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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/296,985	03/08/2019	Shih-Yuan WANG	309-0007USCON

CONFIRMATION NO. 5511

POA ACCEPTANCE LETTER

139982
Wissing Miller LLP
The Lofts at Manhattan West
434 West 33rd Street
12th Floor
New York, NY 10001

OC000000121343974

Date Mailed: 11/17/2020

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 11/10/2020.

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**.

/cnguyen/

Electronic Acknowledgement Receipt

EFS ID:	41089700
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	23432
Filer:	Gerard Michael Wissing/Mary Ellen Finnegan
Filer Authorized By:	Gerard Michael Wissing
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	10-NOV-2020
Filing Date:	08-MAR-2019
Time Stamp:	19:49:57
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	309-0007USCON_StatementUnder37CFR373FINAL.pdf	121248 47482280862d2862e744c20bf41e08784dd45e65	no	3

Warnings:

Information:					
2	Miscellaneous Incoming Letter	309_0007USCON__Assignment.pdf	894136 2c0cff232537318fc072b3a288696a3fe5b9e177	no	6
Warnings:					
Information:					
3	Power of Attorney	309-0007USCON_POA.pdf	647451 40291c1204a2a95b6718ddfdea72e3c737bd8142	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1662835	

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.

ASSIGNMENT

In consideration of One Dollar ($1.00), and other good and valuable considerations, the receipt of which is hereby acknowledged, I, the undersigned,

Shih-Yuan Wang and Shih-Ping Wang

Hereby sell, assign and transfer to W&Wsens Devices, Inc., a corporation of Delaware, having a place of business at 38 Third Street, Suite 307, Los Altos, California, its successors, assigns and legal representatives, the entire right, title and interest for all countries, in and to any and all inventions which are disclosed and claimed, and as possessed by the undersigned, any and all inventions which are disclosed but not claimed, in the patent applications identified in the attached Schedule A, and in and to said applications and all divisional, continuing, substitute, renewal, reissue, and all other applications for U.S. Letters Patent or other related property rights in any and all foreign countries which have been or shall be filed on any of said inventions disclosed in said applications; and in and to all original and reissued patents or related foreign documents which have been or shall be issued on said inventions;

Authorize and request the Commissioner of Patents of the United States and non-U.S. Patent Authorities to issue to said Assignee, the corporation above named, its successors, assigns and legal representatives, in accordance with this assignment, any and all United States Letters Patent and non-U.S. Patents on said inventions or any of them disclosed in said applications;

Agree that said Assignee may apply for and receive foreign Letters Patent or rights of any other kind for said inventions, or any of them; and may claim, in applications for said foreign Letters Patent or other rights, the priority of the aforesaid United States patent application under the provisions of the International Convention of 1883 and later modifications thereof, under the Patent Cooperation Treaty, under the European Patent Convention or under any other available international agreement; and that, when requested, without charge to, but at the expense of, said Assignee, its successors, assigns and legal representatives, to carry out in good faith the intent and purpose of this assignment, the undersigned or the undersigned's executors or administrators will, for the United States and all foreign countries, execute all divisional, continuing, substitute, renewal, reissue, and all other patent applications or other documents on any and all said inventions; execute all

PATENT
REEL: 044457 FRAME: 0753

rightful oaths, assignments, powers of attorney and other papers; communicate to said Assignee, its successors, assigns and representatives, all facts known and documents available to the undersigned relating to said inventions and the history thereof; testify in all legal proceedings; and generally do everything possible which said Assignee, its successors, assigns or representatives shall consider desirable for aiding in securing, maintaining and enforcing proper patent protection for said inventions and for vesting title to said inventions and all applications for patents or related foreign rights and all patents on said inventions, in said Assignee, its successors, assigns and legal representatives; and

COVENANT with said Assignee, its successors, assigns and legal representatives that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by the undersigned, and that full right to convey the same as herein expressed is possessed by the undersigned.

[L.S.]

Shih-Yuan Wang

Date: Nov. 7, 2017

Witness:

TERESA SPENCER

[L.S.]

Shih-Ping Wang

Date: Nov. 7, 2017

Witness:

TERESA SPENCER

SCHEDULE A

	APPLICATION/PATENT NO.	COUNTRY	FILING/ISSUE/PUBLICATION DATE
1.	15/797,821	U.S.	October 30, 2017

ASSIGNMENT

In consideration of One Dollar ($1.00), and other good and valuable considerations, the receipt of which is hereby acknowledged, I, the undersigned,

M. Saif Islam

Hereby sell, assign and transfer to W&Wsens Devices, Inc., a corporation of Delaware, having a place of business at 38 Third Street, Suite 307, Los Altos, California, its successors, assigns and legal representatives, the entire right, title and interest for all countries, in and to any and all inventions which are disclosed and claimed, and as possessed by the undersigned, any and all inventions which are disclosed but not claimed, in the patent applications identified in the attached Schedule A, and in and to said applications and all divisional, continuing, substitute, renewal, reissue, and all other applications for U.S. Letters Patent or other related property rights in any and all foreign countries which have been or shall be filed on any of said inventions disclosed in said applications; and in and to all original and reissued patents or related foreign documents which have been or shall be issued on said inventions;

Authorize and request the Commissioner of Patents of the United States and non-U.S. Patent Authorities to issue to said Assignee, the corporation above named, its successors, assigns and legal representatives, in accordance with this assignment, any and all United States Letters Patent and non-U.S. Patents on said inventions or any of them disclosed in said applications;

Agree that said Assignee may apply for and receive foreign Letters Patent or rights of any other kind for said inventions, or any of them; and may claim, in applications for said foreign Letters Patent or other rights, the priority of the aforesaid United States patent application under the provisions of the International Convention of 1883 and later modifications thereof, under the Patent Cooperation Treaty, under the European Patent Convention or under any other available international agreement; and that, when requested, without charge to, but at the expense of, said Assignee, its successors, assigns and legal representatives, to carry out in good faith the intent and purpose of this assignment, the undersigned or the undersigned's executors or administrators will, for the United States and all foreign countries, execute all divisional, continuing, substitute, renewal, reissue, and all other patent applications or other documents on any and all said inventions; execute all

PATENT
REEL: 044457 FRAME: 0756

rightful oaths, assignments, powers of attorney and other papers; communicate to said Assignee, its successors, assigns and representatives, all facts known and documents available to the undersigned relating to said inventions and the history thereof; testify in all legal proceedings; and generally do everything possible which said Assignee, its successors, assigns or representatives shall consider desirable for aiding in securing, maintaining and enforcing proper patent protection for said inventions and for vesting title to said inventions and all applications for patents or related foreign rights and all patents on said inventions, in said Assignee, its successors, assigns and legal representatives; and

COVENANT with said Assignee, its successors, assigns and legal representatives that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been made to others by the undersigned, and that full right to convey the same as herein expressed is possessed by the undersigned.

[L.S.]

M. Saif Islam

Date: NOV. 3, 2017

Witness:

TERESA SPENCER

SCHEDULE A

	APPLICATION/PATENT NO.	COUNTRY	FILING/ISSUE/PUBLICATION DATE
1.	15/797,821	U.S.	October 30, 2017

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: W&WSens Devices, Inc.

Application No./Patent No.: 16/296,985 Filed/Issue Date: March 8, 2019

Titled: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

W&WSens Devices, Inc., a corporation

(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. ☑ 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 _____, Frame _____, 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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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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.

/Gerard M. Wissing/	November 10, 2020
Signature	Date
Gerard M. Wissing	36309
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.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 03/31/2021. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

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

Application Number	16/296,985
Filing Date	March 8, 2019
First Named Inventor	Shi-Yuan Wang
Title	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
Art Unit	2893
Examiner Name	Eduardo A. Rodela
Attorney Docket Number	309-0007USCON

SIGNATURE of Applicant or Patent Practitioner

Signature	/Gerard M. Wissing/	Date (Optional)	November 10, 2020
Name	Gerard M. Wissing	Registration Number	36309
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
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

POWER OF ATTORNEY BY APPLICANT

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

Application Number	Filing Date

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

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 139982

OR

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

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

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

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

W&WSens Devices, Inc.

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

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

Signature	[signature]	Date (Optional)	Oct 20, 2020
Name	SHUPING WANG		
Title	PRESIDENT CEO		

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

☐ Total of forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	11/05/2019	10468543	5176/88184-CIP-A	5511

23432 7590 10/16/2019

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

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):

Shih-Yuan WANG, Palo Alto, CA;
W&WSens, Devices Inc., Los Altos, CA;
Shih-Ping WANG, Los Altos, CA;
M. Saif ISLAM, Davis, CA;

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	49	20030059820		2003-03-27	Vo-Dinh	
	50	20100059822		2010-03-11	Pinguet et al.	
	51	20080079022		2008-04-03	Yamamoto et al.	
	52	20070170536		2007-07-26	Hsu et al.	
	53	20060267054		2006-11-30	Martin et al.	
	54	20150054997		2015-02-26	Hynecek ~~Aptina Imaging Corporation~~	
	55	20160254407		2016-09-01	Wang et al.	
	56	20040222357		2004-11-11	King et al.	
	57	20020097962		2002-07-25	Yoshimura et al.	
	58	20150340538		2015-11-26	Novack et al. ~~Soriant Advanced Technology~~	
	59	20160240718		2016-08-18	Giziewicz ~~FCI Americas Technology LLC~~	

Change(s) applied to document, /D.D./ 9/13/2019

EFS Web 2.1.17

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

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	16	20100029067		2010-02-01	Vijh	
	17	20100221866		2010-09-01	Graham	
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	First Named Inventor	Shih-Yuan WANG et al.
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

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Corrected ***Notice of Allowability***	**Application No.** 16/296,985	**Applicant(s)** WANG et al.	
	Examiner Eduardo A Rodela	**Art Unit** 2893	**AIA (FITF) Status** Yes

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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.

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

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

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

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Receipt date: 08/14/2019	Application Number	16296985 16/296,985 - GAU: 2893
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

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Examiner Signature	/EDUARDO A RODELA/	Date Considered	09/04/2019

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	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

CERTIFICATION STATEMENT

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

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

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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	Ivan S. Kavrukov	Date (YYYY-MM-DD)	2019-08-14
Name/Print	Ivan S. Kavrukov	Registration Number	25161

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A

CONFIRMATION NO. 5511

PUBLICATION NOTICE

23432
COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

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Title:MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

Publication No.US-2019-0288132-A1
Publication Date:09/19/2019

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16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

23432 7590 09/18/2019

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16/296,985	03/08/2019	WANG et al.	5176/88184-CIP-A

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IDS dated April 2, 2019 had previously been considered, however the form had not been fully completed. It is now complete and included with this communication. Further, the Zang NPL reference (#50 reference on page 22/31) is included as well to clarify the record, as the reference was not previously included in submissions.

Attachment: Zang NPL

/EDUARDO A RODELA/
Primary Examiner, Art Unit 2893

PTO-90C (Rev.04-03)

Doc code: IDS
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First Named Inventor	Shih-Yuan WANG et al.
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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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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16296985
Filing Date	2019-03-08
First Named Inventor	Shih-Yuan WANG et al.
Art Unit	
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Attorney Docket Number	5176/88184-CIP-A

U.S.PATENTS

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NEW YORK, NY 10112



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This application is a CON of 15/797,821 10/30/2017
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which claims benefit of 62/081,538 11/18/2014
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and claims benefit of 62/111,582 02/03/2015
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Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
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Projected Publication Date: 09/19/2019

Non-Publication Request: No

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

MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

Preliminary Class

257

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

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Application Number	16296985
Filing Date	2019-03-08
First Named Inventor	Shih-Yuan WANG
Art Unit	
Examiner Name	
Attorney Docket Number	5176/88184-CIP-A

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

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See attached certification statement.

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

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	Ivan S. Kavrukov	Date (YYYY-MM-DD)	2019-08-14
Name/Print	Ivan S. Kavrukov	Registration Number	25161

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

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.

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

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.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

23432 7590 09/06/2019

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

EXAMINER	
RODELA, EDUARDO A	

ART UNIT	PAPER NUMBER
2893	

MAIL DATE	DELIVERY MODE
09/06/2019	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.

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR/ PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
16/296,985	03/08/2019	WANG et al.	5176/88184-CIP-A

COOPER & DUNHAM, LLP
30 Rockefeller Plaza 20th Floor
NEW YORK, NY 10112

EXAMINER	
Eduardo A Rodela	
ART UNIT	PAPER
2893	20190904

DATE MAILED: _____

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

Commissioner for Patents

The IDS form submitted August 14, 2019 has been considered. It is noted that the IDS form was received by the office a day before the issuance of the notice of allowance and therefore is being treated as merely a miscellaneous communication to the Applicant.

/EDUARDO A RODELA/
Primary Examiner, Art Unit 2893

PTO-90C (Rev.04-03)

Electronic Patent Application Fee Transmittal

Application Number:	16296985
Filing Date:	08-Mar-2019
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Filer:	Ivan Kavrukov/Thomas Trainor
Attorney Docket Number:	5176/88184-CIP-A

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	2501	1	500	500

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

23432 7590 08/15/2019
COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

TITLE OF INVENTION: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/15/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
RODELA, EDUARDO A	2893	257-431000

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

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

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

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 COOPER & DUNHAM LLP
2
3

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

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

(A) NAME OF ASSIGNEE: W&Wsens Devices, Inc.

