of linear and exponential profiles. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of creating a specific profile of the electric field that is suitable for directing the minority carriers in a specific direction.

Response to Arguments

10. Applicant's arguments with respect to claims 10 and 11 (as explained in applicant's interview summary of 05/24/2010) and remarks of 05/14/2010 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/Ajay K. Arora/
Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 11/622,496	Applicant(s)/Patent Under Reexamination RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,160,985	07-1979	Kamins et al.	257/443
*	B	US-2002/0056883	05-2002	Baliga, Bantval Jayant	257/390
*	C	US-2002/0084430	07-2002	Bamji et al.	250/559.05
*	D	US-2002/0102783	08-2002	Fujimoto et al.	438/200
*	E	US-5,517,052	05-1996	Ishaque, Ahmad N.	257/462
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	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.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L28	583	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/08/02 10:21
L19	8	L16 AND donor	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:38
L17	3	L16 AND "complimentary error function"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:04
L16	47	L1 AND (linear AND exponential)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:04
L15	172	(drift WITH layer WITH epitaxial) AND L1	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 07:16
L14	2	("20020084430").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/08/02 05:26
L13	9	L2 AND L8	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:20

L12	98	L1 AND L8	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:20
L11	7	L1 AND L7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
L10	0	L8 AND L7	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
L9	0	L8 AND L6	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
L8	8028	photodiode WITH CMOS	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:13
L7	7	L6 AND (drift WITH layer WITH between WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:48
L6	88	L1 AND (drift WITH layer WITH (graded OR gradation OR gradient) WITH (dopant OR doping OR impurity OR donor OR acceptor))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:47
L5	33	L2 AND L4	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:30

L4	114	L1 AND (minority WITH carrier WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:30
L3	0	L1 AND (minority WITH carrier WITH into WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:29
L2	371	L1 AND (drift WITH field)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:29
L1	3377	((graded OR gradation OR gradient) NEAR3 (dopant OR doping OR impurity OR donor OR acceptor)) AND (semiconductor OR CMOS OR FET OR "field effect" OR NMOS OR PMOS).ab.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:28
S70	16	(layer WITH (dopant OR donor) WITH concentration WITH minority WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 20:02
S69	4	(grad$3 WITH (dop$3 OR donor)) SAME ((dopant OR donor) WITH driv$3 WITH (toward OR into OR deep $2) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 20:00
S68	7	(grad$3 WITH (dop$3 OR donor)) SAME ((dopant OR donor) WITH (sweep$3 OR mov $3 OR attract$3) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:58
S67	0	S66 AND S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:15

S66	12	S64 AND S65	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:14
S65	712	CMOS AND (linear WITH gradient)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:14
S64	55	CMOS AND (exponential WITH gradient)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:13
S62	5	(complementary WITH error WITH function WITH gradient)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:12
S61	74	S60 AND CMOS	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 13:43
S60	173	((graded OR gradient OR gradation) NEAR2 (dop $3 OR impurity)) WITH between WITH substrate AND (active OR source OR drain OR source/drain)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 12:45

EAST Search History (Interference)

<This search history is empty>

8/2/2010 10:40:02 AM
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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	08/02/2010								
	1	-								
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	22	✓								
	23	✓								
	24	✓								
	25	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	8/2/2010	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	8/2/2010	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

/A. K. A./ Examiner.Art Unit 2892	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

AMENDMENT B

Sir:

In response to the Office Action of August 4, 2010, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (canceled)

2. (canceled)

3. (canceled)

4. (canceled)

5. (canceled)

6. (canceled)

7. (canceled)

8. (canceled)

9. (canceled)

10. (new) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said surface layer to said substrate.

11. (new) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (new) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration

follows an exponential gradient.

16. (new) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (canceled)

18. (currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said substrate to said surface layer.

19. (new) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (new) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (new) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (canceled)

REMARKS

Applicant has carefully reviewed the most recent communication from the Patent Office, as well as the cited art. In response, Applicant has canceled claims 17 and 25, as well as amended claim 18. Applicant respectfully traverses the rejections made under 35 U.S.C. § 103(a) as explained below.

Claim 10 stands rejected as obvious in view of the combined teachings of Kamins–Pat. No. 4,160,985 and Bamji–Pub. No. 2002/0084430. Kamins discloses a photosensing device in which different layers of the semiconductor are doped with different concentrations of carriers. Abstract, Fig. 3. In particular, Kamins disclosure states that "[t]he subsurface fields are obtained by incorporating suitable dopant gradients into the structure[...] [T]he subsurface field is formed using a heavily doped 'buried layer' and a lightly doped epitaxial film over a lightly doped substrate [...]" Col. 1, Lines 44-50. Accordingly, Kamins use of the phrase "dopant gradients" refers to layers of different dopant concentrations, and not a single layer with a gradient established in donor concentration as required by the claim element "a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate [...]"

Bamji discloses a method to measure distance or brightness using a CMOS sensor. The most recent office action cites Bamji against claim 10 for the proposition that "integrated circuit structures with photo detectors may be arrays of CMOS devices [...]", which is certainly correct. Office Action of August 4, pp. 4-5. However, Applicant respectfully submits that this disclosure is moot in view of the above recited shortcomings in the disclosure of Kamins.

Claims 11-16 claim varying preferred embodiments that add additional distinction over the prior art. For at least the reason that claim 10 is patentable over the cited prior art, claims 11-

16 are patentable as well.

As pointed out in the most recent Office Action, claim 18 is similar to claim 10, and is patentable for at least the same reasons as claim 10, as recited above. In addition, claims 19-24 further supplement claim 18 by claiming varying preferred embodiments that further distinguish over the prior art. Accordingly, for at least the same reason that claim 18 (and claim 10) is patentable, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required, Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. Although no additional fees are believed to be due at this time, the Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: November 1, 2010

By: _____

David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Acknowledgement Receipt

EFS ID:	8742028
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	01-NOV-2010
Filing Date:	12-JAN-2007
Time Stamp:	14:36:28
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	Amendment/Req. Reconsideration-After Non-Final Reject	Amendment.pdf	231626 2e0c3163549e985d12298a79818ad54d919b163b	no	8

Warnings:

Information:

Total Files Size (in bytes):	231626

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 11/01/2010

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/VENESSA JONES/

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 01/19/2011
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
01/19/2011	PAPER

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 Non-Compliant Amendment (37 CFR 1.121)	Application No. 11/622,496	Applicant(s) RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	

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

The amendment document filed on *01 November 2010* is considered non-compliant because it has failed to meet the requirements of 37 CFR 1.121 or 1.4. In order for the amendment document to be compliant, correction of the following item(s) is required.

THE FOLLOWING MARKED (X) ITEM(S) CAUSE THE AMENDMENT DOCUMENT TO BE NON-COMPLIANT:

- ☐ 1. Amendments to the specification:
  - ☐ A. Amended paragraph(s) do not include markings.
  - ☐ B. New paragraph(s) should not be underlined.
  - ☐ C. Other _____.
- ☐ 2. Abstract:
  - ☐ A. Not presented on a separate sheet. 37 CFR 1.72.
  - ☐ B. Other _____.
- ☐ 3. Amendments to the drawings:
  - ☐ A. The drawings are not properly identified in the top margin as "Replacement Sheet," "New Sheet," or "Annotated Sheet" as required by 37 CFR 1.121(d).
  - ☐ B. The practice of submitting proposed drawing correction has been eliminated. Replacement drawings showing amended figures, without markings, in compliance with 37 CFR 1.84 are required.
  - ☐ C. Other _____.
- ☒ 4. Amendments to the claims:
  - ☐ A. A complete listing of all of the claims is not present.
  - ☐ B. The listing of claims does not include the text of all pending claims (including withdrawn claims)
  - ☒ C. Each claim has not been provided with the proper status identifier, and as such, the individual status of each claim cannot be identified. Note: the status of every claim must be indicated after its claim number by using one of the following status identifiers: (Original), (Currently amended), (Canceled), (Previously presented), (New), (Not entered), (Withdrawn) and (Withdrawn-currently amended).
  - ☐ D. The claims of this amendment paper have not been presented in ascending numerical order.
  - ☐ E. Other: _____.
- ☐ 5. Other (e.g., the amendment is unsigned or not signed in accordance with 37 CFR 1.4):

  _____

For further explanation of the amendment format required by 37 CFR 1.121, see MPEP § 714.

TIME PERIODS FOR FILING A REPLY TO THIS NOTICE:

1. Applicant is given **no new time period** if the non-compliant amendment is an after-final amendment or an amendment filed after allowance. If applicant wishes to resubmit the non-compliant after-final amendment with corrections, the **entire corrected amendment** must be resubmitted.

2. Applicant is given **one month**, or thirty (30) days, whichever is longer, from the mail date of this notice to supply the correction, if the non-compliant amendment is one of the following: a preliminary amendment, a non-final amendment (including a submission for a request for continued examination (RCE) under 37 CFR 1.114), a supplemental amendment filed within a suspension period under 37 CFR 1.103(a) or (c), and an amendment filed in response to a *Quayle* action. If any of above boxes 1. to 4. are checked, the correction required is only the **corrected section** of the non-compliant amendment in compliance with 37 CFR 1.121.

   Extensions of time are available under 37 CFR 1.136(a) only if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action.

   Failure to timely respond to this notice will result in:
   Abandonment of the application if the non-compliant amendment is a non-final amendment or an amendment filed in response to a *Quayle* action; or
   Non-entry of the amendment if the non-compliant amendment is a preliminary amendment or supplemental amendment.

/Ajay K. Arora/ Examiner, Art Unit 2892	

Continuation of Item 4C above: For example, status identifier of claim 10 is not proper as the status identifier is "new" although claim 10 was also presented in applicant's submission of 05/14/2010 to which were addressed in the office action of 8/4/2010. Similar issues exists with claims 11-16 and 19-24

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE TO NOTICE OF NON-COMPLIANT AMENDMENT

Sir:

In response to the Notice of Non-Compliant Amendment of January 19, 2011 and the Office Action of August 4, 2010, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Previously presented) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said surface layer to said substrate.

11. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded

concentration follows an exponential gradient.

16. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a drift field drawing minority carriers from said substrate to said <u>surface</u> layer.

19. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the most recent communication from the Patent Office, as well as the cited art. In response, Applicant has canceled claims 17 and 25, as well as amended claim 18. Applicant respectfully traverses the rejections made under 35 U.S.C. § 103(a) as explained below.

Claim 10 stands rejected as obvious in view of the combined teachings of Kamins–Pat. No. 4,160,985 and Bamji–Pub. No. 2002/0084430. Kamins discloses a photosensing device in which different layers of the semiconductor are doped with different concentrations of carriers. Abstract, Fig. 3. In particular, Kamins disclosure states that "[t]he subsurface fields are obtained by incorporating suitable dopant gradients into the structure[...] [T]he subsurface field is formed using a heavily doped 'buried layer' and a lightly doped epitaxial film over a lightly doped substrate [...]" Col. 1, Lines 44-50. Accordingly, Kamins use of the phrase "dopant gradients" refers to layers of different dopant concentrations, and not a single layer with a gradient established in donor concentration as required by the claim element "a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate [...]"

Bamji discloses a method to measure distance or brightness using a CMOS sensor. The most recent office action cites Bamji against claim 10 for the proposition that "integrated circuit structures with photo detectors may be arrays of CMOS devices [...]", which is certainly correct. Office Action of August 4, pp. 4-5. However, Applicant respectfully submits that this disclosure is moot in view of the above recited shortcomings in the disclosure of Kamins.

Claims 11-16 claim varying preferred embodiments that add additional distinction over the prior art. For at least the reason that claim 10 is patentable over the cited prior art, claims 11-

16 are patentable as well.