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Los Altos, CA

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

4a. Fees submitted: ☒ Issue Fee ☒ Publication Fee (if required) ☒ Advance Order - # of Copies (1)

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

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

☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. 03-3125

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature /Ivan S. Kavrukov/ Date August 22, 2019

Typed or printed name Ivan S. Kavrukov Registration No. 25,161

PTOL-85 Part B (08-18) Approved for use through 01/31/2020 OMB 0651-0033 U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Samsung Exhibit 1044, Page 114 of 638

Electronic Acknowledgement Receipt

EFS ID:	36947227
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	23432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	22-AUG-2019
Filing Date:	08-MAR-2019
Time Stamp:	11:11:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$500
RAM confirmation Number	E20198LB11502271
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	88184-CIP-A--Issue_Fee_Transmittal.pdf	98306 05785aa70c781be54fd128465f2f56fe1c59f605	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30391 c3bbf3b1b388698cf178d04d8a61fca9be66c661	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	128697		

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.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/296,985	WANG et al.
	Examiner	**Art Unit**
	Eduardo A Rodela	2893

CPC						
Symbol					**Type**	**Version**
H01L	/	31	/	02363	F	2013-01-01
H01L	/	31	/	02327	I	2013-01-01
G02B	/	1	/	005	I	2013-01-01
H01L	/	31	/	0232	I	2013-01-01
H01L	/	31	/	02	I	2013-01-01
H01L	/	31	/	028	I	2013-01-01
H01L	/	31	/	02325	I	2013-01-01
H01L	/	27	/	1443	I	2013-01-01
H01L	/	27	/	14625	I	2013-01-01
H01L	/	31	/	103	I	2013-01-01
H01L	/	27	/	1446	I	2013-01-01
H01L	/	31	/	107	I	2013-01-01
H01L	/	31	/	035218	I	2013-01-01
H01L	/	31	/	035281	I	2013-01-01
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H01L	/	31	/	1808	I	2013-01-01
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H04B	/	10	/	691	I	2013-01-01
H04B	/	10	/	40	I	2013-01-01
H04B	/	10	/	25	I	2013-01-01
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G02B	/	1	/	002	I	2013-01-01
H01L	/	31	/	02002	I	2013-01-01
H01L	/	31	/	02016	I	2013-01-01
H01L	/	31	/	09	I	2013-01-01
H01L	/	31	/	105	I	2013-01-01
Y02E	/	10	/	547	A	2013-01-01

NONE (Assistant Examiner) (Date)		**Total Claims Allowed:** 44	
/EDUARDO A RODELA/ Primary Examiner, Art Unit 2893 (Primary Examiner)	13 August 2019 (Date)	O.G. Print Claim(s) 113	O.G. Print Figure 14

U.S. Patent and Trademark Office — Part of Paper No.: 20190809

Samsung Exhibit 1044, Page 117 of 638

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/296,985	WANG et al.
	Examiner	**Art Unit**
	Eduardo A Rodela	2893

CPC Combination Sets									
Symbol					**Type**	**Set**	**Ranking**	**Version**
	/		/					

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	44	
/EDUARDO A RODELA/ Primary Examiner, Art Unit 2893	13 August 2019	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	113	14

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/296,985	WANG et al.
	Examiner	**Art Unit**
	Eduardo A Rodela	2893

INTERNATIONAL CLASSIFICATION					
CLAIMED					
H01L	/	31	/	0236	

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

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

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 44	
/EDUARDO A RODELA/ Primary Examiner, Art Unit 2893 (Primary Examiner) 13 August 2019 (Date)	O.G. Print Claim(s) 113	O.G. Print Figure 14

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/296,985	WANG et al.
	Examiner	**Art Unit**
	Eduardo A Rodela	2893

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	113	10	122	19	131	28	140	37	149						
2	114	11	123	20	132	29	141	38	150						
3	115	12	124	21	133	30	142	39	151						
4	116	13	125	22	134	31	143	40	152						
5	117	14	126	23	135	32	144	41	153						
6	118	15	127	24	136	33	145	42	154						
7	119	16	128	25	137	34	146	43	155						
8	120	17	129	26	138	35	147	44	156						
9	121	18	130	27	139	36	148								

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 44	
/EDUARDO A RODELA/ Primary Examiner, Art Unit 2893 (Primary Examiner)	13 August 2019 (Date)	O.G. Print Claim(s) 113	O.G. Print Figure 14

U.S. Patent and Trademark Office

Part of Paper No.: 20190809

Samsung Exhibit 1044, Page 120 of 638

Notice of References Cited	Application/Control No. 16/296,985	Applicant(s)/Patent Under Reexamination WANG et al.	
	Examiner Eduardo A Rodela	Art Unit 2893	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-20090166628-A1	07-2009	Han; Chang-Hun	H01L27/14632	257/53
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L7	38397	H01L31/00,02,02016,02027,0216,0232,02327,0236,02363,09,101,105.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/13 16:59
L8	10334	((light or photo or image) near (sens$3 or conversion or converting or detect$3)) and (PIN with diode)	US-PGPUB; USPAT; USOCR	OR	ON	2019/08/13 16:59
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L10	4	W&Wsens.as. and (wang near shih-yuan).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/13 17:15
S1	3	W&Wsens.as. and rodela.xp.	USPAT	OR	OFF	2019/08/12 09:55
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S5	48	("20050092925" | "20050184354" | "20070092192" | "20070190434" | "20080047604" | "20080102582" | "20080218740" | "20080229941" | "20080248608" | "20080265449" | "20090188557" | "20090267049" | "20100029067" | "20100126548" | "20100193768" | "20100197068" | "20100221866" | "20100313941" | "20120193676" | "20120292676" | "20130207222" | "20140001528" | "20150041965" | "20160225631" | "4571559" | "4637129" | "4716449" | "5451767" | "5457327" | "5625636" | "5757057" | "5886374" | "6027956" | "6177289" | "6867528" | "7115971" | "7397101" | "7495308" | "7601597" | "7674563" | "7772615" | "7795064" | "7893348" | "7898052" | "7972934" | "8114695" | "8129710" | "8436370").PN. OR ("9496435").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/08/12 11:58
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S17	30	("20030116767" | "20050139842" | "20050201439" | "20050285132" | "20080273335" | "20070018178" | "5585848" | "6323052" | "6492681" | "6552369" | "6857236" | "6784462" | "6797987" | "6858873" | "6992334" | "7154125" | "7355212" | "7375380").PN. OR ("8324652").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/08/13 11:53
S18	338	("3954534" | "5414281" | "5491350" | "5528057" | "5557115" | "5744828" | "5779924" | "5793062" | "6091085" | "6410942").PN. OR ("6857236").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/08/13 11:57
S19	4101	(light or photo or image) near (sens$3 or conversion or converting) with (PIN)	US-PGPUB; USPAT;	OR	ON	2019/08/13 12:07

			USOCR			
S20	82	(surface near (texture or divots or holes)) with photonic	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/13 12:35
S21	0	S19 and S20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/13 12:36
S22	3	"20120279553"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2019/08/13 13:04

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L11	0	H01L31/00,02,02016,02027,0216,0232,02327,0236,02363,09,101,105.cpc. and ((microstructure near enhanced near photodetector)(reverse-bias)(active near electronic near circuit)(single near substrate)(optical near input)(continuous near spatially)(electrical near output)(first near region)(intermediate near region)(second near region)(silicon or germanium)(holes)(doped near material) (undoped)(amplification)(processing)(communication near channel)(routing)(destinations)).clm.	US-PGPUB; USPAT	AND	ON	2019/08/13 17:18

8/13/2019 5:19:08 PM
C:\Users\erodela\Documents\EASTold\EAST\Workspaces\16296985.wsp

Examiner-Initiated Interview Summary	**Application No.** 16/296,985	**Applicant(s)** WANG et al.	
	Examiner Eduardo A Rodela	**Art Unit** 2893	**AIA (FITF) Status** Yes

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

(1) Eduardo A. Rodela, Examiner. (3) _____.

(2) Ivan S. Kavrukov, Applicant's Representative. (4) _____.

Date of Interview: 13 August 2019.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☐ 101 ☐ 112 ☐ 102 ☐ 103 ☑ Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 113.

Identification of prior art discussed: N/A.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/EDUARDO A RODELA/
Primary Examiner, Art Unit 2893

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: Examiner proposed amendments to claim 113, which would overcome potential 112 scope of enablement issues, which would arise if the clause , "at least one of said regions, or an overlying covering region that may be present, has holes intentionally formed therein" remained as such. The claim limitation could be interpreted to have the holes be present only in the covering layer, where the disclosure does not have support for this interpretation. Applicant's Representative agreed to the proposed amendment.

Bibliographic Data

Application No: 16/296,985

Foreign Priority claimed: ○ Yes ◉ No

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

Verified and Acknowledged: /EDUARDO A RODELA/ Examiner's Signature | Initials

Title: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
03/08/2019	257	2893	5176/88184-CIP-A
RULE			

APPLICANTS

W&WSens, Devices Inc., Los Altos, CA,

INVENTORS

Shih-Yuan WANG Palo Alto, CA, UNITED STATES

Shih-Ping WANG Los Altos, CA, UNITED STATES

M. Saif ISLAM Davis, CA, UNITED STATES

CONTINUING DATA

This application is a CON of 15797821 10/30/2017

15797821 has PRO of 62561869 09/22/2017

15797821 has PRO of 62556426 09/10/2017

15797821 has PRO of 62553844 09/02/2017

15797821 has PRO of 62547728 08/18/2017

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15797821 has PRO of 62522169 06/20/2017

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FOREIGN APPLICATIONS

IF REQUIRED, FOREIGN LICENSE GRANTED**

03/26/2019

**** SMALL ENTITY ****

STATE OR COUNTRY

UNITED STATES

ADDRESS

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112
UNITED STATES

FILING FEE RECEIVED

$1,985

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/296,985	WANG et al.
	Examiner	Art Unit
	Eduardo A Rodela	2893

CPC - Searched*		
Symbol	Date	Examiner
H01L31/00,02,02016,02027,0216,0232,02327,0236,02363,09,101,105	08/13/2019	EAR

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

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

Search Notes		
Search Notes	Date	Examiner
EAST search - see history for complete details	08/13/2019	EAR
Inventor and Applicant search	08/13/2019	EAR

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
noted CPC search area	in conjunction with a text search	08/13/2019	EAR

	/EDUARDO A RODELA/ Primary Examiner, Art Unit 2893

UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

23432 7590 08/15/2019

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

EXAMINER
RODELA, EDUARDO A

ART UNIT	PAPER NUMBER
2893	

DATE MAILED: 08/15/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

TITLE OF INVENTION: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/15/2019

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

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

HOW TO REPLY TO THIS NOTICE:

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

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

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

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

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

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

23432 7590 08/15/2019

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

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

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

TITLE OF INVENTION: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$500	$0.00	$0.00	$500	11/15/2019

EXAMINER	ART UNIT	CLASS-SUBCLASS
RODELA, EDUARDO A	2893	257-431000

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

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

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

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

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

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

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

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

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

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

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Samsung Exhibit 1044, Page 132 of 638

UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A	5511

23432 7590 08/15/2019

COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

EXAMINER	
RODELA, EDUARDO A	
ART UNIT	PAPER NUMBER
2893	

DATE MAILED: 08/15/2019

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

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

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

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

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

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

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

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/296,985	Applicant(s) WANG et al.	
	Examiner Eduardo A Rodela	Art Unit 2893	AIA (FITF) Status Yes

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

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

1. ☑ This communication is responsive to 3/8/2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

3. ☑ The allowed claim(s) is/are 113-156 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information , please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

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

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

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

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

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

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

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 4/2/2019.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. 8/13/2019.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/EDUARDO A RODELA/
Primary Examiner, Art Unit 2893

DETAILED ACTION

This correspondence is in response to the communications received March 8, 2019. Claims 113-156 are pending.

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee. Permission for the Examiner proposed amendment was granted by Applicant's Representative, Ivan S. Kavrukov, as discussed in the Examiner initiated interview conducted via telephone on August 13, 2019.

The application has been amended as follows:

In the Claims:

Regarding claim 113, please replace lines 11 and 12, with the following, "at least one of said regions, and an optional overlying covering region, have holes intentionally formed therein".

REASONS FOR ALLOWANCE

Claims 113-156 are allowed.

The following is an Examiner's statement of reasons for allowance: The single chip device comprising a microstructure enhanced photodetector and an electronic circuit as recited in the claims of the instant invention fail to be taught by the prior art cited of interest.

Regarding claim 113, prior art discloses a single chip device comprising a microstructure enhanced photodetector and an electronic circuit, but fails to disclose the specific characteristic recited in the claims of the instant invention e.g. the single substrate with the electronic circuit and the combination of features of the photodetector of particular materials with first region, intermediate region and second region and an optional overlying covering region, where each of the first and second regions are doped material, intermediate region is either less doped that first and second regions, or is undoped, wherein at least one of said regions and an optional overlying covering region have holes intentionally formed therein, and further with a reverse bias circuit energizing the photodetector, coupled with particulars of the electronic circuit arrangement which processes the output of the photodetector.