As pointed out in the most recent Office Action, claim 18 is similar to claim 10, and is patentable for at least the same reasons as claim 10, as recited above. In addition, claims 19-24 further supplement claim 18 by claiming varying preferred embodiments that further distinguish over the prior art. Accordingly, for at least the same reason that claim 18 (and claim 10) is patentable, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required, Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. Although no additional fees are believed to be due at this time, the Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: January 26, 2011 By: _____

David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Acknowledgement Receipt

EFS ID:	9316990
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	27-JAN-2011
Filing Date:	12-JAN-2007
Time Stamp:	10:09:52
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	Amendment/Req. Reconsideration-After Non-Final Reject	Response.pdf	244409 df477f2ab6cf8b248f6cb55e63d4bf663a380e4d	no	8

Warnings:

Information:

Total Files Size (in bytes):	244409

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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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.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 01/27/2011

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DALE HALL/

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 04/13/2011
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
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EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
04/13/2011	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 January 2011*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10-16 and 18-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-16 & 18-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

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

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

2. Claims 10-11, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins (US 4,160,985), hereinafter Kamins, in view of Bamji (US 2002/0084430), hereinafter Bamji.

Regarding claim 10, Kamins (refer to Figures 2-3) teaches a semiconductor device comprising:

a surface layer (23);

s substrate (19);

an active region (comprising photodiodes 11, 13, 15 and 17 are formed), disposed on one surface (i.e. upper surface in Figure 2) of said surface layer (23); and

a drift layer (21) disposed between the other surface (i.e. lower surface in Figure 2) of said surface layer (23) and said substrate (19), said drift layer having a graded concentration of dopants (see Figure 3) extending between said surface layer and said

substrate to create a drift field (Col. 2, line 64 - Col. 3, line 2) drawing minority carriers (Col. 2, lines 15-16) from said surface layer to said substrate (Col. 1, lines 38-46 and Col. 3, lines 8-11).

Whereas Kamins teaches photosensing elements like photodiodes and associated integrated circuit structures (Col. 2, lines 56-59), Kaminis does not teach that the semiconductor device is a “CMOS” semiconductor device and with the active region including “a source and a drain”. Bamji teaches that integrated circuit structures with photo detectors such as photodiodes may be arrays of CMOS devices (page 1, para 0004) wherein active regions may include a source and a drain (page 9, para 0098, 1st sentence). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the semiconductor device is a CMOS semiconductor device and with the active region includes a source and a drain. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using CMOS technology that is suitable for field effect devices with source and drain regions, as CMOS technology enables integration of images sensors on a single integrated circuit and reduction in power consumption (see Bamji, page 1, para 0002).

Claim 18 is similar to claim 10 (and hence the same rejection applies) except for the direction of drawing minority carriers. However, Kamins also teaches the direction of drawing minority carriers as in claim 18; i.e. drawing minority carriers (Col. 2, lines 15-16) may also be from said substrate to said surface layer (Col. 1, lines 38-46 and Col. 3, lines 6-18).

Regarding claims 11 and 19, Kamins teaches that said drift layer (21) is a deeply implanted layer (see Figures 2-3; also see Col. 2, lines 36-42).

3. Claims 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins and Bamji as applied to claims 10 and 18 above above, and further in view of Baliga (US 2002/0056883), hereinafter Baliga.

Regarding claims 12 and 20, Kamins (refer to Figures 2-3) teaches substantially the claimed structure but does not teach that the drift layer is an “epitaxial" layer. Baliga (US 2002/0056883) teaches that it is known in the art that a drift layer with graded dopant concentration may be an epitaxial layer (page 2, para 0008, 2nd and 3rd sentences and page 9, para 0063, especially 7th – 9th sentences). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the drift layer is an epitaxial layer. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using a layer that has a uniform crystal structure which makes electrical properties more predictable and can also act as a base for further epitaxial layers in which devices may be formed.

4. Claims 13-16 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins and Bamji as applied to claims 10 and 18 above above, and

further in view of Fujimoto (2002/0102783), hereinafter Fujimoto; and Ishaque (US 5,517,052), hereinafter Ishaque.

Regarding claims 13-16 and 21-24, Kamins (refer to Figure 3) teaches substantially the claimed structure but does not specifically state if the gradient is “linear”, “quasi-linear”, “exponential”; or "complimentary error function". Fujimoto teaches that an impurity region having a concentration gradient may have a profile that is linear, exponential,“or a combination thereof (page 3, para 0038). Further, Ishaque teaches that doping gradient is typically complementary error function or Gaussian if a deep diffusion process is used (Col. 3, line 49 to Col. 4, line 14). Given that Kamins teaches that a desired electric field is formed as a result of the gradient in doping (thus suggesting the gradient affects profile of the field) and various profiles of concentration gradient are known (as explained above in view of Fujimoto and Ishaque), it would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the gradient is linear, exponential; or alternatively other profiles such as “quasi-linear” or "complimentary error function", which are essentially combinations of linear and exponential profiles. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of creating a specific profile of the electric field that is suitable for directing the minority carriers in a specific direction.

Response to Arguments

5. Applicant's arguments filed 01/27/2011 have been fully considered but they are not persuasive. On page 6 of applicant's response, applicant argues that Kamins reference does not teach the limitation "a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate…" (see last sentence of para 2 on page 6 of applicant's response). To explain the above argument, applicant points out that "Kamins uses a heavily doped 'buried layer' and a lightly doped epitaxial film over a lightly doped substrate", and based on the above, concludes that Kamins reference to "dopant gradients" is to use of "two separate layers of different dopant concentrations"; and not to "a single layer with a gradient established in donor concentration as required by claim" (see page 6, 2nd para of applicant's response). In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., drift layer is required to be a "single layer"; i.e. the drift layer cannot have a multilayer structure) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Further, Figure 3 shows that the N+ buried layer of Figure 2 (i.e. layer 21, which is the drift layer as explained in rejection of claim 10) does have a variable doping profile represented by the central hump of the dopant profile 24 of Figure 3 (y-axis of

Figure 3 represents doping concentration). As can be seen, this dopant profile has a gradient. Kamins also explains that one of the steps "redistributes" the dopant (i.e. phosphorous) – see Col. 2, lines 51-59), which also explains the doping gradient shown by central part of 24 in Figure 3 as it relates to the the drift layer (i.e. the N+ layer 21 or drift layer of Figure 2). Thus, the Kamins reference does read on the limitation "a drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate…" of claim 10 (and claim 18 is similar).

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/Ajay K. Arora/
Primary Examiner, Art Unit 2892

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	598	(257/655). CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/04/10 20:57

EAST Search History (Interference)

<This search history is empty>

4/10/2011 10:14:24 PM
C:\Documents and Settings\aarora\My Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	08/02/2010	04/10/2011							
	1	-	-							
	2	-	-							
	3	-	-							
	4	-	-							
	5	-	-							
	6	-	-							
	7	-	-							
	8	-	-							
	9	-	-							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	-							
	18	✓	✓							
	19	✓	✓							
	20	✓	✓							
	21	✓	✓							
	22	✓	✓							
	23	✓	✓							
	24	✓	✓							
	25	✓	-							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	4/10/2011	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Refer to EAST search history report	4/10/2011	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE TO FINAL OFFICE ACTION

AMENDMENT C

Sir:

In response to the Final Office Action of April 13, 2011, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a unidirectional drift field drawing all minority carriers from said surface layer to said substrate.

11. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded

concentration follows an exponential gradient.

16. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a <u>single</u> drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a <u>unidirectional</u> drift field drawing <u>all</u> minority carriers from said substrate to said <u>surface</u> layer.

19. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the most recent communication from the Patent Office, as well as the cited art. In response, Applicant has amended claims 10 and 18 to better define the invention.

Claim 10 stands rejected as obvious in view of the combined teachings of Kamins–Pat. No. 4,160,985 and Bamji–Pub. No. 2002/0084430. Kamins discloses a photosensing device in which selective doping of a semiconductor substrate of the device produces electric fields in the substrate which accelerate photogenerated charge carriers toward or away from the surface of the device . Abstract, Fig. 3. In particular, Kamins' disclosure further states that "[t]he carriers therefore tend to be accelerated either toward the nearest photosensor or away from the surface. More specifically, carriers created below the maximum dopant concentration are accelerated into the substrate [...], while carriers created above the maximum dopant concentration are accelerated toward the surface [...]." Col. 3, Lines 6-13, Fig. 2 (showing minority carries accelerated into the substrate <u>and</u> the surface layer, depending on the location of the carriers relative to the maximum dopant concentration within the "buried layer" 21) and Fig. 3 (showing two electrical fields with opposing directions, away from the area of maximum dopant concentration towards both the surface layer and the substrate, respectively).

The amendments to claim 10 further clarify that Applicant's claimed "drift layer" is a single unidirectional layer with a graded dopant concentration which draws all minority carriers away from the surface layer to the substrate – none of the carriers is drawn from the substrate to the surface layer. The amendments to claim 18 further clarify that Applicant's claimed "drift layer" is a single unidirectional layer with a graded dopant concentration that, which draws all minority carriers away from the substrate to the surface layer – none of the carriers is drawn

from the surface layer to the substrate.

Bamji discloses a method to measure distance or brightness using a CMOS sensor. The most recent office action cites Bamji against claim 10 for the proposition that integrated circuit structures with photo detectors may be arrays of CMOS devices. However, Applicant respectfully submits that this disclosure is moot in view of the above recited shortcomings in the disclosure of Kamins and in view of Applicant's amendments to claims 10 and 18.

Claims 11-16 depend on claim 10 and for at least the reason that claim 10 is patentable over the cited prior art, claims 11-16 are patentable as well. Claims 19-24 depend on claim 18 and for at least the reason that claim 18 is patentable over the cited prior art, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required, Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. Although no additional fees are believed to be due at this time, the Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: June 13, 2011 By: _____

David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Acknowledgement Receipt

EFS ID:	10285731
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	13-JUN-2011
Filing Date:	12-JAN-2007
Time Stamp:	10:55:27
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	Amendment After Final	Response.pdf	437841 f8ef0cde04222718a5cb8a08af0722802f0801c0	no	8

Warnings:

Information:

Total Files Size (in bytes):	437841

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT 06/13/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $26 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***8	= 0	X $110 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/RENEE HAWKINS/

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 06/27/2011
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
06/27/2011	PAPER

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.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 11/622,496	**Applicant(s)** RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	**Art Unit** 2892	

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

THE REPLY FILED 13 June 2011 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

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

NOTICE OF APPEAL

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

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *10-16 and 18-24*.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.
12. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

Continuation of 3. NOTE: The amendments to base claim 10 to include the limitations of a "single" dirft layer (see line 6 of claim 10) and a "unidirectional" drift field drawing "all" minority carriers (see 2nd last line of claim 10) raise new issues that would require further consideration and/or search. It is noted that applicant has not recited the specific structure that enables the drift field to have the properties of being "unidirectional" or possessing the ability of drawing "all minority carriers".

DO NOT ENTER: /AA/

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE TO FINAL OFFICE ACTION

AMENDMENT C

Sir:

In response to the Final Office Action of April 13, 2011, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	11/622496
Filing Date	01/12/2007
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	Ajay Arora
Attorney Docket Number	0299-0001.01

This is a Request for Continued Examination (RCE) under 37 CFR 1 .114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

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

i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

ii. ☐ Other _____

b. ☒ Enclosed

i. ☒ Amendment/Reply

ii. ☐ Affidavit(s)/ Declaration(s)

iii. ☒ Information Disclosure Statement (IDS)

iv. ☒ Other Petition for Extension of Time

2. Miscellaneous

Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a

a. ☐ period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
The Director is hereby authorized to charge the following fees any underpayment of fees or credit any overpayments to

a. ☒ Deposit Account No. 50-4199 .

i. ☒ RCE fee required under 37 CFR 1.17(e)

ii ☒ Extension of time fee (37 CFR 1.136 and 1.17)

iii ☐ Other _____

b. ☐ Check in the amount of $ _____ enclosed

c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/David M. Mundt/	Date	October 12, 2011
Name (Print/Type)	David M. Mundt	Registration No.	41,207

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	Francisca M A Hubbard		
Name (Print/Type)	Francisca M. A. Hubbard	Date	October 12, 2011

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

REQUEST FOR CONTINUED EXAMINATION

AMENDMENT D

Sir:

In response to the Advisory Action of June 27, 2011, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a unidirectional drift field drawing all minority carriers from said surface layer to said substrate.

11. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows an exponential gradient.

16. (Previously presented) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a <u>single</u> drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create a <u>unidirectional</u> drift field drawing <u>all</u> minority carriers from said substrate to said <u>surface</u> layer.

19. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Previously presented) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the Advisory Action of June 27, 2011. In addition, Applicant incorporates herein by reference his June 13, 2011 Response to the Final Office Action. In further response to the Advisory Action and the particular issues raised therein, Applicant states as follows:

Applicant has previously amended claims 10 and 18 to better define the invention. Claim 10 stands rejected as obvious in view of the combined teachings of Kamins–Pat. No. 4,160,985 and Bamji–Pub. No. 2002/0084430. Kamins discloses a photosensing device in which selective doping of a semiconductor substrate of the device produces electric fields in the substrate which accelerate photogenerated charge carriers toward or away from the surface of the device . Abstract, Fig. 3. In particular, Kamins' disclosure further states that "[t]he carriers therefore tend to be accelerated either toward the nearest photosensor or away from the surface. More specifically, carriers created below the maximum dopant concentration are accelerated into the substrate [...], while carriers created above the maximum dopant concentration are accelerated toward the surface [...]." Col. 3, Lines 6-13, Fig. 2 (showing minority carries accelerated into the substrate <u>and</u> the surface layer, depending on the location of the carriers relative to the maximum dopant concentration within the "buried layer" 21) and Fig. 3 (showing two electrical fields with opposing directions, away from the area of maximum dopant concentration towards both the surface layer and the substrate, respectively).

The amendments to claim 10 further clarify that Applicant's claimed "drift layer" is a <u>single</u> <u>unidirectional</u> layer with a graded dopant concentration which draws <u>all</u> minority carriers away from the surface layer to the substrate – none of the carriers is drawn from the substrate to the surface layer. The amendments to claim 18 further clarify that Applicant's claimed "drift

layer" is a single unidirectional layer with a graded dopant concentration that, which draws all minority carriers away from the substrate to the surface layer – none of the carriers is drawn from the surface layer to the substrate.

The Advisory Action contends that Applicant "has not recited the specific structure that enables the drift field to have the properties of being 'unidirectional' or possessing the ability of drawing 'all minority carriers'." In response, Applicant respectfully states that a unidirectional drift field and its structure is well known in the prior art. The corresponding structure is illustrated in Applicant's Fig. 1 (Prior Art), which shows two types of popular bipolar junction transistors – a uniform (dopant) base "A" and a graded (dopant) base "B," commonly referred to as a "drift transistor." The drift transistor comprising an aiding drift field was invented by Herbert Kroemer in 1954. *See* "Herb's Bipolar Transistors," Berinder Brar *et al.*, *IEEE Transactions on Electron Devices*, Vol. 48, No. 11, Nov. 2001; *see also*, "Influence of Mobility and Lifetime Variations on Drift-Field Effects in Silicon-Junction Devices," W. Murray Bullis *et al.*, *IEEE Transactions on Electron Devices*, Vol. Ed. 14, No. 2, Feb. 1967.

As described in paragraph [0011] of Applicant's specification, the aiding drift field is graded whereby "the gradient can be linear, quasi liner, exponential or complimentary error function." The specification further states that "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." In other words, the drift field for the holes (minority carriers) is unidirectional, i.e., from the emitter (surface layer) to the collector (substrate) because of the particular slope of the donor concentration. This unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way – moving all minority carriers in the same direction because of the unidirectional drift due to the existence of

the electric field. *See* "Physics and Technology of Semiconductor Devices," A.S. Grove, pp. 224-225, John Wiley and Sons, Inc., New York, 1st Edition 1967. Depending on the particular slope of the graded concentration of dopant, all minority carriers are either swept "down" (from the surface layer to the substrate) or "up" (from the substrate to the surface layer). *See* Applicant's Figs. 5(b) and 5(c).

Bamji discloses a method to measure distance or brightness using a CMOS sensor. The most recent office action cites Bamji against claim 10 for the proposition that integrated circuit structures with photo detectors may be arrays of CMOS devices. However, Applicant respectfully submits that this disclosure is moot in view of the above recited shortcomings in the disclosure of Kamins and in view of Applicant's amendments to claims 10 and 18.

Claims 11-16 depend on claim 10 and for at least the reason that claim 10 is patentable over the cited prior art, claims 11-16 are patentable as well. Claims 19-24 depend on claim 18 and for at least the reason that claim 18 is patentable over the cited prior art, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required; Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. The Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: October 12, 2011

By: _____

David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

U.S.PATENTS

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
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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					

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FOREIGN PATENT DOCUMENTS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

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]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

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	A. S. GROVE, Physics and Technology of Semiconductor Devices, John Wiley Sons, Inc., New York, November 1967	☐
	2	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, February 1967	☐
	3	BERINDER BRAR et al., Herb's Bipolar Transistors, IEEE Transactions on Electron Devices, Vol. 48, No. 11, November 2001	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

[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	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

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	/David M. Mundt/	Date (YYYY-MM-DD)	2011-10-12
Name/Print	David M. Mundt	Registration Number	41,207

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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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) 0299-0001.01
Application Number 11/622496	Filed 01/12/2007
For SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS	
Art Unit 2892	Examiner Ajay Arora

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$150	$75	$
☐	Two months (37 CFR 1.17(a)(2))	$560	$280	$
☑	Three months (37 CFR 1.17(a)(3))	$1270	$635	$ 635.00
☐	Four months (37 CFR 1.17(a)(4))	$1980	$990	$
☐	Five months (37 CFR 1.17(a)(5))	$2690	$1345	$

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-4199.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 41,207

☐ attorney or agent under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____

/David M. Mundt/ — Signature

October 12, 2011 — Date

David M. Mundt — Typed or printed name

312-984-0144 — Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☑ Total of 1 forms are submitted.

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

Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	David Michael Mundt/Francisca Hubbard
Attorney Docket Number:	0299-0001.01

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	2253	1	635	635

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	465	465
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**1280**

Electronic Acknowledgement Receipt

EFS ID:	11169330
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	12-OCT-2011
Filing Date:	12-JAN-2007
Time Stamp:	13:34:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1280
RAM confirmation Number	10379
Deposit Account	504199
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 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	Request for Continued Examination (RCE)	RCE.pdf	161862 ef00f0e2a65ffc745ea1f300b71bef8424b8379c	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2	Amendment After Final	Amendment.pdf	558486 9fd2d566e0f3b9a4ed0efc0565dbc3457936332b	no	9
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	327332 6230733906e2d79abc352cdb16e8cab3b4202c81	no	3
Warnings:					
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4	Non Patent Literature	NPL1.pdf	636718 700dcded84d49b37e100633d61b66eda32597b75	no	3
Warnings:					
Information:					
5	Non Patent Literature	NPL2.pdf	1692888 3396ef026ab561a3d6cff3af6f53487009dfc51e	no	7
Warnings:					
Information:					
6	Non Patent Literature	NPL3.pdf	1539230 c4080c88ecf4434455da0fae2c8e61ec628285d5	no	4
Warnings:					
Information:					
7	Extension of Time	ExtOfTime.pdf	193401 0d00bf1451f4dbdf56c20b78d835e69d6965b8af	no	1
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	34016 0810aec2afa88c6b23b93f1acdf5f74aa99808c5	no	2
Warnings:					

Information:	
Total Files Size (in bytes):	5143933

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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.

PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 10/12/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $30 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***8	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/LINDA 18 WISE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 12/20/2011
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
12/20/2011	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 October 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *10-16 and 18-24* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *10-16 and 18-24* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/12/2011*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/12/2011 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 10-16 and 18-24 rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for “a unidirectional drift field” (see line 8 of base claims 10 and 18, each, which is shown in Figure 2 of the specification) , does not reasonably provide enablement for “drawing <u>all</u> minority carriers from said substrate to said surface layer” (emphasis added, see last two lines each of base claims 10 and 18). The specification does not enable any person skilled in the art to which it pertains, or

with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. It is not clear if simply the application of "a unidirectional drift field" is sufficient to achieve the effect of "drawing all minority carriers from said substrate to said surface layer". In a complex electronic device, movement of minority carriers is affected by multiple forces and fields, and it does not appear that simply the presence of "a unidirectional drift field" in itself can achieve "drawing all minority carriers from said surface layer to said substrate". Whereas it is true that such a unidirectional drift field may attempt to apply a force on all minority carriers in a specific direction, it does not appear to ensure (without knowing other parameters of the device) that it will draw "all" minority carriers from said surface layer to said surface.

Claim Rejections - 35 USC § 103

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

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

5. Claims 10-11, and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins (US 4,160,985) of prior record, hereinafter Kamins, in view Jastrzebski (US 4,481,522), hereinafter Jastrzebski, and further in view of Bamji (US 2002/0084430) of prior record, hereinafter Bamji.

Regarding claim 10, Kamins (refer to Figures 2-3) teaches a semiconductor device comprising:

a surface layer (23);

s substrate (19);

an active region (comprising photodiodes 11, 13, 15 and 17 are formed), disposed on one surface (i.e. upper surface in Figure 2) of said surface layer (23); and

a single drift layer (21) disposed between the other surface (i.e. lower surface in Figure 2) of said surface layer (23) and said substrate (19), said drift layer having a graded concentration of dopants (see Figure 3) extending between said surface layer and said substrate to create a drift field (Col. 2, line 64 - Col. 3, line 2) drawing minority carriers (Col. 2, lines 15-16) from said surface layer to said substrate (Col. 1, lines 38-46 and Col. 3, lines 8-11).

Kamins does not teach that the drift field is a “unidirectional drift field” so that it draws “all" minority carriers in a given direction. Jastrzebski (refer to Figures 1a-b) teaches a semiconductor device in which a drift field utilized is a “unidirectional drift field” so as to tend to draw “all” minority carriers in a specific direction' i.e. direction of the unidirectional drift field (Col. 5, lines 17-20 and 25-30). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the the drift field is a unidirectional drift field that it draws all minority carriers in a given direction. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of optimizing the performance of any device that may be used in

conjunction with transistors (as part of an integrated circuit) that may require drawing of minority carriers in a specific direction to improve performance (see Jastrzebski, Col. 2, lines 22-42).

Further, whereas Kamins teaches photosensing elements like photodiodes and associated integrated circuit structures (Col. 2, lines 56-59), Kaminis does not teach that the semiconductor device is a "CMOS" semiconductor device and with the active region including "a source and a drain". Bamji teaches that integrated circuit structures with photo detectors such as photodiodes may be arrays of CMOS devices (page 1, para 0004) wherein active regions may include a source and a drain (page 9, para 0098, 1st sentence). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the semiconductor device is a CMOS semiconductor device and with the active region includes a source and a drain. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using CMOS technology that is suitable for field effect devices with source and drain regions, as CMOS technology enables integration of images sensors on a single integrated circuit and reduction in power consumption (see Bamji, page 1, para 0002).

Claim 18 is similar to claim 10 (and hence the same rejection applies) except for the direction of drawing minority carriers. However, Kamins also teaches the direction of drawing minority carriers as in claim 18; i.e. drawing minority carriers (Col. 2, lines 15-16) may also be from said substrate to said surface layer (Col. 1, lines 38-46 and Col. 3, lines 6-18).

Regarding claims 11 and 19, Kamins teaches that said drift layer (21) is a deeply implanted layer (see Figures 2-3; also see Col. 2, lines 36-42).

6. Claims 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins, Jastrzebski and Bamji as applied to claims 10 and 18 above above, and further in view of Baliga (US 2002/0056883) of prior record, hereinafter Baliga.

Regarding claims 12 and 20, Kamins (refer to Figures 2-3) teaches substantially the claimed structure but does not teach that the drift layer is an “epitaxial" layer. Baliga (US 2002/0056883) teaches that it is known in the art that a drift layer with graded dopant concentration may be an epitaxial layer (page 2, para 0008, 2nd and 3rd sentences and page 9, para 0063, especially 7th – 9th sentences). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the drift layer is an epitaxial layer. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using a layer that has a uniform crystal structure which makes electrical properties more predictable and can also act as a base for further epitaxial layers in which devices may be formed.

7. Claims 13-16 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins, Jastrzebski and Bamji as applied to claims 10 and 18 above

above, and further in view of Fujimoto (2002/0102783) of prior record, hereinafter Fujimoto; and Ishaque (US 5,517,052) of prior record, hereinafter Ishaque.

Regarding claims 13-16 and 21-24, Kamins (refer to Figure 3) teaches substantially the claimed structure but does not specifically state if the gradient is “linear”, “quasi-linear”, “exponential”; or "complimentary error function". Fujimoto teaches that an impurity region having a concentration gradient may have a profile that is linear, exponential,“or a combination thereof (page 3, para 0038). Further, Ishaque teaches that doping gradient is typically complementary error function or Gaussian if a deep diffusion process is used (Col. 3, line 49 to Col. 4, line 14). Given that Kamins teaches that a desired electric field is formed as a result of the gradient in doping (thus suggesting the gradient affects profile of the field) and various profiles of concentration gradient are known (as explained above in view of Fujimoto and Ishaque), it would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the gradient is linear, exponential; or alternatively other profiles such as “quasi-linear” or "complimentary error function", which are essentially combinations of linear and exponential profiles. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of creating a specific profile of the electric field that is suitable for directing the minority carriers in a specific direction.

Response to Arguments

8. Applicant's arguments with respect to claims 10 and 18 (see pages 6-8 of applicant's response of 10/12/2011) have been considered but are moot in view of the new ground(s) of rejection. However, applicant's response related to advisory action (on page 7 of applicant's response) is still relevant. This has been addressed in the 35 USC 112, 1st paragraph rejection above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

Notice of References Cited	Application/Control No. 11/622,496	Applicant(s)/Patent Under Reexamination RAO, G.R. MOHAN	
	Examiner AJAY K. ARORA	Art Unit 2892	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,481,522	11-1984	Jastrzebski et al.	257/229
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	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.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	12/16/2011	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Revised EAST search history report	12/16/2011	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

U.S.PATENTS

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					
	2					
	3					
	4					
	5					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

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					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

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]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

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]
/A.A./	1	A. S. GROVE, Physics and Technology of Semiconductor Devices, John Wiley Sons, Inc., New York, November 1967	☐
/A.A./	2	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, February 1967	☐
/A.A./	3	BERINDER BRAR et al., Herb's Bipolar Transistors, IEEE Transactions on Electron Devices, Vol. 48, No. 11, November 2001	☐

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

EXAMINER SIGNATURE

Examiner Signature	/Ajay Arora/	Date Considered	12/16/2011

*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	11622496
	Filing Date	2007-01-12
	First Named Inventor	G.R. Mohan Rao
	Art Unit	2892
	Examiner Name	Ajay Arora
	Attorney Docket Number	0299-0001.01

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	/David M. Mundt/	Date (YYYY-MM-DD)	2011-10-12
Name/Print	David M. Mundt	Registration Number	41,207

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.**

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	456	(257/655).CCLS.	USPAT; USOCR	OR	OFF	2011/12/16 09:45
S92	1	("4481522").PN.	USPAT; USOCR	OR	OFF	2011/12/16 08:02

12/16/2011 10:39:51 AM
C:\Users\aarora\Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	08/02/2010	04/10/2011	12/16/2011						
	1	-	-	-						
	2	-	-	-						
	3	-	-	-						
	4	-	-	-						
	5	-	-	-						
	6	-	-	-						
	7	-	-	-						
	8	-	-	-						
	9	-	-	-						
	10	✓	✓	✓						
	11	✓	✓	✓						
	12	✓	✓	✓						
	13	✓	✓	✓						
	14	✓	✓	✓						
	15	✓	✓	✓						
	16	✓	✓	✓						
	17	✓	-	-						
	18	✓	✓	✓						
	19	✓	✓	✓						
	20	✓	✓	✓						
	21	✓	✓	✓						
	22	✓	✓	✓						
	23	✓	✓	✓						
	24	✓	✓	✓						
	25	✓	-	-						

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE PURSUANT TO 37 CFR 1.114

AMENDMENT E

Sir:

In response to the non-final Office Action of December 20, 2011, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Currently Amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create and maintain a single static unidirectional electric drift field to aid the movement of ~~drawing~~ ~~all~~ minority carriers from said surface layer to said substrate.

11. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows an exponential gradient.

16. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate to create and maintain a single static unidirectional electric drift field to aid the movement of ~~drawing~~ ~~all~~ minority carriers from said substrate to said surface layer.

19. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the non-final Office Action of December 20, 2012 ("Office Action") and in response thereto states as follows:

The Office Action maintains a rejection pursuant to 35 U.S.C. §112, first paragraph, and in particular states that, because "movement of minority carriers is affected by multiple forces and fields ... it does not appear that simply the presence of 'a unidirectional drift field' in itself can achieve 'drawing all minority carriers from said surface layer to said substrate.'" Office Action at ¶3.

Applicant respectfully disagrees with this position because (as previously argued by Applicant) a unidirectional drift (electric) field necessarily affects all the present minority carriers in the same way – moving all minority carriers in the same direction because of the unidirectional drift due to the existence of the electric field. *See* "Physics and Technology of Semiconductor Devices," A.S. Grove, pp. 224-225, John Wiley and Sons, Inc., New York, 1st Edition 1967 ("This same electric field will then be of such direction as to aid the motion of injected holes. Thus the injected minority carriers will now move not only by diffusion but also by drift due to the existence of this electric field."). Depending on the particular slope of the graded concentration of dopant, all minority carriers are either swept "down" (from the surface layer to the substrate) or "up" (from the substrate to the surface layer). *See* Applicant's Figs. 5(b) and 5(c).

The Office Action also states that "such a unidirectional drift field may attempt to apply a force on all minority carriers in a specific direction, it does not appear to ensure (without knowing other parameters of the device) that it will draw 'all' minority carriers..." Yet, this argument appears to not consider that the graded dopant concentration itself creates a "built-in"

electrical field that forces the movement of carriers into a particular direction, whereby the "direction" of the electrical field and the resulting direction of the carrier movement depends solely on the slope of the graded concentration of dopant. With regard to the existence of a "built-in" electric field created by a graded dopant density, *see*, e.g., Jastrzebski (US 4,481,522) col. 5, lines 11-13 (cited in Office Action). Applicant respectfully submits that this inherent "built-in" unidirectional electric field is the additional parameter for ensuring that all minority carriers are being moved in one direction and which parameter the Office Action deemed to be missing from the disclosure.

However, without conceding Applicant's position on this issue, Applicant has further amended claims 10 and 18 to overcome the rejection pursuant to 35 U.S.C. 112, first paragraph. In particular, Applicant has removed the word "all" from the rejected claim language which now reads: "unidirectional electric drift field to aid the movement of minority carriers ..." This claim language is supported at least by Applicant's disclosure in paragraph 11 and original claim 6.

Independent claims 10 and 18 stand rejected as obvious in view of the combined teachings of Kamins (US 4,160,985) of prior record in view of Jastrzebski (US 4,481,522) and Bamji (US 2002/0084430) of prior record. Kamins discloses a photosensing device in which selective doping of a semiconductor substrate of the device produces electric fields in the substrate which accelerate photogenerated charge carriers toward or away from the surface of the device. Abstract, Fig. 3. As the Office Action acknowledges, Kamins does not teach that the electric drift field is a "unidirectional electric drift field."

Jastrzebski discloses three-phase charge-coupled device (CCD) imagers having unidirectional electric drift fields in their semiconductive substrates to improve the operation of the CCD (*see* e.g., col. 1, lines 5-8, col 2, lines 62-64, col. 3, lines 20-52 and Fig. 1a). Jastrzebski

describes the three-phase clocking signals as follows:

> **Electrodes 13 and 16 are shown connected to receive a first phase ϕ_1 of the three-phase clocking signals; electrodes 14 and 17, to receive a second phase ϕ_2 of those signals; and electrodes 15 and 18, to receive a third phase ϕ_3 of those signals. The successive application of the clocking signals ϕ_1, ϕ_2, and ϕ_3 in order of their ordinal number subscripts will, as known, cause shift of charge packets in potential wells induced under the electrodes in a rightward direction on each clocking signal transition. These potential wells are associated with the charge depletion regions induced below the electrodes receiving relatively positive clocking signal phases. In FIG. 1 the depletion regions are shown in dashed outline being induced under electrode pairs 13, 14 and 16, 17 presumed to be receiving ϕ_1, ϕ_2 clock voltages relatively positive to the ϕ_3 clock voltage applied to electrodes 15 and 18.**

(Jastrzebski, Col. 3, lines 20-36, underlines added).

As the underlined text above indicates, the application of clocking signals causes a shift of charge packets in the regions directly underneath the electrodes which causes a change of value of the unidirectional electric drift field located directly underneath the electrodes. Unlike the capacitor electrodes/gates in a CMOS image sensor, which have a fixed potential, the electrodes/gates in a CCD shift register do not have a fixed potential. As made clear in Jastrzebski, successive application of clocked signals effectively creates multiple electrical fields underneath the gates with varying electric values (potentials), or at least, arguably, one dynamic (varying with time) unidirectional electric field with varying electric (values) potentials. That is so because the electric field described in Jastrzebski is influenced by at least two factors. First, φ1, φ2 and φ3 "swing" back and forth (shift) their charge and therefore modulate the electric field created by the graded dopant concentration in the substrate. Second, this modulation disturbs the electric field and affects the effectiveness of the electric field to aid the movement of carriers in a single desired direction. Because a CMOS image sensor only has electrodes/gates with a fixed potential, there is no modulation of the electric unidirectional drift field.

Consequently, Applicant's claimed CMOS semiconductor device includes a single static (time-invariant) unidirectional electric drift field.

Applicant has amended claims 10 and 18 to better distinguish over the cited prior art by claiming "a graded concentration of dopants extending between said surface layer and said substrate to create and maintain a single static unidirectional electric drift field to aid the movement of minority carriers."

Bamji discloses a method to measure distance or brightness using a CMOS sensor. The most recent office action cites Bamji against claim 10 for the proposition that integrated circuit structures with photo detectors may be arrays of CMOS devices. However, Applicant respectfully submits that this disclosure is moot in view of the above recited shortcomings in the disclosure of Kamins and Jastrzebski and in view of Applicant's additional amendments to claims 10 and 18.

Claims 11-16 depend on claim 10 and for at least the same reason that claim 10 is patentable over the cited prior art, claims 11-16 are patentable as well. Claims 19-24 depend on claim 18 and for at least the reasons that claim 18 is patentable over the cited prior art, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required; Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. The Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

By: _____

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PTO/SB/22 (09-11)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) 0299-0001.01
Application Number 11/622496	Filed 01/12/2007
For SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS	
Art Unit 2892	Examiner Ajay Arora

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$150	$75	$ 75.00
☐	Two months (37 CFR 1.17(a)(2))	$560	$280	$
☐	Three months (37 CFR 1.17(a)(3))	$1270	$635	$
☐	Four months (37 CFR 1.17(a)(4))	$1980	$990	$
☐	Five months (37 CFR 1.17(a)(5))	$2690	$1345	$

☑ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-4199.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 41,207

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____

/David M. Mundt/	April 17, 2012
Signature	Date
David M. Mundt	312-984-0144
Typed or printed name	Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☑ Total of 1 forms are submitted.