Double Patenting

The terminal disclaimers filed on March 8, 2019 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 9,818,893, US 9,530,905, US Application 16/042,535, US Application 15/797,821 (Allowed but patent not printed as of the time of this office action), US 9,530,905, US 9,496,435 and US 9,525,084 have been reviewed and are accepted. The terminal disclaimer has been recorded.

Fax / Telephone Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eduardo A Rodela whose telephone number is (571)272-8797. The examiner can normally be reached on M-F, 8:30-5:00pm ET.

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

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571) 272-1907. 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.

/EDUARDO A RODELA/
Primary Examiner, Art Unit 2893

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
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16296985
Filing Date	2019-03-08
First Named Inventor	Shih-Yuan WANG et al.
Art Unit	
Examiner Name	
Attorney Docket Number	5176/88184-CIP-A

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	4637129		1987-01-20	DERKITS G. JR et at.	
	2	5457327A		1995-10-10	TAGUCHI, K	
	3	7397101		2008-07-08	MASINI, G. et al.	
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	9	7674563		2010-03-09	Suda	
	10	8436370		2013-05-07	Park et al.	
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	20	7495306		2009-02-24	Langguth et al.	
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If you wish to add additional U.S. Patent citation information please click the Add button.

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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
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	2	20050184354		2005-08-25	CHU, J et al.	
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FOREIGN PATENT DOCUMENTS

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	1	WO2012149441	WO		2012-11-01	CHANG-HASNAIN, Connie et al.		☐
	2	WO2012034078	WO		2012-03-15	Wang, S.		☐
	3	WO2014190189	WO		2014-11-27	Wang, S.		☐
	4	WO2013180690	WO		2013-12-05	Hewlett-Packard Development Company, L.P.		☐
	5	WO2016081476	WO		2016-05-26	Wang, S.		☐
	6	WO2017112747	WO		2017-06-29	Wang, S.		☐
	7	6-53424	JP		1994-02-25	International Business Machines Corporation		☐
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NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	ZANG K. et al. "Silicon single-photon avalanche diodes with nano-structured light trapping" Nat. Comm. 2017, 8, 628	☐
	2	GAO, Y. et al. "Photon-trapping microstructures enable high-speed high-efficiency silicon photodiodes" Nature, 2017, 11, 301-308	☐
	3	International Search Report dated November 28 2014 in connection with PCT/US2014/39208	☐
	4	International Search Report dated December 23, 2011 in connection with PCT/US2011/051091	☐
	5	International Search report dated March 11, 2016 in connection with PCT/US2015/061120.	☐
	6	International Search report dated March 9, 2017 in connection with PCT/US2016/67977.	☐
	7	REN, R., et al., "Enhanced absorption in elliptical silicon nanowire arrays for solar energy harvesting", Optical Engineering, Vol 53(2), 027102, February, (2014), http://opticalengineering.spiedigitallibrary.org/article.aspx?articleid=1828860	☐
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	10	GASCA, L., "From O to L: The Future of Optical-Wavelength Bands," BROADBAND PROPERTIES, June 2008, pp 83-85. www.broadbandproperties.com	☐
	11	"FINISAR, "World's Largest Supplier of Optical Solutions for the Communications Industry."http://files.shareholder.com/downloads/FNSR/0x0x382377/0b3893ea-fb06-417d-ac71-84f2f9084b0d/Finisar_Investor_Presentation.pdf,)"	☐
	12	SILVACO., "Investigation of the SiGe Waveguide Phototides Using FDTD Method for High Speed Optical Communication, " Simulation Standard, http://www.silvaco.com/tech_lib_TCAD/simulationstandard/2010/apr_may_jun/a1/a1.html)	☐
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	17	KANG, Y., "Monolithic Ge/Si Avalnache Photodiodes," 978-1-4244-4403, IEEE, (2009).	☐
	18	LIU, A.Y., et al., Quantum Dot Lasers on Silicon," aUCSB Materials Department, Santa Barbara, California, USA, bUCSB Department of Electrical and Computer Engineering, Santa Barbara, California, USA.	☐
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	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
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U.S.PATENTS

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Dkt. 5176/88184-CIP-A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Shih-Yuan WANG et al.

Application No.: 16/296,985 Date Filed: March 8, 2019

For: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

This correspondence is being filed electronically with the U.S. Patent and Trademark Office via EFS-Web.

/Thomas Trainor/ **April 2, 2019**

Thomas Trainor Date

30 Rockefeller Plaza, 20th Floor
New York, New York 10112
Tel.: (212) 278-0400

INFORMATION DISCLOSURE STATEMENT

Applicants hereby provide the Examiner with updated information regarding applications/patents with related subject matter:

1. Application No. 14/947,718, filed November 20, 2015, published as publication no. US 2016/0254407 A1 on September 1, 2016;

2. Application No. 14/892,821 filed November 20, 2015, published as publication no. US 2016/0126381 A1 on May 5, 2016, now US 9,496,435 issued November 15, 2016;

3. Application No. 14/943,898 filed November 17, 2015, published as publication no. US 2016/0307939 A1 on October 20, 2016, now US 9,530,905 issued December 27, 2016;

4. Application No. 14/945,003 filed November 18, 2015, published as publication no. US 2016/0308075 A1 on October 20, 2016, now US 9,525,084 issued December 20, 2016;

5. Application No. 15/309,922 filed November 9, 2016, published as publication no. US 2017/0194522 A1 US on July 6, 2017, now US 9,818,893 issued November 14, 2017;

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6. Application No. 15/797,821 filed October 30, 2017, published as publication no. US 2018/0102442 A1 on April 12, 2018;

7. Application No. 13/821,963 filed October 22, 2013, published as publication no. US 2014/0034120 A1 on February 6, 2014, now US 9,559,231 issued January 31, 2017;

8. International Application No. PCT/US14/39208 filed May 22, 2014;

9. International Application No. PCT/US15/61120 filed November 17, 2015;

10. International Application No. PCT/US16/67977 filed December 21, 2016; and

11. International Application No. PCT/US11/51091 filed September 9, 2011.

Applicants direct the Examiner's attention to the claims of the above-identified patents and applications for consideration regarding any double-patenting issues, and request the Examiner to consider the references cited in the prosecution of said patents/applications.

No fees are believed to be required in connection with this filing. Nevertheless, the Patent Office is hereby authorized to charge any fees that are required for consideration of this Information Disclosure Statement, and to credit any overpayment during prosecution of this application, to our Deposit Account No. 03-3125.

Respectfully submitted,

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/EDUARDO A RODELA/

08/13/2019

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Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	23432
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31	Non Patent Literature	30_Wang_InP_based_balanced_photodetector.pdf	1628786 dbc46e8275d32e43130765e7e7de1d44fdcf6b09	no	4
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32	Non Patent Literature	31_Yokogawa_IR_sensitivity_enhancement_of_CMOS_Image_Sensor.pdf	2926109 81980725afc7ca907eb9c66b1fd7dd3e04706f70	no	9
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33	Non Patent Literature	32_Simpanen_Long-Reach_1060_nm_SM_VCSEL.pdf	332201 78a8aed50be3237afbcb26c8a016149041d36bd8	no	3
Warnings:					
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34	Non Patent Literature	33_Heroux_Low_power_CMOS-driven_1060_nm_multimode_optical_link.pdf	713810 0011650da706dd7d04c0549b5e5fd03a1d66a01c	no	3
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35	Non Patent Literature	34_Kang_Monolithic_germanium_silicon_avalanche_photodiodes.pdf	2763889 86341a55f38fc4bbc1dca1006a0e82209adecee9	no	5
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36	Non Patent Literature	35_Knoll_monolithic_integration_25G_Ge_waveguide_PD_and_BiCMOS.pdf	630405 5aaf3f0f0dde5c0e38e843d3bf0debe36f405aee	no	3
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37	Non Patent Literature	36_Piemonte_Overview_on_the_main_parameters_and_technology_modern_Silicon_Photomultipliers.pdf	2289526 0f5de353e9f602a825d8ec7888395c6ed987a817	no	14
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38	Non Patent Literature	37_Photodetector_lidar_kapd0005e.pdf	2370883 54ccaed1a687378b4cc13f0441cf6a07f156b858	no	15
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40	Non Patent Literature	39_Zhang_CMOS_SPAD_Imager.pdf	6416025 42298d2cc8dfca7f01375cd944107f7445c07779	no	19
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41	Non Patent Literature	40_Youn_Si_APD_2012_OFC.pdf	808404 e02ac38b3fe6db26d8bdb814ad7530b6b9fc8b86	no	3
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45	Non Patent Literature	44_Beer_SPAD-based_flash_LiDAR_sensor.pdf	880772 635a695806576f90c1cbae20dd60f9021e14b7a8	no	9
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47	Non Patent Literature	46_Runge_WaveguideIntegratedBalancedPhotodetectorsforCoherentReceive.pdf	3140747 4773c4693b3fc1a17d1b6a284067201731a6319b	no	7
Warnings:					
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48	Non Patent Literature	47_WaveguidedGe_SiAvalanchePhotodiode.pdf	307625 e3505e507044fa4ac1a12feb23f0bd61a53850b4	no	3
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First Named Inventor	Shih-Yuan WANG
Art Unit	
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Attorney Docket Number	5176/88184-CIP-A

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Signature	Ivan S. Kavrukov	Date (YYYY-MM-DD)	2019-08-14
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Date Mailed: 06/12/2019

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

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

Inventor(s)

Shih-Yuan WANG, Palo Alto, CA;
Shih-Ping WANG, Los Altos, CA;
M. Saif ISLAM, Davis, CA;

Applicant(s)

W&WSens, Devices Inc., Los Altos, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/797,821 10/30/2017
which is a CIP of 15/309,922 11/09/2016 PAT 9818893
which is a 371 of PCT/US2015/061120 11/17/2015
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,675 04/29/2015
and claims benefit of 62/157,876 05/06/2015
and claims benefit of 62/171,915 06/05/2015
and claims benefit of 62/174,498 06/11/2015
and claims benefit of 62/175,855 06/15/2015

and claims benefit of 62/182,602 06/21/2015
and claims benefit of 62/188,876 07/06/2015
and claims benefit of 62/197,120 07/27/2015
and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/309,922 11/09/2016
is a CON of 14/943,898 11/17/2015 PAT 9530905
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,975 04/30/2015
and claims benefit of 62/157,876 05/06/2015
and claims benefit of 62/171,915 06/05/2015
and claims benefit of 62/174,498 06/11/2015
and claims benefit of 62/175,855 06/15/2015
and claims benefit of 62/182,602 06/21/2015
and claims benefit of 62/188,876 07/06/2015
and claims benefit of 62/197,120 07/27/2015
and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/309,922 11/09/2016
is a CON of 14/945,003 11/18/2015 PAT 9525084
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,675 04/29/2015
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and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/797,821 10/30/2017

is a CIP of 14/947,718 11/20/2015
which is a CON of PCT/US2014/039208 05/22/2014
which claims benefit of 61/826,446 05/22/2013
and claims benefit of 61/834,873 06/13/2013
and claims benefit of 61/843,021 07/04/2013
and said 15/797,821 10/30/2017
is a CIP of PCT/US16/67977 12/21/2016
which claims benefit of 62/270,577 12/21/2015
and claims benefit of 62/290,391 02/02/2016
and claims benefit of 62/304,907 03/07/2016
and claims benefit of 62/334,934 05/11/2016
and claims benefit of 62/338,263 05/18/2016
and claims benefit of 62/346,850 06/07/2016
and claims benefit of 62/359,349 07/07/2016
and claims benefit of 62/366,188 07/25/2016
and claims benefit of 62/368,109 07/28/2016
and claims benefit of 62/374,828 08/13/2016
and claims benefit of 62/376,869 08/18/2016
and claims benefit of 62/380,364 08/27/2016
and claims benefit of 62/383,391 09/03/2016
and claims benefit of 62/383,479 09/04/2016
and claims benefit of 62/394,222 09/14/2016
and claims benefit of 62/398,607 09/23/2016
and claims benefit of 62/401,126 09/28/2016
and claims benefit of 62/406,999 10/12/2016
and claims benefit of 62/414,671 10/29/2016
and claims benefit of 62/415,339 10/31/2016
and said 15/797,821 10/30/2017
claims benefit of 62/465,734 03/01/2017
and claims benefit of 62/474,179 03/21/2017
and claims benefit of 62/484,474 04/12/2017
and claims benefit of 62/487,606 04/20/2017
and claims benefit of 62/488,998 04/24/2017
and claims benefit of 62/500,581 05/03/2017
and claims benefit of 62/505,974 05/14/2017
and claims benefit of 62/509,093 05/20/2017
and claims benefit of 62/510,249 05/23/2017
and claims benefit of 62/514,889 06/04/2017
and claims benefit of 62/521,507 06/18/2017
and claims benefit of 62/522,169 06/20/2017
and claims benefit of 62/527,962 06/30/2017
and claims benefit of 62/530,281 07/09/2017
and claims benefit of 62/533,078 07/16/2017
and claims benefit of 62/533,603 07/17/2017
and claims benefit of 62/535,801 07/21/2017
and claims benefit of 62/540,524 08/02/2017
and claims benefit of 62/542,243 08/07/2017
and claims benefit of 62/547,728 08/18/2017
and claims benefit of 62/553,844 09/02/2017
and claims benefit of 62/556,426 09/10/2017
and claims benefit of 62/561,869 09/22/2017

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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

If Required, Foreign Filing License Granted: 03/26/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/296,985**

Projected Publication Date: 09/19/2019

Non-Publication Request: No

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

MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

Preliminary Class

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

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

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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

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

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

SelectUSA

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Samsung Exhibit 1044, Page 197 of 638

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/296,985

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	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	44 minus 20 =	* 24	x 50 =	1200	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			600			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	2585		TOTAL	

APPLICATION AS AMENDED - PART II

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	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	

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	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 found in the appropriate box in column 1.

Electronic Acknowledgement Receipt

EFS ID:	36270542
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	23432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	11-JUN-2019
Filing Date:	08-MAR-2019
Time Stamp:	18:28:49
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$700
RAM confirmation Number	061219INTEFSW00005524033125
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	88184-CIP-A--Response_NTFMP.pdf	43771 a8562532614bad15e362b0cf2a660af43ad81bed	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32648 786198e91011cd3aed579e61d9632b8e86ab2ae9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	76419		

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.

Docket No. 5176/88184-CIP-A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: W&WSens, Devices Inc.

Application No.: 16/296,985

Filed: March 8, 2019 Confirmation No.: 5511

For: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

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

Sir:

RESPONSE TO MARCH 27, 2019 NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION – FILING DATE GRANTED AND PETITION FOR ONE-MONTH EXTENSION OF TIME

The Notice To File Missing Parts of Nonprovisional Application – Filing Date Granted dated March 27, 2019 indicates that an application size fee of $600.00 for 150 electronically equivalent pages in excess of 100 is required. A response to the Notice was due within two months from the mail date of the decision (i.e. by May 27, 2019). Applicant hereby petitions for a one-month extension of time from May 27, 2019 to June 27, 2019.

The Patent Office is authorized to charge the $600.00 application size fee, the $100.00 fee for the petition for one-month extension of time, and any required fees, and to credit any overpayment, to Deposit Account No. 03-3125.

Respectfully submitted,

/Ivan S. Kavrukov/

This correspondence is being filed electronically with the U.S. Patent and Trademark Office via EFS-Web.

/Thomas Trainor/ June 11, 2019

Thomas Trainor Date

Ivan S. Kavrukov, Reg. No 25,161
Attorney for Applicant
COOPER & DUNHAM LLP
30 Rockefeller Center, 20th Floor
New York, New York 10112
Tel.: (212) 278-0400

Electronic Patent Application Fee Transmittal

Application Number:	16296985
Filing Date:	08-Mar-2019
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Filer:	Ivan Kavrukov/Thomas Trainor
Attorney Docket Number:	5176/88184-CIP-A

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
UTILITY APPL SIZE FEE PER 50 SHEETS >100	2081	3	200	600
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	100	100
Miscellaneous:				
			Total in USD ($)	**700**

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/296,985

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	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
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INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			600			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	2585		TOTAL	

APPLICATION AS AMENDED - PART II

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	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	

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	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.
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*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A

CONFIRMATION NO. 5511

23432
COOPER & DUNHAM, LLP
30 Rockefeller Plaza
20th Floor
NEW YORK, NY 10112

FORMALITIES LETTER

OC000000108796431

Date Mailed: 06/10/2019

NOTICE OF INCOMPLETE REPLY (NONPROVISIONAL)

Filing Date Granted

The U.S. Patent and Trademark Office has received your reply on 06/07/2019 to the NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION (Notice) mailed 03/27/2019 and it has been entered into the application. The reply, however, is not a complete reply for the reason(s) listed below. A complete reply must be timely filed to prevent ABANDONMENT of the above-identified application. Replies should be mailed to: Mail Stop Missing Parts, Commissioner for Patents, P.O.Box 1450, Alexandria VA 22313-1450.

The period for reply continues to run from the date of the Notice mailed 03/27/2019. Applicant must submit 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 appropriate extension fee under the provisions of 37 CFR 1.136(a).

Applicant's reply to the Notice mailed on 03/27/2019 was received in the U.S. Patent and Trademark Office on 06/07/2019, after the expiration of the two month period for reply set forth in the Notice. The application will become abandoned unless applicant obtains an extension of the period for reply, as above. The petition must be accompanied by the appropriate fee as set forth in 37 CFR 1.17 (see the current fees below). The date on which the reply, the petition, and the fee have been filed is the date of the reply and also the date for purposes of determining the period of extension and the corresponding amount of the fee due. The expiration of the time period is determined by the amount of the fee paid. Applicant is advised that extensions may not be granted under 37 CFR 1.136(a) for more than FIVE MONTHS beyond the time period set in the Notice.

Items Required to Avoid Abandonment:

The required items noted below SHOULD be filed along with any items required above.

SUMMARY OF FEES DUE:

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

- $ **600** for **150** electronically equivalent pages in excess of **100** application size fee.
- $(**0**) previous unapplied payment amount.
- $ **600** TOTAL FEE BALANCE DUE.

Mail date of Notice: 03/27/2019

Last date that extension may be obtained: (Note: The petition and fee must be received by this date, or include a proper certificate of mailing under 37 CFR 1.8 with a date on or before this date, and extend the time to include this date.) 10/27/2019

Length of Extension of Time	Fee under 37 CFR 1.17(a) effective March 19, 2013		
(response due on or before)	Undiscounted	Small Entity	Micro Entity
One Month (06/27/2019)	$200	$100	$50
Two Months (07/27/2019)	$600	$300	$150
Three Months (08/27/2019)	$1400	$700	$350
Four Months (09/27/2019)	$2200	$1100	$550
Five Months (10/27/2019)	$3000	$1500	$750

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

Replies should be mailed to:

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, including a copy of this Notice and selecting the document description "Applicant response to Pre-Exam Formalities Notice". https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

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

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

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

/ltaba/

Electronic Acknowledgement Receipt

EFS ID:	36234738
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	32432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	07-JUN-2019
Filing Date:	08-MAR-2019
Time Stamp:	12:29:55
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	Change of Address	88184-CIP-A--Change_Correspondence_Address.pdf	58648 af242cb33468ca32b320e96c45a47e7f30debaaf	no	1

Warnings:

Information:	
Total Files Size (in bytes):	58648

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/AIA/122 (08-12)
Approved for use through 03/31/2021. OMB 0651-0035
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Application

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

Application Number	16/296,985
Filing Date	March 8, 2019
First Named Inventor	Shih-Yuan WANG
Art Unit	
Examiner Name	
Attorney Docket Number	5176/88184-CIP-A

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I am the:

☐ Applicant

☒ Attorney or agent of record. Registration Number 25161.

☐ Registered practitioner named in the application transmittal papers who acts in a representative capacity under 37 CFR 1.34. See 37 CFR 1.33(a)(1). Registration Number _____.

Signature /Ivan Kavrukov/

Typed or Printed Name Ivan Kavrukov

Date June 7, 2019	Telephone (212) 278-0400

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. 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 1.33. 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:	35608472
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	32432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	02-APR-2019
Filing Date:	08-MAR-2019
Time Stamp:	18:17:48
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		88184-CIP-A--IDS.pdf	1843016 0ec10aa5f5ce8acf2032905fcb579af94b82d692	yes	35

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Transmittal Letter	3	4
	Information Disclosure Statement (IDS) Form (SB08)	5	35
Warnings:			
Information:			
	Total Files Size (in bytes):	1843016	

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

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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/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	16296985
Filing Date	2019-03-08
First Named Inventor	Shih-Yuan WANG et al.
Art Unit	
Examiner Name	
Attorney Docket Number	5176/88184-CIP-A

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	4637129		1987-01-20	DERKITS G. JR et at.	
	2	5457327A		1995-10-10	TAGUCHI, K	
	3	7397101		2008-07-08	MASINI, G. et al.	
	4	7795064		2010-09-14	PAN, Z et al.	
	5	7893348		2011-02-22	Korevaar, B	
	6	8129710		2012-03-06	Cho, et al.	
	7	7601597		2009-10-13	Takei, M.	
	8	7115971		2006-10-03	Stumbo	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	9	7674563		2010-03-09	Suda	
	10	8436370		2013-05-07	Park et al.	
	11	5451767		1995-09-19	Amano et al.	
	12	4716449		1987-12-29	Miller	
	13	8114695		2012-02-14	Masuoka et al.	
	14	7772615		2010-08-10	Ledentsov et al.	
	15	5625636		1997-04-29	Bryan et al.	
	16	5757057		1998-05-26	Dabrowski	
	17	5886374		1999-03-23	Sakamoto et al.	
	18	6027956		2000-02-22	Irissou	
	19	7898052		2011-03-01	Prantl et al.	

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	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	20	7495306		2009-02-24	Langguth et al.	
	21	7972934		2011-07-05	Wilson et al.	
	22	4571559		1986-02-18	Henry et al.	
	23	6667528		2003-12-23	Cohen et al.	
	24	6177289		2001-01-23	Crow et al.	
	25	8357960		2013-01-22	Achyut Kumar Dutta	
	26	7161220		2007-01-09	Cohen	
	27	7977637		2011-07-12	Yap et al.	
	28	7340709		2008-03-04	Masini et al.	
	29	4292512		1981-09-29	Miller et al.	
	30	7251386		2007-07-31	Dickinson et al.	

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	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	31	9045418		2015-06-02	Jordan et al.	
	32	6879014		2005-04-12	Wagner et al.	
	33	4814847		1989-03-21	Tabatabaie	
	34	8319241		2012-11-27	Gyu NA et al.	
	35	6392282		2002-05-21	Sahara et al.	
	36	9525084		2016-12-20	Wang et al.	
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	38	6724798		2004-04-20	Liu et al.	
	39	5244749		1993-09-14	Bean et al.	
	40	6845034		2005-01-18	Bhattacharyya	
	41	9818893		2017-11-14	Wang et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	42	9496435		2016-11-15	Wang et al.	
	43	5525828		1996-06-11	Bassous et al.	
	44	7605406		2009-10-20	Iguchi	
	45	9360554		2016-06-07	Facet Technology Corp	
	46	8728847		2014-05-20	Maruyama et al.	

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	20050092925		2005-05-05	ZENTAI, G et al.	
	2	20050184354		2005-08-25	CHU, J et al.	
	3	20070092192		2007-04-26	ACHOUCHE, M et al.	
	4	20080218740		2008-09-11	WILLIAMS. R. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	5	20100193768		2010-08-05	Habib	
	6	20100197068		2010-08-05	Poon	
	7	20100126548		2010-05-27	JANG, ET AL.	
	8	20080265449		2008-10-30	Meinders et al.	
	9	20090188557		2009-07-30	Wang et al.	
	10	20080229941		2008-09-25	Heidari	
	11	20080047604		2008-02-28	Korevaar et al.	
	12	20090267049		2009-10-29	Cho et al.	
	13	20080102582		2008-01-05	Takei	
	14	20070190434		2007-08-16	Suda	
	15	20100313941		2010-12-01	Huang	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	16	20100029067		2010-02-01	Vijh	
	17	20100221866		2010-09-01	Graham	
	18	20130207222		2013-08-15	QU et al.	
	19	20140001528		2014-01-02	Pfirsch et al.	
	20	20120292676		2012-11-22	Pan	
	21	20080248608		2008-10-09	Wilson et al.	
	22	20120193676		2012-08-02	Bobde et al.	
	23	20150041965		2015-02-12	Schulze et al.	
	24	20160225631		2016-08-04	JUN et al.	
	25	20030122210		2007-07-03	Cohen	
	26	20070215968		2007-09-20	Wilson; Robin	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	27	20110000545		2011-01-06	Nishi et al.	
	28	20120141122		2012-06-07	Carusone et al.	
	29	20130009265		2013-01-10	DAUTET et al.	
	30	20140225063		2014-08-14	KLEM et al.	
	31	20140167107		2014-06-19	YONEDA et al.	
	32	20140263975		2014-09-18	Nagano et al.	
	33	20060186501		2006-08-24	Ishimura	
	34	20090321868		2009-12-31	Nakaji	
	35	20130114629		2013-05-09	Firth et al.	
	36	20080080854		2008-04-03	Tian et al.	
	37	20100288341		2010-11-18	Kim et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	38	20100308428		2010-12-09	Okamoto et al.	
	39	20090230498		2009-09-17	Iwai et al.	
	40	20120153260		2012-06-21	Kim et al.	
	41	20100148318		2010-06-17	Wang et al.	
	42	20090225804		2009-09-10	Sasahata et al.	
	43	20070277869		2007-12-06	Shan	
	44	20130084044		2013-04-04	Ertel et al.	
	45	20130230272		2013-09-05	Raj et al.	
	46	20100059789		2010-03-11	Choi	
	47	20120279553		2012-11-08	Shigeta et al.	
	48	20090008735		2009-01-08	Ogino et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
	Filing Date	2019-03-08
	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