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

Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	David Michael Mundt/Francisca Hubbard
Attorney Docket Number:	0299-0001.01

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	75	75

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**75**

Electronic Acknowledgement Receipt

EFS ID:	12560817
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	17-APR-2012
Filing Date:	12-JAN-2007
Time Stamp:	15:20:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$75
RAM confirmation Number	1922
Deposit Account	504199
Authorized User	

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

Charge any Additional Fees required under 37 C.F.R. Section 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	Amendment/Req. Reconsideration-After Non-Final Reject	AmendmentE.pdf	694682 df7ff0ed5b70459b2c714986b91a259d9e26330c	no	10
Warnings:					
Information:					
2	Extension of Time	ExtOfTime.pdf	132721 dee7fa1a4348d38dd841d010681af572790a8c55	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30313 837f11c98ef38348acddbabb3fbf17ca31904272	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	857716		

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.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 08/13/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
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EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
08/13/2012	PAPER

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.

Office Action Summary	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 April 2012*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ 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.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *10-16 and 18-24* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *10-16 & 18-24* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

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

a)☐ All b)☐ Some * c)☐ None of:

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)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 10-16 and 18-24 rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for "to create a unidirectional electric drift field" (see lines 8-9 of base claims 10 and 18) , does not reasonably provide enablement for "to create and <u>maintain</u> a <u>single static</u> unidirectional electric drift field" (emphasis added, as recited in lines 8-9 of the currently amended claims 10 and 18). The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims. Applicant has not pointed out to the part of the specification that supports the above amendment. Also, in view of arguments that applicant has presented on pages 8-9 of applicant's response of 04/17/2012 to argue that Jastrzebski reference does not read on "to create and <u>maintain</u> a <u>single static</u> unidirectional electric drift field", it is not clear how any of applicant's Figures conveys the above limitation any more than Figure 1 of Jastrzebski.

Claim Rejections - 35 USC § 103

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

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

4. Claims 10-11, and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins (US 4,160,985) of prior record, hereinafter Kamins, in view Jastrzebski (US 4,481,522) of prior record, hereinafter Jastrzebski, and further in view of Bamji (US 2002/0084430) of prior record, hereinafter Bamji.

Regarding claim 10, Kamins (refer to Figures 2-3) teaches a semiconductor device comprising:

a surface layer (23);

s substrate (19);

an active region (comprising photodiodes 11, 13, 15 and 17 are formed), disposed on one surface (i.e. upper surface in Figure 2) of said surface layer (23); and

a single drift layer (21) disposed between the other surface (i.e. lower surface in Figure 2) of said surface layer (23) and said substrate (19), said drift layer having a graded concentration of dopants (see Figure 3) extending between said surface layer and said substrate, which is capable of creating and maintaining a single static electric

drift field (because the drift field is created by graded concentration of dopants which does not change over time; i.e. it is "single static"). Also see Col. 2, lines 15-16; Col. 2, line 64 - Col. 3, line 2; Col. 1, lines 38-46; and Col. 3, lines 8-11).

Kamins does not teach that the drift field is a "unidirectional drift field" that is capable of aiding the movement of minority carriers in a given direction. Jastrzebski (refer to Figures 1a-b) teaches a semiconductor device in which a drift field utilized is a "unidirectional drift field" so as aid movement of minority carriers in a specific direction; i.e. direction of the unidirectional drift field (Col. 5, lines 17-20 and 25-30). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the drift field is a unidirectional drift field that is capable of aiding the movement of minority carriers in a given direction. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of optimizing the performance of any device that may be used in conjunction with transistors (as part of an integrated circuit) that may require drawing of minority carriers in a specific direction to improve performance (see Jastrzebski, Col. 2, lines 22-42).

Further, whereas Kamins teaches photosensing elements like photodiodes and associated integrated circuit structures (Col. 2, lines 56-59), Kaminis does not teach that the semiconductor device is a "CMOS" semiconductor device and with the active region including "a source and a drain". Bamji teaches that integrated circuit structures with photo detectors such as photodiodes may be arrays of CMOS devices (page 1, para 0004) wherein active regions may include a source and a drain (page 9, para 0098, 1st sentence). It would have been obvious to one of ordinary skills in the art at the time of

the invention to modify Kamins so that the semiconductor device is a CMOS semiconductor device and with the active region includes a source and a drain. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using CMOS technology that is suitable for field effect devices with source and drain regions, as CMOS technology enables integration of images sensors on a single integrated circuit and reduction in power consumption (see Bamji, page 1, para 0002).

It is noted that claim 10 is a product claim but recites a method therein (i.e. "create and maintain a single static unidirectional electric drift field"; emphasis added). Therefore, claim 10 (same applies to claim 18) amounts to a product by process claim. *"Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). See MPEP 2113.* To the extent the limitation of "create and maintain a single static unidirectional electric drift field" applies to the electric drift field inherently created by the claimed "graded concentration of dopants", it conveys a structural limitation. However, if the above implies absence of other electric fields (see applicant's arguments on page 8 of applicant's response of 4/17/2012), that does not constitute a structural limitation but rather method steps.

Claim 18 is similar to claim 10 (and hence the same rejection applies) except for the direction of drawing minority carriers. However, Kamins also teaches the direction of drawing minority carriers as in claim 18; i.e. drawing minority carriers (Col. 2, lines 15-16) may also be from said substrate to said surface layer (Col. 1, lines 38-46 and Col. 3, lines 6-18).

Regarding claims 11 and 19, Kamins teaches that said drift layer (21) is a deeply implanted layer (see Figures 2-3; also see Col. 2, lines 36-42).

5. Claims 12 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins, Jastrzebski and Bamji as applied to claims 10 and 18 above above, and further in view of Baliga (US 2002/0056883) of prior record, hereinafter Baliga.

Regarding claims 12 and 20, Kamins (refer to Figures 2-3) teaches substantially the claimed structure but does not teach that the drift layer is an “epitaxial" layer. Baliga (US 2002/0056883) teaches that it is known in the art that a drift layer with graded dopant concentration may be an epitaxial layer (page 2, para 0008, 2nd and 3rd sentences and page 9, para 0063, especially 7th – 9th sentences). It would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the drift layer is an epitaxial layer. The ordinary artisan would have been motivated to modify Kamins for at least the purpose of using a layer that has a uniform crystal structure

which makes electrical properties more predictable and can also act as a base for further epitaxial layers in which devices may be formed.

6. Claims 13-16 and 21-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamins, Jastrzebski and Bamji as applied to claims 10 and 18 above above, and further in view of Fujimoto (2002/0102783) of prior record, hereinafter Fujimoto; and Ishaque (US 5,517,052) of prior record, hereinafter Ishaque.

Regarding claims 13-16 and 21-24, Kamins (refer to Figure 3) teaches substantially the claimed structure but does not specifically state if the gradient is “linear”, “quasi-linear”, “exponential”; or "complimentary error function". Fujimoto teaches that an impurity region having a concentration gradient may have a profile that is linear, exponential,“or a combination thereof (page 3, para 0038). Further, Ishaque teaches that doping gradient is typically complementary error function or Gaussian if a deep diffusion process is used (Col. 3, line 49 to Col. 4, line 14). Given that Kamins teaches that a desired electric field is formed as a result of the gradient in doping (thus suggesting the gradient affects profile of the field) and various profiles of concentration gradient are known (as explained above in view of Fujimoto and Ishaque), it would have been obvious to one of ordinary skills in the art at the time of the invention to modify Kamins so that the gradient is linear, exponential; or alternatively other profiles such as “quasi-linear” or "complimentary error function", which are essentially combinations of linear and exponential profiles. The ordinary artisan would have been motivated to modify

Kamins for at least the purpose of creating a specific profile of the electric field that is suitable for directing the minority carriers in a specific direction.

Response to Arguments

7. Applicant's arguments with respect to 35 USC 112, 1st paragraph rejection of claims 10 and 18 related to "drawing all minority carriers from said substrate to said surface layer" have been considered but are moot because the arguments do not apply in view of the amendment to the claims. However, the amendments result in new 35 USC 112, 1st paragraph rejections, which have been outlined above.

8. Applicant's arguments with respect to 35 USC 103(a) rejections of claims 10 and 18 (see 2nd last paragraph of page 7 to page 9) have been considered but they are not persuasive.

9. On page 7, last paragraph to page 9, 1st paragraph of applicant's response, applicant argues that because Jastrzebski reference teaches "clocking signals" in addition to the drift field created by graded dopant concentration, it does not read on "create and maintain a single static unidirectional electric drift field". This argument is not persuasive. This argument is addressed in the revised rejection of claims 10 and 18, which now points out product-by-process limitations.

Conclusion

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

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	12/16/2011	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Revised EAST search history report	12/16/2011	AKA
Revised EAST search history report	8/10/2012	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S94	0	(single WITh static WITH drift) AND ((gradient OR grading OR graded) WITH dop$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/10 00:21
S96	1	(unidirectional WITH field WITH drift) AND ((gradient OR grading OR graded) WITH dop$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/10 00:24

8/10/2012 1:40:03 AM
C:\Users\aarora\Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	08/02/2010	04/10/2011	12/16/2011	08/10/2012					
	1	-	-	-	-					
	2	-	-	-	-					
	3	-	-	-	-					
	4	-	-	-	-					
	5	-	-	-	-					
	6	-	-	-	-					
	7	-	-	-	-					
	8	-	-	-	-					
	9	-	-	-	-					
	10	✓	✓	✓	✓					
	11	✓	✓	✓	✓					
	12	✓	✓	✓	✓					
	13	✓	✓	✓	✓					
	14	✓	✓	✓	✓					
	15	✓	✓	✓	✓					
	16	✓	✓	✓	✓					
	17	✓	-	-	-					
	18	✓	✓	✓	✓					
	19	✓	✓	✓	✓					
	20	✓	✓	✓	✓					
	21	✓	✓	✓	✓					
	22	✓	✓	✓	✓					
	23	✓	✓	✓	✓					
	24	✓	✓	✓	✓					
	25	✓	-	-	-					

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE PURSUANT TO 37 CFR 1.114

AMENDMENT F

Sir:

In response to the final Office Action of August 13, 2012, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Currently Amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

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

at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

11. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows an exponential gradient.

16. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

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

at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the

movement of minority carriers from said substrate to said surface layer.

19. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the final Office Action of August 13, 2012 ("Office Action") and in response thereto states as follows:

Claims 10-16 and 18-24 stand rejected pursuant to 35 U.S.C. 112, first paragraph because Applicant's specification does not enable "to create and maintain a single static unidirectional electric drift field." Office Action at ¶2. Without conceding the merits of this rejection, Applicant has further amended base claims 10 and 18 to overcome the rejection pursuant to 35 U.S.C. 112, first paragraph. In particular, Applicant has removed any reference to the terms "create," "maintain" and "single." With regard to the remaining term "static," Applicant respectfully notes that prior art reference Kamins (US 4,160,985), just like Applicant, discloses the presence of a "static" drift field, "because the drift field is created by graded concentration of dopants which does not change over time." See Office Action ¶4 p.4 lines 1-3, further citing to Kamins, Col. 2, lines 15-16; Col. 2, line 64 – Col. 3, line 2; Col. 1, lines 38-46; and Col. 3, lines 8-11.

Claims 10-11 and 18-19 stand rejected as obvious in view of the combined teachings of Kamins (of prior record) in view of Jastrzebski (US 4,481,522) (of prior record) and Bamji (US 2002/0084430) (of prior record). Applicant has previously summarized the disclosure of these references. Without conceding any of Applicant's positions, Applicant has further amended independent claims 10 and 18 to better distinguish over the cited prior art by claiming "at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers." Applicant respectfully submits that neither Kamins nor Jastrzebski, disclose the above limitation.