	49	20030059820		2003-03-27	Vo-Dinh	
	50	20100059822		2010-03-11	Pinguet et al.	
	51	20080079022		2008-04-03	Yamamoto et al.	
	52	20070170536		2007-07-26	Hsu et al.	
	53	20060267054		2006-11-30	Martin et al.	
	54	20150054997		2015-02-26	Aptina Imaging Corporation	
	55	20160254407		2016-09-01	Wang et al.	
	56	20040222357		2004-11-11	King et al.	
	57	20020097962		2002-07-25	Yoshimura et al.	
	58	20150340538		2015-11-26	Coriant Advanced Technology	
	59	20160240718		2016-08-18	FCI Americas Technology LLC	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	WO2012149441	WO		2012-11-01	CHANG-HASNAIN, Connie et al.		☐
	2	WO2012034078	WO		2012-03-15	Wang, S.		☐
	3	WO2014190189	WO		2014-11-27	Wang, S.		☐
	4	WO2013180690	WO		2013-12-05	Hewlett-Packard Development Company, L.P.		☐
	5	WO2016081476	WO		2016-05-26	Wang, S.		☐
	6	WO2017112747	WO		2017-06-29	Wang, S.		☐
	7	6-53424	JP		1994-02-25	International Business Machines Corporation		☐
	8	2003-142778	JP		2003-05-16	CIT ALCATEL		☒
	9	2012-502466	JP		2012-01-26	Samuleson et al.		☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16296985
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

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.	T5
	1	ZANG K. et al. "Silicon single-photon avalanche diodes with nano-structured light trapping" Nat. Comm. 2017, 8, 628	☐
	2	GAO, Y. et al. "Photon-trapping microstructures enable high-speed high-efficiency silicon photodiodes" Nature, 2017, 11, 301-308	☐
	3	International Search Report dated November 28 2014 in connection with PCT/US2014/39208	☐
	4	International Search Report dated December 23, 2011 in connection with PCT/US2011/051091	☐
	5	International Search report dated March 11, 2016 in connection with PCT/US2015/061120.	☐
	6	International Search report dated March 9, 2017 in connection with PCT/US2016/67977.	☐
	7	REN, R., et al., "Enhanced absorption in elliptical silicon nanowire arrays for solar energy harvesting", Optical Engineering, Vol 53(2), 027102, February, (2014), http://opticalengineering.spiedigitallibrary.org/article.aspx?articleid=1828860	☐
	8	DAYAL, G., et al, "Broadband infrared metamaterial absorber with visible transparency using ITO as ground plane", OPTICS EXPRESS 15104 June (2014).	☐
	9	DONNELLY, J. L., et al., "Mode-based analysis of silicon nanohole arrays for photovoltaic applications," Vol. 22, No. S5, OPTICS EXPRESS, A1343, August 25 (2014).	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	Shih-Yuan WANG et al.
	Art Unit	
	Examiner Name	
	Attorney Docket Number	5176/88184-CIP-A

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

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Attorney Docket Number	5176/88184-CIP-A

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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	1	Zang et al., "Silicon single-photon avalanche diodes with nanostructured light trapping" NATURE COMMUNICATIONS | 8: 628 (September 20 2017)	☐
	2	Liu et al. "Tensile strained Ge photodetectors on Si platform for C and L band telecommunications", Appl. Phys. Lett. 87 (2005). American Institute of Physics. pp. 011110-1-011110-3.	☐
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	7	July 16, 2018 European Search Report issued by the European Patent Office in connection with European Patent Application No. 15861593.0	☐
	8	January 8, 2019 official action issued by the Japanese Patent Office in connection with Japanese Patent Application No. 2016-515097	☒
	9	January 15, 2019 International Search Report of the International Searching Authority in connection with PCT/ US2018/057963	☐
	10	February 12, 2019 International Search Report of the International Searching Authority in connection with PCT/ US2018/043289	☐
	11	Yokogawa, s., et al. IR sensitivity enhancement of CMOS Image Sensor with diffractive light trapping pixels, Scientific Reports/7:3832/DOI:10.1038/s41598-017-04200-y, 19 June 2017.	☐

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Shih-Yuan WANG et al.

Application No.: 16/296,985 Date Filed: March 8, 2019

For: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

This correspondence is being filed electronically with the U.S. Patent and Trademark Office via EFS-Web.	
/Thomas Trainor/	**April 2, 2019**
Thomas Trainor	Date

30 Rockefeller Plaza, 20th Floor
New York, New York 10112
Tel.: (212) 278-0400

INFORMATION DISCLOSURE STATEMENT

Applicants hereby provide the Examiner with updated information regarding applications/patents with related subject matter:

1. Application No. 14/947,718, filed November 20, 2015, published as publication no. US 2016/0254407 A1 on September 1, 2016;

2. Application No. 14/892,821 filed November 20, 2015, published as publication no. US 2016/0126381 A1 on May 5, 2016, now US 9,496,435 issued November 15, 2016;

3. Application No. 14/943,898 filed November 17, 2015, published as publication no. US 2016/0307939 A1 on October 20, 2016, now US 9,530,905 issued December 27, 2016;

4. Application No. 14/945,003 filed November 18, 2015, published as publication no. US 2016/0308075 A1 on October 20, 2016, now US 9,525,084 issued December 20, 2016;

5. Application No. 15/309,922 filed November 9, 2016, published as publication no. US 2017/0194522 A1 US on July 6, 2017, now US 9,818,893 issued November 14, 2017;

6. Application No. 15/797,821 filed October 30, 2017, published as publication no. US 2018/0102442 A1 on April 12, 2018;

7. Application No. 13/821,963 filed October 22, 2013, published as publication no. US 2014/0034120 A1 on February 6, 2014, now US 9,559,231 issued January 31, 2017;

8. International Application No. PCT/US14/39208 filed May 22, 2014;

9. International Application No. PCT/US15/61120 filed November 17, 2015;

10. International Application No. PCT/US16/67977 filed December 21, 2016; and

11. International Application No. PCT/US11/51091 filed September 9, 2011.

Applicants direct the Examiner's attention to the claims of the above-identified patents and applications for consideration regarding any double-patenting issues, and request the Examiner to consider the references cited in the prosecution of said patents/applications.

No fees are believed to be required in connection with this filing. Nevertheless, the Patent Office is hereby authorized to charge any fees that are required for consideration of this Information Disclosure Statement, and to credit any overpayment during prosecution of this application, to our Deposit Account No. 03-3125.

Respectfully submitted,

/Ivan Kavrukov/

Ivan Kavrukov, Reg. No. 25,161
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Dkt. 5176/88184-CIP-A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Shih-Yuan WANG et al.

Application No.: 16/296,985 Date Filed: March 8, 2019

For: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

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/Thomas Trainor/ **April 2, 2019**

Thomas Trainor Date

30 Rockefeller Plaza, 20th Floor
New York, New York 10112
Tel.: (212) 278-0400

INFORMATION DISCLOSURE STATEMENT

This IDS is being filed pursuant to 37 C.F.R. §1.97(b)(1) within three months after the March 8, 2019 filing date of this application.

The above-identified application claims benefit under 35 U.S.C §120 of Application No. 15/797,821, filed October 30, 2017 which is (i) a continuation-in-part of Application No. 15/309,922 filed November 9, 2016, (ii) a continuation-in-part of PCT/US2016/67977 filed December 21, 2016, and (iii) a continuation-in-part of Application No. 14/947,718 filed November 20, 2015. Application No. 15/309,922 is (I) a Sect. 371 National Stage entry of PCT/US2015/061120 filed November 17, 2015, (II) a continuation of Application No. 14/943,898 filed November 17, 2015, and (III) a continuation of Application No. 14/945,003 filed November 18, 2015.

In accordance with 37 C.F.R. §1.98, copies of references which have previously been submitted to, or cited by the U.S. Patent Office in connection with the aforementioned applications to which the present application claims benefit are not being provided.

It is respectfully requested that the information cited in annexed Forms PTO/SB/08a (01-10) be considered by the Examiner in connection with the above-identified patent application, and that such art be made of record in said application.

The citation of the listed items is not a representation that they constitute a complete or exhaustive listing of the relevant art or that these items are prior art. The items listed are submitted

in good faith, but are not intended to substitute for the Examiner's search. It is hoped, however, that in addition to apprising the Examiner of the particular items, they will assist in identifying fields of search and in making as full and complete a search as possible.

The filing of this Information Disclosure Statement is not an admission that the information cited herein is, or is considered to be, material to patentability as defined in 37 C.F.R. §1.56(b).

No fees are believed to be required in connection with this filing. Nevertheless, the Patent Office is hereby authorized to charge any fees that are required for consideration of this Information Disclosure Statement, and to credit any overpayment during prosecution of this application, to our Deposit Account No. 03-3125.

Respectfully submitted,

/Ivan Kavrukov/

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/296,985

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	75		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	330		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	380		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	44 minus 20 =	* 24	x 50 =	1200	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*	x 230 =	0.00			
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			600			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	2585		TOTAL	

APPLICATION AS AMENDED - PART II

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	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	

		(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($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	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".

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/296,985	03/08/2019	Shih-Yuan WANG	5176/88184-CIP-A

CONFIRMATION NO. 5511

32432
DAN CREIGHTON
699 SEAPORT BLVD.
REDWOOD CITY, CA 94063

FORMALITIES LETTER

OC000000106905386

Date Mailed: 03/27/2019

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

SUMMARY OF FEES DUE:

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

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

/elbanaybanay/

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
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/296,985	03/08/2019		1985	5176/88184-CIP-A	44	1

CONFIRMATION NO. 5511

32432
DAN CREIGHTON
699 SEAPORT BLVD.
REDWOOD CITY, CA 94063

FILING RECEIPT

OC000000108905385

Date Mailed: 03/27/2019

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 submit a written request for a Filing Receipt Correction. 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**

Inventor(s)

Shih-Yuan WANG, Palo Alto, CA;
Shih-Ping WANG, Los Altos, CA;
M. Saif ISLAM, Davis, CA;

Applicant(s)

W&WSens, Devices Inc., Los Altos, CA;

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 15/797,821 10/30/2017
which is a CIP of 15/309,922 11/09/2016 PAT 9818893
which is a 371 of PCT/US2015/061120 11/17/2015
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,675 04/29/2015
and claims benefit of 62/157,876 05/06/2015
and claims benefit of 62/171,915 06/05/2015
and claims benefit of 62/174,498 06/11/2015
and claims benefit of 62/175,855 06/15/2015
and claims benefit of 62/182,602 06/21/2015
and claims benefit of 62/188,876 07/06/2015
and claims benefit of 62/197,120 07/27/2015

and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/309,922 11/09/2016
is a CON of 14/943,898 11/17/2015 PAT 9530905
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,975 04/30/2015
and claims benefit of 62/157,876 05/06/2015
and claims benefit of 62/171,915 06/05/2015
and claims benefit of 62/174,498 06/11/2015
and claims benefit of 62/175,855 06/15/2015
and claims benefit of 62/182,602 06/21/2015
and claims benefit of 62/188,876 07/06/2015
and claims benefit of 62/197,120 07/27/2015
and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/309,922 11/09/2016
is a CON of 14/945,003 11/18/2015 PAT 9525084
which claims benefit of 62/081,538 11/18/2014
and claims benefit of 62/090,879 12/11/2014
and claims benefit of 62/100,025 01/05/2015
and claims benefit of 62/111,582 02/03/2015
and claims benefit of 62/139,511 03/27/2015
and claims benefit of 62/153,443 04/27/2015
and claims benefit of 62/154,675 04/29/2015
and claims benefit of 62/157,876 05/06/2015
and claims benefit of 62/171,915 06/05/2015
and claims benefit of 62/174,498 06/11/2015
and claims benefit of 62/175,855 06/15/2015
and claims benefit of 62/182,602 06/21/2015
and claims benefit of 62/188,876 07/06/2015
and claims benefit of 62/197,120 07/27/2015
and claims benefit of 62/199,607 07/31/2015
and claims benefit of 62/205,717 08/15/2015
and claims benefit of 62/209,311 08/24/2015
and claims benefit of 62/213,556 09/02/2015
and claims benefit of 62/232,716 09/25/2015
and said 15/797,821 10/30/2017
is a CIP of 14/947,718 11/20/2015
which is a CON of PCT/US2014/039208 05/22/2014
which claims benefit of 61/826,446 05/22/2013

and claims benefit of 61/834,873 06/13/2013
and claims benefit of 61/843,021 07/04/2013
and said 15/797,821 10/30/2017
is a CIP of PCT/US16/67977 12/21/2016
which claims benefit of 62/270,577 12/21/2015
and claims benefit of 62/290,391 02/02/2016
and claims benefit of 62/304,907 03/07/2016
and claims benefit of 62/334,934 05/11/2016
and claims benefit of 62/338,263 05/18/2016
and claims benefit of 62/346,850 06/07/2016
and claims benefit of 62/359,349 07/07/2016
and claims benefit of 62/366,188 07/25/2016
and claims benefit of 62/368,109 07/28/2016
and claims benefit of 62/374,828 08/13/2016
and claims benefit of 62/376,869 08/18/2016
and claims benefit of 62/380,364 08/27/2016
and claims benefit of 62/383,391 09/03/2016
and claims benefit of 62/383,479 09/04/2016
and claims benefit of 62/394,222 09/14/2016
and claims benefit of 62/398,607 09/23/2016
and claims benefit of 62/401,126 09/28/2016
and claims benefit of 62/406,999 10/12/2016
and claims benefit of 62/414,671 10/29/2016
and claims benefit of 62/415,339 10/31/2016
and said 15/797,821 10/30/2017
claims benefit of 62/465,734 03/01/2017
and claims benefit of 62/474,179 03/21/2017
and claims benefit of 62/484,474 04/12/2017
and claims benefit of 62/487,606 04/20/2017
and claims benefit of 62/488,998 04/24/2017
and claims benefit of 62/500,581 05/03/2017
and claims benefit of 62/505,974 05/14/2017
and claims benefit of 62/509,093 05/20/2017
and claims benefit of 62/510,249 05/23/2017
and claims benefit of 62/514,889 06/04/2017
and claims benefit of 62/521,507 06/18/2017
and claims benefit of 62/522,169 06/20/2017
and claims benefit of 62/527,962 06/30/2017
and claims benefit of 62/530,281 07/09/2017
and claims benefit of 62/533,078 07/16/2017
and claims benefit of 62/533,603 07/17/2017
and claims benefit of 62/535,801 07/21/2017
and claims benefit of 62/540,524 08/02/2017
and claims benefit of 62/542,243 08/07/2017
and claims benefit of 62/547,728 08/18/2017
and claims benefit of 62/553,844 09/02/2017
and claims benefit of 62/556,426 09/10/2017
and claims benefit of 62/561,869 09/22/2017

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

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

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: Yes

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

If Required, Foreign Filing License Granted: 03/26/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/296,985**

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

Non-Publication Request: No

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

MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

Preliminary Class

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

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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

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

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

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign

patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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

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

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

NOT GRANTED

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United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

In re Application of
Shih-Yuan WANG

Application No. 16296985

Filed:

Attorney Docket No. 5176/88184-CIP-A

:DECISION ON PETITION TO MAKE SPECIAL
:UNDER 37 CFR 1.102(c)(1)

This is a decision on the electronic petition under 37 CFR 1.102 (c)(1), filed 08-MAR-2019 to make the above-identified application special based on applicant's age as set forth in MPEP § 708.02, Section II.

The petition is **GRANTED**.

A grantable petition to make an application special under 37 CFR 1.102(c)(1), MPEP § 708.02, Section II : Applicant's Age must include a statement by applicant or a registered practitioner having evidence that applicant is at least 65 years of age. No fee is required.

Accordingly, the above-identified application has been accorded "special" status and will be taken up for action by the examiner upon the completion of all pre-examination processing.

Telephone inquiries concerning this electronic decision should be directed to the Electronic Business Center at 866-217-9197.

All other inquiries concerning either the examination or status of the application should be directed to the Technology Center.

Electronic Acknowledgement Receipt

EFS ID:	35371743
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	32432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	08-MAR-2019
Filing Date:	
Time Stamp:	18:00:53
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	Petition automatically granted by EFS	petition-request.pdf	37980 1e6a0b2226e3a0fcd922f263f22c397872665f08	no	2

Warnings:

Information:	
Total Files Size (in bytes):	37980

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/130 (07-09)
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PETITION TO MAKE SPECIAL BASED ON AGE FOR ADVANCEMENT OF EXAMINATION UNDER 37 CFR 1.102(c)(1)

Application Information

Application Number	16296985	Confirmation Number	3243	Filing Date	01-Jan-0001
Attorney Docket Number (optional)	5176/88184-CIP-A	Art Unit		Examiner	
First Named Inventor	Shih-Yuan WANG				
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES				

Attention: Office of Petitions

An application may be made special for advancement of examination upon filing of a petition showing that the applicant is 65 years of age, or more. No fee is required with such a petition. See 37 CFR 1.102(c)(1) and MPEP 708.02 (II).

APPLICANT HEREBY PETITIONS TO MAKE SPECIAL FOR ADVANCEMENT OF EXAMINATION IN THIS APPLICATION UNDER 37 CFR 1.102(c)(1) and MPEP 708.02 (II) ON THE BASIS OF THE APPLICANT'S AGE.

A grantable petition requires one of the following items:
(1) Statement by one named inventor in the application that he/she is 65 years of age, or more; or
(2) Certification by a registered attorney/agent having evidence such as a birth certificate, passport, driver's license, etc. showing one named inventor in the application is 65 years of age, or more.

Name of Inventor who is 65 years of age, or older

Given Name	Middle Name	Family Name	Suffix
Shih-Yuan		WANG	

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the format of the signature.

Select (1) or (2) :

○ (1) I am an inventor in this application and I am 65 years of age, or more.

◉ (2) I am an attorney or agent registered to practice before the Patent and Trademark Office, and I certify that I am in possession of evidence, and will retain such in the application file record, showing that the inventor listed above is 65 years of age, or more.

Signature	/Ivan Kavrukov/		
Name	Ivan Kavrukov	Registration Number	25161

PTO/SB/130 (07-09)
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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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 Fr eedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about indivi duals.

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.

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. 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 contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Shih-Yuan		WANG	

Residence Information (Select One) ● US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Palo Alto	CA	US

Mailing Address of Inventor:

Address 1	766 Encina Grande Dr.
Address 2	
City	Palo Alto
State/Province	
Postal Code	94306
Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Shih-Ping		WANG	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

City	State/Province	Country of Residence
Los Altos	CA	US

Mailing Address of Inventor:

Address 1	38 3rd Street, Suite #307
Address 2	
City	Los Altos
State/Province	
Postal Code	94022
Country	US

Inventor 3 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	M. Saif		ISLAM	

Residence Information (Select One) ◉ US Residency Non US Residency Active US Military Service

PTO/AIA/14 (02-18)
Approved for use through 11/30/2020. 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 contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

City	Davis	State/Province	CA	Country of Residence	US

Mailing Address of Inventor:

Address 1	3038 Mallorca Ln		
Address 2			
City	Davis	**State/Province**	CA
Postal Code	95618	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	32432		
Email Address	pdocketing@cooperdunham.com	Add Email	Remove Email

Application Information:

Title of the Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES		
Attorney Docket Number	5176/88184-CIP-A	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	131	**Suggested Figure for Publication (if any)**	

Filing By Reference:

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

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

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

Publication Information:

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

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

PTO/AIA/14 (02-18)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Representative Information:

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Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

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Customer Number	23432		

Domestic Benefit/National Stage Information:

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

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	Continuation of	15797821	2017-10-30
Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15797821	Continuation in part of	15309922	2016-11-09	9818893	2017-11-14

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15309922	a 371 of international	PCT/US2015/061120	2015-11-17
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62081538	2014-11-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62090879	2014-12-11

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	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62100025	2015-01-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62111582	2015-02-03
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62139511	2015-03-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62153443	2015-04-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62154675	2015-04-29
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62157876	2015-05-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62171915	2015-06-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62174498	2015-06-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62175855	2015-06-15

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Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62182602	2015-06-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62188876	2015-07-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62197120	2015-07-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62199607	2015-07-31
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62205717	2015-08-15
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62209311	2015-08-24
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62213556	2015-09-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2015/061120	Claims benefit of provisional	62232716	2015-09-25
Prior Application Status	Patented		Remove

Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15309922	Continuation of	14943898	2015-11-17	9530905	2016-12-27

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	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62081538	2014-11-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62090879	2014-12-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62100025	2015-01-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62111582	2015-02-03
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62139511	2015-03-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62153443	2015-04-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62154675	2015-04-29
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62157876	2015-05-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62171915	2015-06-05

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Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62174498	2015-06-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62175855	2015-06-15
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62182602	2015-06-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62188876	2015-07-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62197120	2015-07-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62199607	2015-07-31
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62205717	2015-08-15
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62209311	2015-08-24
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62213556	2015-09-02

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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14943898	Claims benefit of provisional	62232716	2015-09-25

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
15309922	Continuation of	14945003	2015-11-18	9525084	2016-12-20

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62081538	2014-11-18

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62090879	2014-12-11

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62100025	2015-01-05

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62111582	2015-02-03

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62139511	2015-03-27

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62153443	2015-04-27

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62154675	2015-04-29

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	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62157876	2015-05-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62171915	2015-06-05
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62174498	2015-06-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62175855	2015-06-15
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62182602	2015-06-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62188876	2015-07-06
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62197120	2015-07-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62199607	2015-07-31
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62205717	2015-08-15

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	Application Number	
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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62209311	2015-08-24
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62213556	2015-09-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14945003	Claims benefit of provisional	62232716	2015-09-25
Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Continuation in part of	14947718	2015-11-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
14947718	Continuation of	PCT/US2014/039208	2014-05-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2014/039208	Claims benefit of provisional	61826446	2013-05-22
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2014/039208	Claims benefit of provisional	61834873	2013-06-13
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2014/039208	Claims benefit of provisional	61843021	2013-07-04
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US2014/039208	Claims benefit of provisional	61905109	2013-11-15

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Continuation in part of	PCT/US16/67977	2016-12-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62270577	2015-12-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62290391	2016-02-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62304907	2016-03-07
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62334934	2016-05-11
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62338263	2016-05-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62346850	2016-06-07
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62359349	2016-07-07
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62366188	2016-07-25

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62368109	2016-07-28
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62374828	2016-08-13
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62376869	2016-08-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62380364	2016-08-27
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62383391	2016-09-03
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62383479	2016-09-04
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62394222	2016-09-14
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62398607	2016-09-23
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62401126	2016-09-28

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Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62406999	2016-10-12
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62414671	2016-10-29
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
PCT/US16/67977	Claims benefit of provisional	62415339	2016-10-31
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62465734	2017-03-01
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62474179	2017-03-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62484474	2017-04-12
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62487606	2017-04-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62488998	2017-04-24
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62500581	2017-05-03

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	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62505974	2017-05-14
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62509093	2017-05-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62510249	2017-05-23
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62514889	2017-06-04
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62521504	2017-06-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62522169	2017-06-20
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62527962	2017-06-30
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62530281	2017-07-09
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62533078	2017-07-16

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	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62533603	2017-07-17
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62535801	2017-07-21
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62540524	2017-08-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62542243	2017-08-07
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62547728	2017-08-18
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62553844	2017-09-02
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62556426	2017-09-10
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
15797821	Claims benefit of provisional	62561869	2017-09-22

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Foreign Priority Information:

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

Remove

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

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

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Authorization or Opt-Out of Authorization to Permit Access:

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

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

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

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

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

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

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

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

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

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

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Applicant Information:

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

Applicant 1 — Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

● Assignee	Legal Representative under 35 U.S.C. 117	Joint Inventor
Person to whom the inventor is obligated to assign.	Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	W&WSens, Devices Inc.		
Mailing Address Information For Applicant:			
Address 1	4546 El Camino Real, Suite 215		
Address 2			
City	Los Altos	**State/Province**	CA
Country	US	Postal Code	94022
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

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

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	5176/88184-CIP-A
	Application Number	
Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

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Signature:

Remove

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

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

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

Signature	/Ivan S. Kavrukov/			Date (YYYY-MM-DD)	2019-03-08
First Name	Ivan	Last Name	Kavrukov	Registration Number	25,161

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This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

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

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

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

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3 A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent CooperationTreaty.

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.

CLAIMS

1. A single-chip device comprising an integrated combination of a microstructure-enhanced photodetector (MSPD) and an active electronic circuit, both formed on or in a single substrate and configured to receive an optical input that in cross-section is substantially continuous spatially at least some of time, convert the optical input to an electrical output, and process the electrical output into a processed output, wherein:

the MSPD on or in said single substrate comprises an intermediate layer, a first layer at one side of the intermediate layer, and a second layer at an opposite side of the intermediate layer, wherein:

each of the layers comprises Silicon, Germanium, or an alloy thereof;

at least one of said layers, or an overlying covering layer that may be present, has holes intentionally formed therein, extending in directions transverse to the layers;

each of the first and second layers comprises a doped material;

the intermediate layer comprises a material that is less doped than at least one of the first and second layers or is undoped, wherein the degree of doping is the same or different for different positions in the intermediate layer;

an input portion configured to concurrently receive at a plurality of said holes said optical input that has said substantially continuous cross-section; and

an output portion configured to provide said electrical output from the MSPD; and

the active electronic circuit on or in said single substrate is configured to process the electrical output from the MSPD by applying thereto:

amplification to form said processed output from the single-chip device;

processing other than or in addition to amplification to form said processed output from the single-chip device; and

routing to one or more selected destinations; and

a communication channel on or in said single-chip device, configured to deliver the electrical output from the MSPD to the active electronic circuit.

2. The single-chip device of claim 1, in which said active electronic circuit is at least partly extends beyond said substrate.

3. The single-chip device of claim 1, in which said active electronic circuit is at least partly inside said substrate.

4. The single-chip device of claim 1, in which said overlying layer is present as a superstrate at one side of said first, intermediate, and second layers, and contains said holes.

5. The single-chip device of claim 1, in which said MSPD comprises a III-V materials family photodiode.

6. The single-chip device of claim 1, further including an air-filled volume between the substrate and the MSPD.

7. The single-chip device of claim 1, further including a layer of a dielectric material that covers the holes and is in the propagation path of said optical input.