Finally, Applicant has further amended claims 10 and 18 to address the Examiner's

position that claims 10 and 18 as previously submitted are product by process claims. See Office Action at p.5. In particular, Applicant has amended claim 10 as follows:

> "a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate, said drift layer further having a first ~~to create and maintain a single~~ static unidirectional electric drift field to aid the movement of minority carriers from said substrate to said surface layer ..."

Claims 11-16 depend on claim 10 and for at least the same reason that claim 10 is patentable over the cited prior art, claims 11-16 are patentable as well. Claims 19-24 depend on claim 18 and for at least the reasons that claim 18 is patentable over the cited prior art, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required; Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. The Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

By: _____

David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 N. Wacker
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Acknowledgement Receipt

EFS ID:	13981170
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	15-OCT-2012
Filing Date:	12-JAN-2007
Time Stamp:	11:20:04
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	Amendment After Final	AmendmentF.pdf	473206 200b0f61139362e54ef9b9229051b8cc71a7b5e7	no	8

Warnings:

Information:

Total Files Size (in bytes):	473206

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.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 10/15/2012

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $31 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***8	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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))									
☐ 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 number found in the appropriate box in column 1.

Legal Instrument Examiner:
/RAMONA WILSON/

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

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

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 10/24/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

MAIL DATE	DELIVERY MODE
10/24/2012	PAPER

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.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 11/622,496	**Applicant(s)** RAO, G.R. MOHAN
	Examiner AJAY K. ARORA	**Art Unit** 2892

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

THE REPLY FILED 15 October 2012 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance;

(2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:

a) ☐ The period for reply expires _____months from the mailing date of the final rejection.

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

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

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

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

NOTICE OF APPEAL

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

AMENDMENTS

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

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

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

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

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

NOTE: *The new limitations of base claims 10 requiring "at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate" (see last 3 lines of claim 10). Amended base claim 18 also recites similar new limitations (see last 3 lines of claim 18).* (See 37 CFR 1.116 and 41.33(a)).

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

5. ☐ Applicant's reply has overcome the following rejection(s): _____.

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

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

AFFIDAVIT OR OTHER EVIDENCE

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

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

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

REQUEST FOR RECONSIDERATION/OTHER

11. ☐ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: _____.

12. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____

13. ☐ Other: _____.

STATUS OF CLAIMS

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

Claim(s) allowed: .

Claim(s) objected to: .

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

DO NOT ENTER: /A.A./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

RESPONSE PURSUANT TO 37 CFR 1.114

AMENDMENT F

Sir:

In response to the final Office Action of August 13, 2012, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

PTO/SB/30 (07-09)
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	11/622496
Filing Date	01/12/2007
First Named Inventor	G.R. Mohan Rao
Art Unit	2892
Examiner Name	Ajay Arora
Attorney Docket Number	0299-0001.01

This is a Request for Continued Examination (RCE) under 37 CFR 1 .114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

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

      i. ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. ☐ Other _____

   b. ☒ Enclosed

      i. ☒ Amendment/Reply

      ii. ☐ Affidavit(s)/ Declaration(s)

      iii. ☐ Information Disclosure Statement (IDS)

      iv. ☐ Other _____

2. Miscellaneous

   Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a

   a. ☐ period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. ☐ Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.
   The Director is hereby authorized to charge the following fees any underpayment of fees or credit any overpayments to

   a. ☒ Deposit Account No. 50-4199 .

      i. ☒ RCE fee required under 37 CFR 1.17(e)

      ii ☐ Extension of time fee (37 CFR 1.136 and 1.17)

      iii ☐ Other _____

   b. ☐ Check in the amount of $ _____ enclosed

   c. ☐ Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/David M. Mundt/	Date	November 13, 2012
Name (Print/Type)	David M. Mundt	Registration No.	41,207

CERTIFICATE OF MAILING OR TRANSMISSION

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Mail Stop RCE, Commissioner for Patents, P. O. Box 1450, Alexandria, VA 22313-1450 or facsimile transmitted to the U.S. Patent and Trademark Office on the date shown below.

Signature	Francisca M A Hubbard Electronic Filing		
Name (Print/Type)	Francisca M. A. Hubbard	Date	November 13, 2012

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop RCE, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	11/622,496
Confirmation No.	:	3086
Inventor	:	G. R. Mohan Rao
Filed	:	January 12, 2007
TC/A.U.	:	2892
Examiner	:	Ajay Arora
Title	:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Docket No.	:	0299-0001.01

REQUEST FOR CONTINUED EXAMINATION

AMENDMENT F

Sir:

In response to the Advisory Action of October 24, 2012, Applicant submits the following amendment:

Claims. Amendments to the claims begin on page 2 of this amendment.

Remarks. Remarks begin on page 6 of this amendment.

LISTING OF CLAIMS

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

Claims:

1. (Canceled)

2. (Canceled)

3. (Canceled)

4. (Canceled)

5. (Canceled)

6. (Canceled)

7. (Canceled)

8. (Canceled)

9. (Canceled)

10. (Currently Amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

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

at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said substrate.

11. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is a deeply-implanted layer.

12. (Original) The CMOS Semiconductor device of claim 10 wherein said drift layer is an epitaxial layer.

13. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a linear gradient.

14. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a quasi-linear gradient.

15. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows an exponential gradient.

16. (Original) The CMOS Semiconductor device of claim 10 wherein said graded concentration follows a complimentary error function gradient.

17. (Canceled)

18. (Currently amended) A CMOS Semiconductor device comprising:

a surface layer;

a substrate;

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

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

at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the

movement of minority carriers from said substrate to said surface layer.

19. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is a deeply-implanted layer.

20. (Original) The CMOS Semiconductor device of claim 18 wherein said drift layer is an epitaxial layer.

21. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a linear gradient.

22. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a quasi-linear gradient.

23. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows an exponential gradient.

24. (Original) The CMOS Semiconductor device of claim 18 wherein said graded concentration follows a complimentary error function gradient.

25. (Canceled)

REMARKS

Applicant has carefully reviewed the Advisory Action of October 24, 2012. In addition, Applicant incorporates herein by reference the October 15, 2012 Response to the Final Office Action and states as follows:

Claims 10-16 and 18-24 stand rejected pursuant to 35 U.S.C. 112, first paragraph because Applicant's specification does not enable "to create and maintain a single static unidirectional electric drift field." Office Action at ¶2. Without conceding the merits of this rejection, Applicant has further amended base claims 10 and 18 to overcome the rejection pursuant to 35 U.S.C. 112, first paragraph. In particular, Applicant has removed any reference to the terms "create," "maintain" and "single." With regard to the remaining term "static," Applicant respectfully notes that prior art reference Kamins (US 4,160,985), just like Applicant, discloses the presence of a "static" drift field, "because the drift field is created by graded concentration of dopants which does not change over time." See Office Action ¶4 p.4 lines 1-3, further citing to Kamins, Col. 2, lines 15-16; Col. 2, line 64 – Col. 3, line 2; Col. 1, lines 38-46; and Col. 3, lines 8-11.

Claims 10-11 and 18-19 stand rejected as obvious in view of the combined teachings of Kamins (of prior record) in view of Jastrzebski (US 4,481,522) (of prior record) and Bamji (US 2002/0084430) (of prior record). Applicant has previously summarized the disclosure of these references. Without conceding any of Applicant's positions, Applicant has further amended independent claims 10 and 18 to better distinguish over the cited prior art by claiming "at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers." Applicant respectfully submits that neither Kamins nor Jastrzebski, disclose the above limitation.

Finally, Applicant has further amended claims 10 and 18 to address the Examiner's position that claims 10 and 18 as previously submitted are product by process claims. See Office Action at p.5. In particular, Applicant has amended claim 10 as follows:

> "a single drift layer disposed between the other surface of said surface layer and said substrate, said drift layer having a graded concentration of dopants extending between said surface layer and said substrate, said drift layer further having a first ~~to create and maintain a single~~ static unidirectional electric drift field to aid the movement of minority carriers from said substrate to said surface layer ..."

Claims 11-16 depend on claim 10 and for at least the same reason that claim 10 is patentable over the cited prior art, claims 11-16 are patentable as well. Claims 19-24 depend on claim 18 and for at least the reasons that claim 18 is patentable over the cited prior art, claims 19-24 are patentable as well.

CONCLUSION

Applicant respectfully submits that in view of the amendments made to the claims and the discussion set forth herein, this application is now in condition for allowance. However, should Examiner be of the opinion that further amendment or response is required; Applicant encourages Examiner to contact the undersigned attorney at the telephone number set forth below. The Commissioner is authorized to charge any additional fees or deficiencies or credit any overpayments to Eugene M. Cummings, P.C., Deposit Account No. **50-4199**, with reference to attorney docket number (0299-0001.01).

Respectfully submitted,

Date: November 13, 2012

By: /David M. Mundt/
David M. Mundt, Reg. No. 41,207

Law Offices of Eugene M. Cummings, P.C.
1 North Wacker Drive
Suite 4130
Chicago, Illinois 60606

Telephone: (312) 984-0144
Facsimile: (312) 984-0146

Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	David Michael Mundt/Francisca Hubbard
Attorney Docket Number:	0299-0001.01

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	2801	1	465	465
		Total in USD ($)		**465**

Electronic Acknowledgement Receipt

EFS ID:	14209126
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	13-NOV-2012
Filing Date:	12-JAN-2007
Time Stamp:	09:12:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$465
RAM confirmation Number	17230
Deposit Account	504199
Authorized User	

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

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	RCE.pdf	151110 669bd13352097826785b6b507e921bb2d21f3ba0	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2	Amendment After Final	AmendmentF.pdf	726410 c3fe02a1a6fa54c984a7668cd2344d6e4c426b1f	no	8
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30433 1669af2e315b53327c32b94c85ccbe287af2f2ce	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	907953		

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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.

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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.

PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/622,496	01/12/2007	

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY ☒ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 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).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT 11/13/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $31 =	0	OR	X $ =	
Independent (37 CFR 1.16(h))	* 2	Minus	***8	= 0	X $125 =	0	OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE	0	OR	TOTAL ADD'L FEE	

AMENDMENT	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
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))									
☐ 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".

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Legal Instrument Examiner:
/LAJUAN HICKSON/

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70653 7590 12/12/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

DATE MAILED: 12/12/2012

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$885	$300	$0	$1185	03/12/2013

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 SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

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B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

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: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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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)

70653 7590 12/12/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

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

Certificate of Mailing or Transmission

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

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$885	$300	$0	$1185	03/12/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
ARORA, AJAY	2892	257-371000

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 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1_____
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 has been filed for recordation as set forth in 37 CFR 3.11. 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. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information 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 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, 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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

70653 7590 12/12/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

EXAMINER
ARORA, AJAY

ART UNIT	PAPER NUMBER
2892	

DATE MAILED: 12/12/2012

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

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

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 Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No.	Applicant(s)	
	11/622,496	RAO, G.R. MOHAN	
	Examiner	Art Unit	
	AJAY K. ARORA	2892	

-- 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 *11/13/12*.

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 *10-16 & 18-24*. 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).
   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 _____
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 _____.

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/13/2012 has been entered.

Reasons for Allowance

1. Claims 10-16 and 18-24 are allowed. The following is an examiner's statement of reasons for allowance:

2. Claims 10-16 and 18-24 are allowed because the prior art of record does not teach or suggest, singularly or in combination, at least the limitations of base claim 10 which requires "at least one well region disposed in said single drift layer, said well region having a graded concentration of dopants and a second static unidirectional electric drift field to aid the movement of minority carriers from said surface layer to said

substrate" (see last 3 lines of claim 10). Base claim 18 recites similar limitations (see last 3 lines of claim 18).