8. The single-chip device of claim 1, further including an avalanche region at one side of the MSPD, forming therewith an avalanche microstructured photodiode (MSAPD).

9. The single-chip device of claim 1, in which said holes are present in said intermediate layer.

10. The single-chip device of claim 1, in which said holes are present in said intermediate layer as well as in at least one of the first and second layers.

11. The single-chip device of claim 1, in which said holes are present in each of the first, second, and intermediate layer.

12. The single-chip device of claim 1, in which each of said first and second layers and said intermediate layer has a thickness and at least some of said holes extend through the entire thickness of said intermediate layer and of one of said first layer and second layer and through at least a part of the thickness of the other one of said first and second layers.

13. The single-chip device of claim 1, in which at least some of said holes are shaped as inverted pyramids.

14. The single-chip device of claim 1, in which at least some of said holes have triangular sections in planes transverse to said layers.

15. The single-chip device of claim 1, in which at least some of said holes have triangular sections in planes transverse to said layers, with vertices within the intermediate layer.

16. The single-chip device of claim 1, in which at least some of said holes have sidewalls that slope in planes transverse to said layers.

17. The single-chip device of claim 1, in which at least some of said holes have sidewalls with plural different slopes along the inside walls of the holes.

18. The single-chip device of claim 1, in which at least some of said holes differ from each other in at least one of (i) distance by which the holes extend in said directions, (ii) shape of the holes, and (iii) spacing of the holes from each other.

19. The single-chip device of claim 1, in which the holes are in the intermediate layer and wherein one of said first and second layers conformally covers inside walls of the holes as well as spaces between the holes.

20. The single-chip device of claim 1, in which the holes are at least partly filled with a dielectric material.

21. The single-chip device of claim 1, in which the holes are entirely filled with a dielectric material.

22. The single-chip device of claim 1, in which said optical input enters the MSPD through one or both of said first and second layers, and each of the first and second layers through which the optical input enters is no more than 500 nanometers thick.

23. The single-chip device of claim 1, in which at least one of the first layer, the second layer, and the intermediate layer comprises a material represented by $Ge_x Si_{1-x}$, where x is greater than zero.

24. The single-chip device of claim 1, in which said MSPD further comprises ohmic contacts configured for reverse-biasing the MSPD.

25. The single-chip device of claim 1, in which the MSPD further includes ohmic contacts to said first and second layers, at least one of said ohmic contact being through a via in said substrate.

26. The single-chip device of claim 1, further comprising a light guide to said MSPD for directing said optical input thereto, and electrical contacts from the active electronic circuit configured to carry said processed output out of the single-chip device.

27. The single-chip device of claim 1, further comprising a light guide to said MSPD configured to bend the optical input from an initial propagation direction to a propagation direction transverse to said layers, and electrical contacts from the active electronic circuit configured to carry said processed output out of the single-chip device.

28. The single-chip device of claim 1, further comprising one or more additional MSPD on or in the same substrate, and respective different optical bandpass filters coupled with at least two of the MSPDs on or in said single substrate, whereby at least two of said MSPDs are configured to respond to different wavelength ranges that are within said optical input.

29. The single-chip device of claim 1, further comprising one or more additional MSPDs on or in said single substrate, one or more additional active electronic circuits on or in the said single substrate, and one or more additional communication channels configured to supply electrical outputs from the MSPDs to the one or more of the active electronic circuits.

30. The single-chip device of claim 1, further comprising one or more additional active electronic circuits that are formed on or in the said single substrate.

31. The single-chip device of claim 1, further comprising one or more additional active electronic circuits that are formed on or in the said single substrate and comprise one or more transimpedance amplifiers (TIAs) and one or more application specific integrated circuits (ASICs).

32. The single-chip device of claim 1, further comprising one or more additional active electronic circuits that are formed on or in the said single substrate and comprise one or more of CMOS, BiCMOS, and bipolar active devices.

33. The single-chip device of claim 1, further comprising one or more additional MSPDs in an array on or in said single substrate and one or more additional active electronic circuits also on or in said single substrate, said MSPDs and active electronic circuits being configured into an optical communication structure or a light distance and ranging (LIDAR) structure.

34. The single-chip device of claim 1, further comprising a laser emitter formed on or in said single substrate.

35. The single-chip device of claim 1, further including a layer of selected material that is over a side of one of the first and second layers facing away from the intermediate layer and is configured to reduce sheet resistance.

36. The single-chip device of claim 1, further including a layer of selected material that is over a side of one of the first and second layers facing away from the intermediate layer and is configured to reflect light that has passed through the intermediate layer back toward the intermediate layer.

37. The single-chip device of claim 1, further including a deliberately textured surface at a side of one of said first and second layers facing away from the intermediate layer.

38. The single-chip device of claim 1, further including a layer of micro-nano structures formed at of one of said first and second facing, at a surface thereof facing away from the intermediate layer.

39. The single-chip device of claim 1, further including one or more distributed Bragg reflectors formed at one of said first and second layers, at a surface thereof away from the intermediate layer.

40. The single-chip device of claim 1, further including an isolation trench between the MSPD and the active electronic circuit.

41. The single-chip device of claim 1, further including a light shield layer over said active electronic circuit.

42. The single-chip device of claim 1, wherein the optical input and the electrical output are each modulated at a frequency of at least 30 Gigabits per second.

43. The single-chip device of claim 1, wherein the quantum efficiency of the MSPD that is at least 1.5 times greater than that of an otherwise same photodetector that does not include said holes.

44. The single-chip device of claim 1, further including a hermetic seal integral with the device.

45. A microstructure-enhanced photodetector (MSPD) configured to convert to an electrical output an optical input that in cross-section is essentially continuous spatially at least some of the time, comprising:

a substrate and a top layer, a bottom layer, and an intermediate layer between the top and bottom layers formed on or in the substrate, wherein:

at least one of the layers has holes intentionally formed therein, extending in directions transverse to the layers;

each of the top and bottom layers comprises a doped material;

the intermediate layer comprises a material that is undoped or is less doped than the top or bottom layer, wherein the degree of doping is the same or different for different positions in the intermediate layer;

an input portion configured to receive, concurrently at a plurality of said holes, said optical input that has said essentially continuous cross-section; and

an output portion configured to provide said electrical output.

46. The MSPD of claim 45, in which the top layer is no more than 500 nm thick and the holes are at least in the top layer.

47. The MSPD of claim 45, further including an air-filled volume between the substrate and the MSPD.

48. The MSPD of claim 45, further including a layer of a dielectric material that is at a surface of said substrate, over the holes and spaces between the holes, and in the path of said optical input.

49. The MSPD of claim 45, further including an avalanche region under the MSPD, forming therewith an avalanche microstructured photodiode (MSAPD).

50. The MSPD of claim 45, in which said holes are present in said intermediate layer.

51. The MSPD of claim 45, in which said holes are present in said intermediate layer as well as in at least one of the top and bottom layers.

52. The MSPD of claim 45, in which said holes are present in each of the top, bottom, and intermediate layer.

53. The MSPD of claim 45, in which each of said top and bottom layers and said intermediate layer has a thickness and at least some of said holes extend through the entire thickness of said intermediate layer and of one of said top and bottom layers and through at least a part of the thickness of the other one of said top and bottom layers.

54. The MSPD of claim 45, in which at least some of said holes are shaped as inverted pyramids.

55. The MSPD of claim 45, in which at least some of said holes have triangular sections in planes transverse to said layers.

56. The MSPD of claim 45, in which at least some of said holes have triangular sections in planes transverse to said layers, with vertices within the intermediate layer.

57. The MSPD of claim 45, in which at least some of said holes have sidewalls that slope in planes transverse to said layers.

58. The MSPD of claim 45, in which at least some of said holes have sidewalls with plural different slopes along inside walls of the holes.

59. The MSPD of claim 45, in which at least some of said holes differ from each other in at least one of (i) distance by which the holes extend in said directions, (ii) shape of the holes, and (iii) spacing of the holes from each other.

60. The MSPD of claim 45, in which the holes are in the intermediate layer and wherein one of said top and bottom layers conformally covers inside walls of the holes as well as spaces between the holes.

61. The MSPD of claim 45, in which the holes are at least partly filled with a dielectric material.

62. The MSPD of claim 45, in which the holes are entirely filled with a dielectric material.

63. The MSPD of claim 45, in which at least one of the top and bottom layers and the intermediate layer comprises a material represented by $Ge_x Si_{1-x}$, where x is greater than zero but less than unity.

64. The MSPD of claim 45, in which at least one of the top and bottom layers and the intermediate layer comprises a material represented by $Ge_x Si_{1-x}$, where x is zero or unity or a value between zero and unity.

65. The MSPD of claim 45, in which said MSPD further comprises ohmic contacts configured for reverse-biasing the MSPD.

66. The MSPD of claim 45, in which the MSPD further includes ohmic contacts to said top and bottom layers, wherein at least one of said ohmic contact being through a via in said substrate.

67. The MSPD of claim 451, further comprising a light guide to said MSPD for directing said optical input thereto.

68. The MSPD of claim 45, further comprising a light guide to said MSPD configured to bend the optical input from an initial propagation direction to a propagation direction transverse to at least some of said layers.

69. The MSPD of claim 45, further comprising one or more additional MSPDs formed on or in the single substrate, and respective different optical bandpass filters coupled with respective ones of the MSPDs, whereby at least two of said MSPDs are configured to respond to different wavelength ranges that are within said optical input.

70. The MSPD of claim 45, further comprising one or more additional MSPDs in an array on or in said single substrate, said MSPDs being configured into an optical communication structure or a light distance and ranging (LIDAR) structure.

71. The MSPD of claim 45, further comprising a laser emitter formed on or in said single substrate.

72. The MSPD of claim 45, further including a material that is over a side of one of the top and bottom layers facing away from the intermediate layer and is configured to reduce sheet resistance.

73. The MSPD of claim 45, further including a material that is over a side of one of the top and bottom layers facing away from the intermediate layer and is configured to reflect light that has passed through the intermediate layer back toward the intermediate layer.

74. The MSPD of claim 45, further including a deliberately textured surface at a side of one of said top and bottom layers facing away from the intermediate layer.

75. The MSPD of claim 45, further including a layer of micro-nano structures formed at a side of one of said top and bottom layers facing away from the intermediate layer.

76. The MSPD of claim 45, further including one or more distributed Bragg reflectors formed at a surface of one of said top and bottom layers facing away from the intermediate layer.

77. The MSPD of claim 45, further including one or more active electronic circuits formed on or in said substrate and coupled to said MSPD to receive said electrical output therefrom and process it into a processed output, thereby constituting a single-chip integrated circuit configured to receive said optical input, convert it to said electrical output, and provide said processed output.

78. The MSPD of claim 45, wherein the optical input and the electrical output are each modulated at a frequency of at least 30 Gigabits per second.

79. The MSPD of claim 45, wherein the quantum efficiency of the MSPD is at least 1.5 times greater than that of an otherwise the same photodetector lacking said holes.

80. The MSPD of claim 45, further including a hermetic seal integral with the MSPD.

81. A method of making a microstructure-enhanced photodetector (MSPD) configured to convert an optical input that at least some of the time has a cross-section that is essentially continuous spatially to an electrical output, comprising:

providing a substrate and forming on or in said substrate a top layer, a bottom layer, and an intermediate layer between the top and bottom layers, wherein:

at least one of the layers has holes intentionally formed therein, extending in directions transverse to the layers;

each of the top and bottom layers comprises a doped material;

the intermediate layer comprises a material that is undoped or is less doped than the top or bottom layer, wherein the degree of doping is the same or different for different positions in the intermediate layer;

forming an input portion configured to receive, concurrently at a plurality of said holes, said optical input that has said essentially continuous cross-section; and

forming an output configured to provide said electrical output.

82. The method of claim 81, in which the step of forming the top layer comprises limiting the top layer to a thickness of no more than 500 nm, and the step of forming the holes comprises forming the holes at least in the top layer.

83. The method of claim 81, further including forming an air-filled volume between the substrate and the MSPD.

84. The method of claim 81, further including a layer of a dielectric material that is at a surface of said substrate, over the holes and spaces between holes, and in the path of said optical input.

85. The method of claim 81, further including forming on or in said substrate an avalanche region under the MSPD, forming therewith an avalanche microstructured photodiode (MSAPD).

86. The method of claim 81, in which forming said holes comprises including the holes in said intermediate layer.

87. The method of claim 81, in which forming said holes comprises including said holes in said intermediate layer as well as in at least one of the first and second layers.

88. The method of claim 81, in which forming said holes comprises forming the holes in each of the top, bottom, and intermediate layer.

89. The method of claim 81, in which each of said top and bottom layers and said intermediate layer has a thickness and the forming of the holes comprises extending the holes through the entire thickness of said intermediate layer and of one of said top layer and bottom layer and through at least a part of the thickness of the other one of said top and bottom layers.

90. The method of claim 81, in which forming of the holes comprises forming at least some of said holes in the shape of inverted pyramids.

91. The method of claim 81, in which at least some of said holes have triangular sections in planes transverse to said layers.

92. The method of claim 81, in which forming the holes comprises forming at least some of said holes with triangular sections in planes transverse to said layers, with vertices within the intermediate layer.