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. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AJAY K. ARORA whose telephone number is (571)272-8347. The examiner can normally be reached on Mon through Fri, 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Thao X. Le can be reached on (571) 272-1708. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/AJAY K. ARORA/
Primary Examiner, Art Unit 2892

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

SEARCHED

Class	Subclass	Date	Examiner
257	655	12/16/2011	AKA

SEARCH NOTES

Search Notes	Date	Examiner
Revised EAST search history report	12/16/2011	AKA
Revised EAST search history report	8/10/2012	AKA
Revised EAST search history	11/19/2012	AKA
Inventor search	11/19/2012	AKA
.clm. interference search	11/19/2012	AKA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
257	655	12/16/2011	AKA

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

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

ORIGINAL		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
257	655	H	0	1	L	21 / 02 (2006.01.01)					

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
257	611	E33.048			
438	510				

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
-	1	-	17												
-	2	8	18												
-	3	9	19												
-	4	10	20												
-	5	11	21												
-	6	12	22												
-	7	13	23												
-	8	14	24												
-	9	-	25												
1	10														
2	11														
3	12														
4	13														
5	14														
6	15														
7	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 14	
/AJAY K ARORA/ Primary Examiner.Art Unit 2892 (Primary Examiner)	12/04/2012 (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	0	(unidirectional WITH field WITH drift) AND ((gradient OR grading OR graded) WITH dop$3).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/19 14:46
L2	0	(unidirectional WITH field WITH drift) AND ((gradient OR grading OR graded) WITH dop$3).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/19 14:46
L3	0	((GR) near2 (RAO)).INV.	US-PGPUB; USPAT	OR	ON	2012/11/19 14:48
L4	0	((GR) near2 (RAO)).INV.	EPO; JPO; DERWENT	OR	ON	2012/11/19 14:48
L5	0	(("G.R.") near2 (RAO)).INV.	EPO; JPO; DERWENT	OR	ON	2012/11/19 14:49
L6	89	(mohan near2 RAO).INV.	EPO; JPO; DERWENT	OR	ON	2012/11/19 14:49
L7	245	(mohan near2 RAO).INV.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/19 14:49
L8	2	l7 and (grad$3 WITH dop$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/11/19 14:50
S1	2	("20070158790").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/04/08 11:10
S2	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:19
S3	1096	(graded OR gradation) WITH (dopant OR	US-PGPUB;	OR	ON	2008/04/08

		doping) WITH concentration	USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB			11:47
S4	805	S3 AND ("257" OR "438").clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:47
S5	253	(graded OR gradation) WITH (dopant OR doping) WITH concentration WITH (semiconductor OR silicon)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:49
S6	7	S5 SAME (carrier WITH (movement OR mobility))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:51
S7	48	S5 AND (((carrier OR electron OR hole) WITH (movement OR mobility)) SAME ((emitter WITH collector) OR (source WITH drain)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/04/08 11:55
S8	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:16
S10	13	S8 AND ("dopant concentration" OR "concentration of dopant")	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:17
S11	0	S8 AND (dop$3 WITH (concentrat$3 OR amount OR quantity) WITH (variable OR varying OR grad$3)) AND ((doping OR dopant) WITH well) AND ((carrier OR charge) WITH (moving OR movement OR mobile OR mobility))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:22
S12	1136	(graded OR gradation) WITH (dopant OR doping) WITH concentration	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/18 12:22
S13	86	S12 AND (dop$3 WITH (concentrat$3 OR amount OR quantity) WITH (variable OR varying OR grad$3)) AND ((doping OR dopant) WITH well) AND ((carrier OR	US-PGPUB; USPAT; USOCR; EPO; JPO;	OR	ON	2008/07/18 12:22

		charge) WITH (moving OR movement OR mobile OR mobility))	DERWENT; IBM_TDB			
S14	29	("20020068409" | "6303450" | "6437406" | "6458665" | "6483158" | "6489223" | "6509241").PN. OR ("6743684").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2008/07/18 13:13
S15	34	uniform$2 WITH dop$3 WITH drift WITH epitaxial	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:19
S16	2	("5637898").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 15:26
S17	0	(non-uniform$2 OR nonuniform$2 OR grad43 OR grading OR gradient) WITH (dopant OR doping) WITH well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:40
S18	4	(non-uniform$2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping) WITH well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:40
S19	4	("4001864").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 15:43
S20	58	("20020074585" | "20040063288" | "4001864" | "4347654" | "4866000" | "5130262" | "5213988" | "5329144" | "5480816" | "5496746" | "5569612" | "5575862" | "5797999" | "6211028" | "6452086" | "6472715" | "6670544" | "6683343" | "6696314" | "6706550" | "6713813" | "6737722" | "6744117" | "6747883" | "6753202" | "6754093" | "6756616" | "RE37441").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:57
S21	92	S15 S19 S20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:58
S22	39	S21 AND ((non-uniform$2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:58
S23	60	S21 AND well	US-PGPUB; USPAT; USOCR;	OR	ON	2008/07/23 15:59

			EPO; JPO; DERWENT; IBM_TDB			
S24	39	S22 AND well	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 15:59
S25	2	S22 AND (well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 16:00
S26	3	S22 AND (well WITH (carrier OR movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 16:00
S27	2	("20030042511").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/23 16:05
S28	2	S21 AND (substrate WITH carrier WITH away WITH ((active WITH surface) OR (towards NEAR2 substrate) OR (direction NEAR4 substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:17
S29	3	S21 AND (substrate WITH (carrier OR holes OR electron OR majority OR charge) WITH away WITH ((active WITH surface) OR (towards NEAR2 substrate) OR (direction NEAR4 substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:18
S30	30	S21 AND ((non-uniform$2 OR nonuniform$2 OR grad$3 OR grading OR gradient) WITH (dopant OR doping) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:26
S31	253	(grad$3 OR grading OR gradient) NEAR2 (dopant OR doping) NEAR4 substrate	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 17:33
S32	5	dopant WITH concentration WITH donor WITH acceptor WITH optimiz$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:02
S33	2	10/182,784	US-PGPUB; USPAT; USOCR;	OR	ON	2008/07/23 18:06

			EPO; JPO; DERWENT; IBM_TDB			
S34	0	S20 AND (dopant WITH concentration WITH donor WITH acceptor)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:22
S35	0	S20 AND (dopant WITH donor WITH acceptor)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:22
S36	5	(dopant WITH donor WITH acceptor WITH optimiz$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:26
S37	5	(dopant WITH donor WITH acceptor WITH (optimiz$ OR optimization OR optimal))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:27
S38	487	(donor WITH acceptor WITH (optimiz$ OR optimization OR optimal))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:27
S39	14	S38 AND semiconductor.ab.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:28
S40	0	(layer WITH dopant WITH wafer WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:49
S41	0	(dopant WITH wafer WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:49
S42	0	(dopant WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer)) AND (wafer NEAR1 bond$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:50
S43	0	(dopant WITH transfer$4 WITH ((another OR second OR alternate) NEAR1 wafer))	US-PGPUB; USPAT; USOCR;	OR	ON	2008/07/23 18:50

			EPO; JPO; DERWENT; IBM_TDB			
S44	14807	wafer NEAR1 bond$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:51
S45	33	S44 AND (dopant WITH transfer$4)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/07/23 18:51
S46	579	(257/655,269).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2008/07/24 09:14
S47	539	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/01/02 21:01
S48	695	VLSI AND ((graded OR gradation OR gradient) WITH (dopant OR doping OR impurit$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:04
S49	62	S48 AND (((carrier OR electron OR hole) WITH (movement OR mobility)) SAME ((emitter WITH collector) OR (source WITH drain)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:05
S50	4	S48 AND (well WITH carrier WITH (movement OR mobility) WITH ((away WITH active WITH surface) OR (towards WITH substrate)))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/05/24 11:06
S51	4	("4001864").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 11:10
S52	2	("6831292").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 11:36
S53	2	("5029277").PN.	US-PGPUB; USPAT; USOCR;	OR	OFF	2009/05/24 12:17

			EPO; JPO; DERWENT; IBM_TDB			
S54	551	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/24 12:52
S55	564	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/12/22 10:12
S56	2	("6831292").PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/12/22 10:14
S57	10	(US-20040072395-$ or US-20010046753-$ or US-20010050382-$ or US-20020093281-$ or US-20030042511-$).did. or (US-6743684-$ or US-5359221-$ or US-5637898-$ or US-5627092-$ or US-5029277-$).did. or (US-20020093281-A-$).did.	US-PGPUB; USPAT; DERWENT	OR	ON	2009/12/22 10:26
S58	0	S57 AND drift WITH aid$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/12/22 10:27
S59	7	(drift WITH aid$3) WITH dopant WITH concentration	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/12/22 10:27
S60	173	((graded OR gradient OR gradation) NEAR2 (dop$3 OR impurity)) WITH between WITH substrate AND (active OR source OR drain OR source/drain)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 12:45
S61	74	S60 AND CMOS	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 13:43
S62	5	(complementary WITH error WITH function WITH gradient)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:12
S64	55	CMOS AND (exponential WITH gradient)	US-PGPUB; USPAT;	OR	ON	2010/08/01 19:13

			USOCR; EPO; JPO; DERWENT; IBM_TDB			
S65	712	CMOS AND (linear WITH gradient)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:14
S66	12	S64 AND S65	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:14
S67	0	S66 AND S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:15
S68	7	(grad$3 WITH (dop$3 OR donor)) SAME ((dopant OR donor) WITH (sweep$3 OR mov$3 OR attract$3) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 19:58
S69	4	(grad$3 WITH (dop$3 OR donor)) SAME ((dopant OR donor) WITH driv$3 WITH (toward OR into OR deep$2) WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 20:00
S70	16	(layer WITH (dopant OR donor) WITH concentration WITH minority WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/01 20:02
S71	3377	((graded OR gradation OR gradient) NEAR3 (dopant OR doping OR impurity OR donor OR acceptor)) AND (semiconductor OR CMOS OR FET OR "field effect" OR NMOS OR PMOS).ab.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:28
S72	371	S71 AND (drift WITH field)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:29
S73	0	S71 AND (minority WITH carrier WITH into WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:29
S74	114	S71 AND (minority WITH carrier WITH substrate)	US-PGPUB; USPAT;	OR	ON	2010/08/02 04:30

			USOCR; EPO; JPO; DERWENT; IBM_TDB			
S75	33	S72 AND S74	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:30
S76	88	S71 AND (drift WITH layer WITH (graded OR gradation OR gradient) WITH (dopant OR doping OR impurity OR donor OR acceptor))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:47
S77	7	S76 AND (drift WITH layer WITH between WITH substrate)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 04:48
S78	8028	photodiode WITH CMOS	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:13
S79	0	S78 AND S76	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
S80	0	S78 AND S77	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
S81	7	S71 AND S77	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:14
S82	98	S71 AND S78	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:20
S83	9	S72 AND S78	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 05:20
S84	2	("20020084430").PN.	US-PGPUB; USPAT;	OR	OFF	2010/08/02 05:26

			USOCR; EPO; JPO; DERWENT; IBM_TDB			
S85	172	(drift WITH layer WITH epitaxial) AND S71	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 07:16
S86	47	S71 AND (linear AND exponential)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:04
S87	3	S86 AND "complimentary error function"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:04
S88	8	S86 AND donor	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/08/02 08:38
S89	583	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/08/02 10:21
S90	593	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/01/11 11:40
S91	598	(257/655).CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2011/04/10 20:57
S92	1	("4481522").PN.	USPAT; USOCR	OR	OFF	2011/12/16 08:02
S93	456	(257/655).CCLS.	USPAT; USOCR	OR	OFF	2011/12/16 09:45
S94	0	(single WITh static WITH drift) AND ((gradient OR grading OR graded) WITH dop$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/10 00:21
S95	22	(static WITH drift) AND ((gradient OR grading OR graded) WITH dop$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/10 00:21

S96	1	(unidirectional WITH field WITH drift) AND ((gradient OR grading OR graded) WITH dop$3)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/10 00:24

11/19/2012 2:57:22 PM
C:\Users\aarora\Documents\EAST\Workspaces\11622496.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11622496	RAO, G.R. MOHAN
	Examiner	**Art Unit**
	AJAY K ARORA	2892

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

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

CLAIM		DATE								
Final	Original	08/02/2010	04/10/2011	12/16/2011	08/10/2012	11/19/2012				
	1	-	-	-	-	-				
	2	-	-	-	-	-				
	3	-	-	-	-	-				
	4	-	-	-	-	-				
	5	-	-	-	-	-				
	6	-	-	-	-	-				
	7	-	-	-	-	-				
	8	-	-	-	-	-				
	9	-	-	-	-	-				
	10	✓	✓	✓	✓	=				
	11	✓	✓	✓	✓	=				
	12	✓	✓	✓	✓	=				
	13	✓	✓	✓	✓	=				
	14	✓	✓	✓	✓	=				
	15	✓	✓	✓	✓	=				
	16	✓	✓	✓	✓	=				
	17	✓	-	-	-	-				
	18	✓	✓	✓	✓	=				
	19	✓	✓	✓	✓	=				
	20	✓	✓	✓	✓	=				
	21	✓	✓	✓	✓	=				
	22	✓	✓	✓	✓	=				
	23	✓	✓	✓	✓	=				
	24	✓	✓	✓	✓	=				
	25	✓	-	-	-	-				

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (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)

70653 7590 12/12/2012
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

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ELECTRONIC FILING

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Francisca M.A. Hubbard	(Depositor's name)
Francisca M.A. Hubbard	(Signature)
March 12, 2013	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01	3086

TITLE OF INVENTION: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	$885	$300	$0	$1185	03/12/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
ARORA, AJAY	2892	257-371000

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 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

   1 Eugene M. Cummings, P.C.
   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 has been filed for recordation as set forth in 37 CFR 3.11. 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. The following fee(s) are submitted:
- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 504199 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date March 12, 2013

Typed or printed name David M. Mundt Registration No. 41,207

This collection of information 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 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, 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.

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Electronic Patent Application Fee Transmittal

Application Number:	11622496
Filing Date:	12-Jan-2007
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Filer:	David Michael Mundt/Francisca Hubbard
Attorney Docket Number:	0299-0001.01

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	885	885
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1185**

Electronic Acknowledgement Receipt

EFS ID:	15191627
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	David Michael Mundt/Francisca Hubbard
Filer Authorized By:	David Michael Mundt
Attorney Docket Number:	0299-0001.01
Receipt Date:	12-MAR-2013
Filing Date:	12-JAN-2007
Time Stamp:	15:32:54
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1185
RAM confirmation Number	3028
Deposit Account	504199
Authorized User	

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

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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)	IssueFee.pdf	169875 03bcbf9d7d2927752ec0c60b4ff01d078e7fafc1	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	31843 3959a4d0703527cbda6bd4c321ef249fa665b73d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	201718	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office
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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/622,496	04/16/2013	8421195	0299-0001.01	3086

70653 7590 03/27/2013
LAW OFFICES OF EUGENE M. CUMMINGS, P.C.
ONE NORTH WACKER DRIVE
SUITE 4130
CHICAGO, IL 60606

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):

G.R. Mohan Rao, McKinney, TX;

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IR103 (Rev. 10/09)

PTO/SB/81A (12-08)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	8,421,195
Issue Date	04/16/2013
First Named Inventor	RAO, G.R. MOHAN
Title	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Attorney Docket Number	GRTD-32811

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 25883

OR

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Country					
Telephone		Email			

I am the:

☐ Inventor, having ownership of the patent.

OR

☒ Patent owner.
Statement under 37 CFR 3.73(b) (Form PTO/SB/96) submitted herewith or filed on _____

SIGNATURE of Inventor or Patent Owner

Signature	Philip W. Johnson Jr.	Date	3/20/2015
Name	Philip W. Johnson Jr.	Telephone	214-728-8244
Title and Company	President GREENTHREAD, LLC		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☒ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. This 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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PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Greenthread, LLC

Application No./Patent No.: 8,421,195 Filed/Issue Date: April 16, 2013

Titled:
SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Greenthread, LLC, a Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. [X] the assignee of the entire right, title, and interest in;

2. [ ] an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. [ ] the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. [X] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 035630, Frame 0391, or for which a copy therefore is attached.

OR

B. [ ] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

[ ] Additional documents in the chain of title are listed on a supplemental sheet(s).

[X] As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Philip W Johnson Jr — 5/20/2015
Signature — Date

PHILIP W JOHNSON JR — PRESIDENT
Printed or Typed Name — Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. 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.

Electronic Acknowledgement Receipt

EFS ID:	22481607
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	70653
Filer:	Gregory Michael Howison/Heather Hamilton
Filer Authorized By:	Gregory Michael Howison
Attorney Docket Number:	0299-0001.01
Receipt Date:	01-JUN-2015
Filing Date:	12-JAN-2007
Time Stamp:	17:54:54
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	Power of Attorney	GRT32611POAEXE.pdf	642022 12e9c8c605e84c992a66f6dbf27d21bbf40e0f93	no	1

Warnings:

Information:

2	Assignee showing of ownership per 37 CFR 3.73	GRT32611STMT373bEXE.pdf	602530 7949fff2285221279cfa919f38bd9ff17abdb5ae	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	1244552	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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
11/622,496	01/12/2007	G.R. Mohan Rao	0299-0001.01

CONFIRMATION NO. 3086

POWER OF ATTORNEY NOTICE

70653
EUGENE M. CUMMINGS, P.C.
55 W. MONROE
SUITE 3500
CHICAGO, IL 60603

OC000000075553091

Date Mailed: 06/08/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2015.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. 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**.

/sleutchit/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD-32611

CONFIRMATION NO. 3086

POA ACCEPTANCE LETTER

25883
HOWISON & ARNOTT, L.L.P
P.O. BOX 741715
DALLAS, TX 75374-1715

OC000000075553289

Date Mailed: 06/08/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/01/2015.

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.

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/sleutchit/

PTO/AIA/81A (02-15)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	8,421,195
Issue Date	04-16-2013
First Named Inventor	G.R. Mohan Rao
Title	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Attorney Docket No.	GRTD.01.01.DV1

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 40672

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☒ The address associated with the above-identified Customer Number.

OR

☐ The address associated with the Customer Number identified in the box at right:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on 06-01-2015

SIGNATURE of Applicant or Patent Owner

Signature	Philip W. John Jr.	Date	3/20/2020
Name	Philip W. John, Jr.	Telephone	
Title and Company	PRESIDENT of GREENTHREAD, LLC		

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☑ A total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 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.

Electronic Acknowledgement Receipt

EFS ID:	38951953
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
Title of Invention:	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
First Named Inventor/Applicant Name:	G.R. Mohan Rao
Customer Number:	25883
Filer:	Bill Naifeh/April Reasoner
Filer Authorized By:	Bill Naifeh
Attorney Docket Number:	GRTD-32611
Receipt Date:	24-MAR-2020
Filing Date:	12-JAN-2007
Time Stamp:	13:35:00
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	Power of Attorney	POA_8421195_GRTD0101DV1.pdf	2184135 12cacaad717a3a8effb040956d502574c1497c1d	no	1

Warnings:

Information:	
Total Files Size (in bytes):	2184135

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
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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
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD.01.01.DV1

CONFIRMATION NO. 3086

POA ACCEPTANCE LETTER

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

OC000000115879964

Date Mailed: 04/02/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/24/2020.

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**.

/mmasfaw/

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
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD-32611

CONFIRMATION NO. 3086

POWER OF ATTORNEY NOTICE

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

OC000000115879847

Date Mailed: 04/02/2020

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/24/2020.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

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/mmasfaw/

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

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 Eastern District of Texas, Marshall Division on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:19-cv-147	4/30/2019	Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
Greenthread, LLC	Samsung Electronics Co., Ltd, Samsung Semiconductor, Inc. Samsung Electronics America, Inc. Samsung Austin Semiconductor, LLC

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,421,195 B2	4/16/2013	Greenthread, LLC
2 9,190,502 B2	11/17/2015	Greenthread, LLC
3 8,106,481 B2	1/31/2012	Greenthread, LLC
4 9,647,070 B2	5/9/2017	Greenthread, LLC
5		

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		
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**

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	REQUEST ID
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD.01.01.DV1	121958

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 09/28/2020 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

X Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Bill R. Naifeh, Reg. No. 44962/
Name:	Bill R. Naifeh
Registration Number:	44962

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**

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 Eastern District of Texas, Marshall Division on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
2:19-cv-147	4/30/2019	Eastern District of Texas, Marshall Division

PLAINTIFF	DEFENDANT
Greenthread, LLC	Samsung Electronics Co., Ltd, Samsung Semiconductor, Inc. Samsung Electronics America, Inc. Samsung Austin Semiconductor, LLC

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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2 9,190,502 B2	11/17/2015	Greenthread, LLC
3 8,106,481 B2	1/31/2012	Greenthread, LLC
4 9,647,070 B2	5/9/2017	Greenthread, LLC
5		

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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		
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**

PTO/AIA/81A (02-15)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995 no persons are required to respond to a collection of information unless it displays a valid OMB control number

PATENT - POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Patent Number	8,421,195
Issue Date	2013-04-16
First Named Inventor	G.R. Mohan RAO
Title	SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS
Attorney Docket No.	GRTD60-32611

I hereby revoke all previous powers of attorney given in the above-identified patent.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith: 25883

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) with respect to the patent identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified patent to:

☐ The address associated with the above-identified Customer Number.

OR

☒ The address associated with the Customer Number identified in the box at right: 25883

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the:

☐ Applicant.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.

SIGNATURE of Applicant or Patent Owner

Signature		Date	7/22-21
Name	Phillip John	Telephone	214 728 8204
Title and Company	Manager Greenthread, LLC		

NOTE: Signatures of all the applicants or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☐ A total of _____ forms are submitted.

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

Electronic Acknowledgement Receipt

EFS ID:	43954488
Application Number:	11622496
International Application Number:	
Confirmation Number:	3086
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.DV1
Receipt Date:	07-OCT-2021
Filing Date:	12-JAN-2007
Time Stamp:	11:42:37
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	Assignee showing of ownership per 37 CFR 3.73	GRT32611373STMT.pdf	120620 b2a7259e26c87f8e7a642c4b7fa9da3b56e8aa23	no	3

Warnings:

Information:					
2	Power of Attorney	GRT32611POACHANGEADD.pdf	1027082 8f46fd57bac53173c2e2064aa1566b991ab20f01	no	1
Warnings:					
Information:					
			Total Files Size (in bytes):	1147702	

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.

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PTO/AIA/96 (08-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Greenthread, LLC

Application No./Patent No.: 8,421,195 Filed/Issue Date: 2013-04-16

Titled: SEMICONDUCTOR DEVICES WITH GRADED DOPANT REGIONS

Greenthread, LLC, a Limited Liability Company

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. [x] The assignee of the entire right, title, and interest.

2. [ ] An assignee of less than the entire right, title, and interest (check applicable box):

   [ ] The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   [ ] There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. [ ] The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. [ ] The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. [✓] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 035630, Frame 0391, or for which a copy thereof is attached.

B. [ ] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Gregory M. Howison, Reg. #30646/	October 5, 2021
Signature	Date
Gregory M. Howison	30,646
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

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

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

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

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
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD60-32611

CONFIRMATION NO. 3086

POA ACCEPTANCE LETTER

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

OC000000129114261

Date Mailed: 10/15/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/07/2021.

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**.

/mbeyene/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
11/622,496	01/12/2007	G.R. Mohan Rao	GRTD.01.01.DV1

CONFIRMATION NO. 3086

POWER OF ATTORNEY NOTICE

40672
LAW OFFICE OF BILL NAIFEH
PO BOX 803423
DALLAS, TX 75380

OC000000129114232

Date Mailed: 10/15/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/07/2021.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. 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**.

/mbeyene/

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

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.	DATE FILED	U.S. DISTRICT COURT
6:22-cv-00105	1/27/2022	Western District of Texas, Waco Division

PLAINTIFF	DEFENDANT
GREENTHREAD, LLC	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		
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**