93. The method of claim 81, in which forming said hoes comprises forming at least some of said holes with sidewalls that slope in planes transverse to said layers.

94. The method of claim 81, in which forming said holes comprises forming at least some of said holes with sidewalls that have plural different slopes along inside walls of the holes.

95. The method of claim 81, in which forming said holes comprises forming at least some of said holes such that they differ from each other in at least one of (i) distance by which the holes extend in said directions, (ii) shape of the holes, and (iii) spacing of the holes from each other.

96. The method of claim 81, in which forming said holes comprises forming at least some of the holes in the intermediate layer and forming said top and bottom layers comprises forming at least one of the top and bottom layers to conformally cover inside walls of the holes as well as spaces between the holes.

97. The method of claim 81, including at least partially filling the holes with a dielectric material.

98. The method of claim 81, including completely filling the holes with a dielectric material.

99. The method of claim 81, in which forming the layers comprises forming at least one of the top layer, the bottom layer, and the intermediate layer of a material represented by $Ge_x Si_{1-x}$, where x is greater than zero.

100. The method of claim 81, in which forming the layers comprises forming at least one of the top layer, the bottom layer, and the intermediate

layer of a material represented by $Ge_x Si_{1-x}$, where x is zero or unity or a value between zero and unity.

101. The method of claim 81, further comprising forming ohmic contacts configured for reverse-bias the MSPD.

102. The method of claim 81, further comprising forming a light guide to said MSPD for directing said optical input thereto, said light guide bending the optical input from an initial propagation direction to a propagation direction transverse to said layers.

103. The method of claim 81, further comprising forming one or more additional MSPD on or in said substrate for receiving respective optical inputs, and forming respective different bandpass filters for said optical inputs, thereby configuring different MSPDs on said substrate to respond to different wavelength ranges that are within said optical input.

104. The method of claim 81, further comprising forming one or more additional MSPDs in an array on or in said substrate, said MSPDs being configured into an optical communication structure or a light distance and ranging structure (LIDAR).

105. The method of claim 81, further comprising forming a laser emitter on or in said substrate.

106. The method of claim 81, further including forming a layer of selected material that is over a side of one of the top and bottom layers facing away from the intermediate layers and is configured to reduce sheet resistance.

107. The method of claim 81, further including forming a layer of selected material that is over a side of one of the first and second layers facing away from the intermediate layer and is configured to reflect light that has passed through the intermediate layer back toward the intermediate layer.

108. The method of claim 81, further including deliberately texturing a surface at a side of one of said top and bottom layers facing away from the intermediate layer.

109. The method of claim 81, further including forming a layer of micro-nano structures formed at of one of said top and bottom layers, at a surface thereof facing away from the intermediate layer.

110. The method of claim 81, further including forming one or more distributed Bragg reflectors at one of said top and bottom layers, at a surface thereof away from the intermediate layer.

111. The method of claim 81, further including forming, on or in said substrate, one or more active electronic circuits configured to process the electrical output from the MSPD into a processed output, thereby forming a single-chip integrated circuit configured to receive said optical input, convert it to said electrical output, and provide said processed output.

112. The method of claim 81, further including hermetically sealing the MSPD with a coating integral therewith.

ABSTRACT

Microstructure enhanced photodiodes and avalanche photodiodes are monolithically integrated with CMOS/BiCMOS circuitry such as transimpedance amplifiers. Microstructures, such as holes, can improve quantum efficiency in silicon and III-V materials and can also reduce avalanche voltages for avalanche photodiodes. Applications include optical communications within and between datacenters, telecommunications, LIDAR, and free space data communication.

Electronic Acknowledgement Receipt

EFS ID:	35368901
Application Number:	16296985
International Application Number:	
Confirmation Number:	5511
Title of Invention:	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES
First Named Inventor/Applicant Name:	Shih-Yuan WANG
Customer Number:	23432
Filer:	Ivan Kavrukov/Thomas Trainor
Filer Authorized By:	Ivan Kavrukov
Attorney Docket Number:	5176/88184-CIP-A
Receipt Date:	08-MAR-2019
Filing Date:	
Time Stamp:	15:42:33
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1985
RAM confirmation Number	031119INTEFSW00002282033125
Deposit Account	
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	88184-CIP-A--ADS.pdf	1259232 be561d82a77eea6a16d5c41057a4c7159ce4b919	no	21
Warnings:					
Information:					
2	Oath or Declaration filed	88184-CIP-A--Declarations_of_Inventors.pdf	929032 b8737bc42791f2f526b44374f6513ff52ee00268	no	6
Warnings:					
Information:					
3		88184-CIP-A--Spec_Claims_Abstract.pdf	9810157 c084422e6eec78eecae910f22ebb133f6db821ab	yes	195

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	178
Claims	179	194
Abstract	195	195

Warnings:					
Information:					
4	Drawings-only black and white line drawings	88184-CIP-A--Drawings.pdf	6733861 5138d95329a1c5c6985f7bdc776bdd6493b2dfed	no	131
Warnings:					
Information:					
5		88184-CIP-A--PreliminaryAmendment.pdf	589387 a5e266d97d3f358f3b36578c18954cc59060c140	yes	13

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Specification	2	4
	Claims	5	11
	Applicant Arguments/Remarks Made in an Amendment	12	13

Warnings:					
Information:					
6	Terminal Disclaimer Filed	88184-CIP-A--Terminal_Disclaimer_over_9496435.pdf	68899 bd6955b02b1cb36ba148dd3258d82b0eaf0fafda	no	1
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Information:					
		Total Files Size (in bytes):	19787163		

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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.

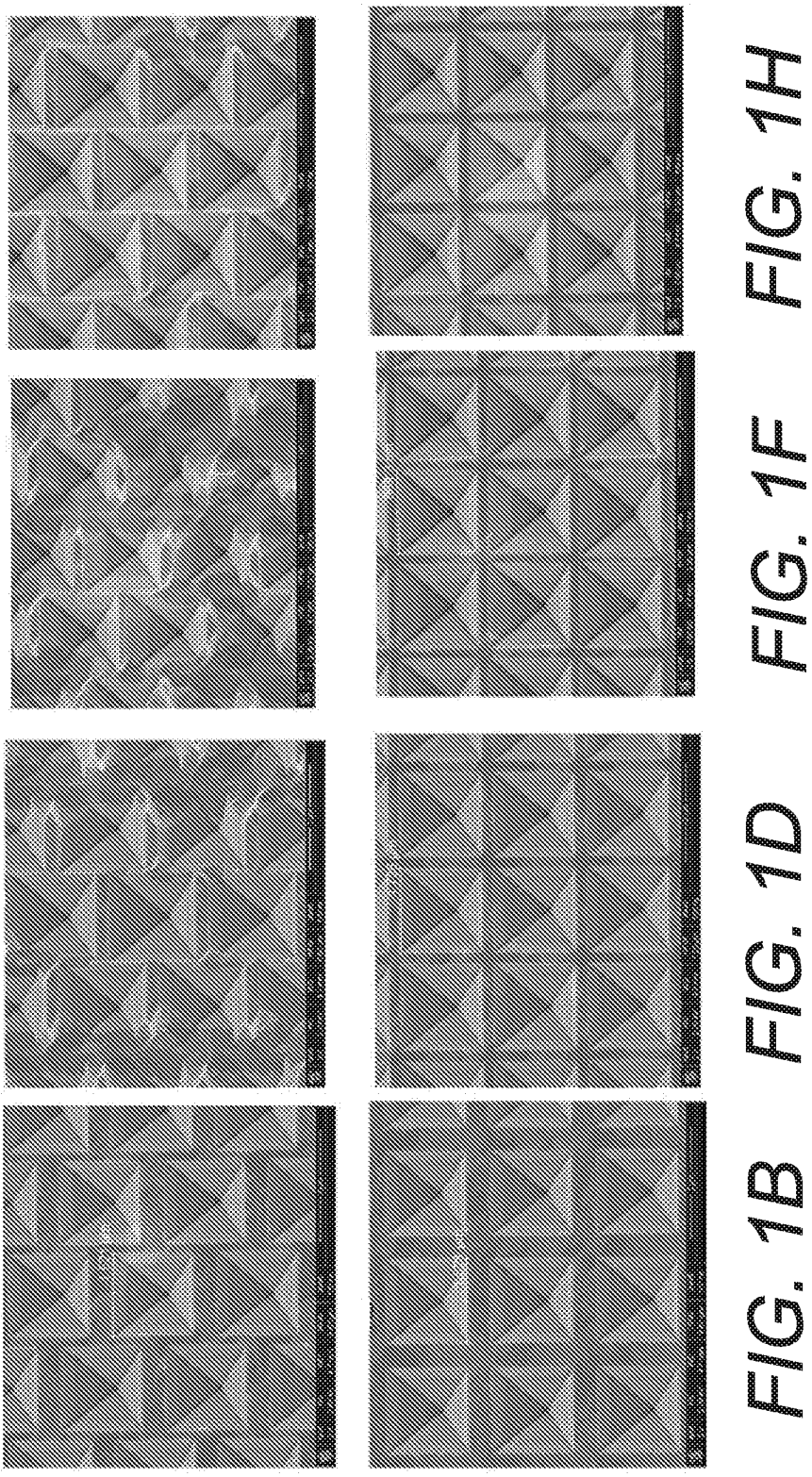


FIG. 1A FIG. 1C FIG. 1E FIG. 1G

FIG. 1B FIG. 1D FIG. 1F FIG. 1H

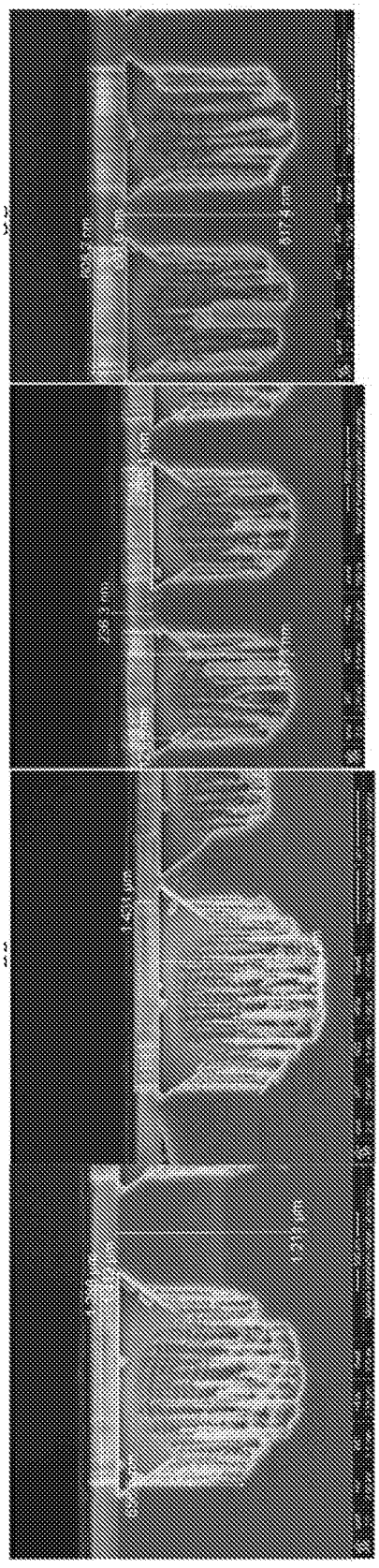


FIG. 2A FIG. 2B FIG. 2C FIG. 2D

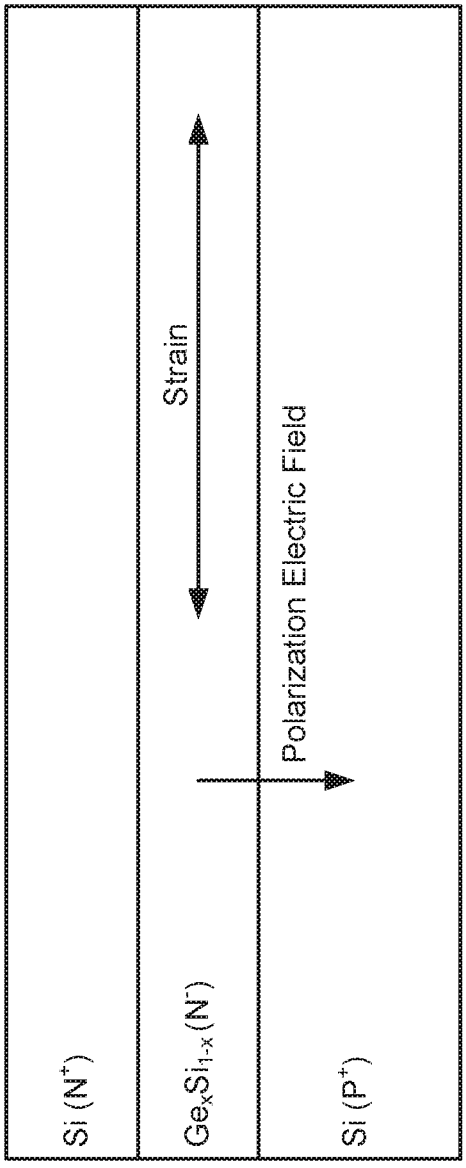


FIG. 3

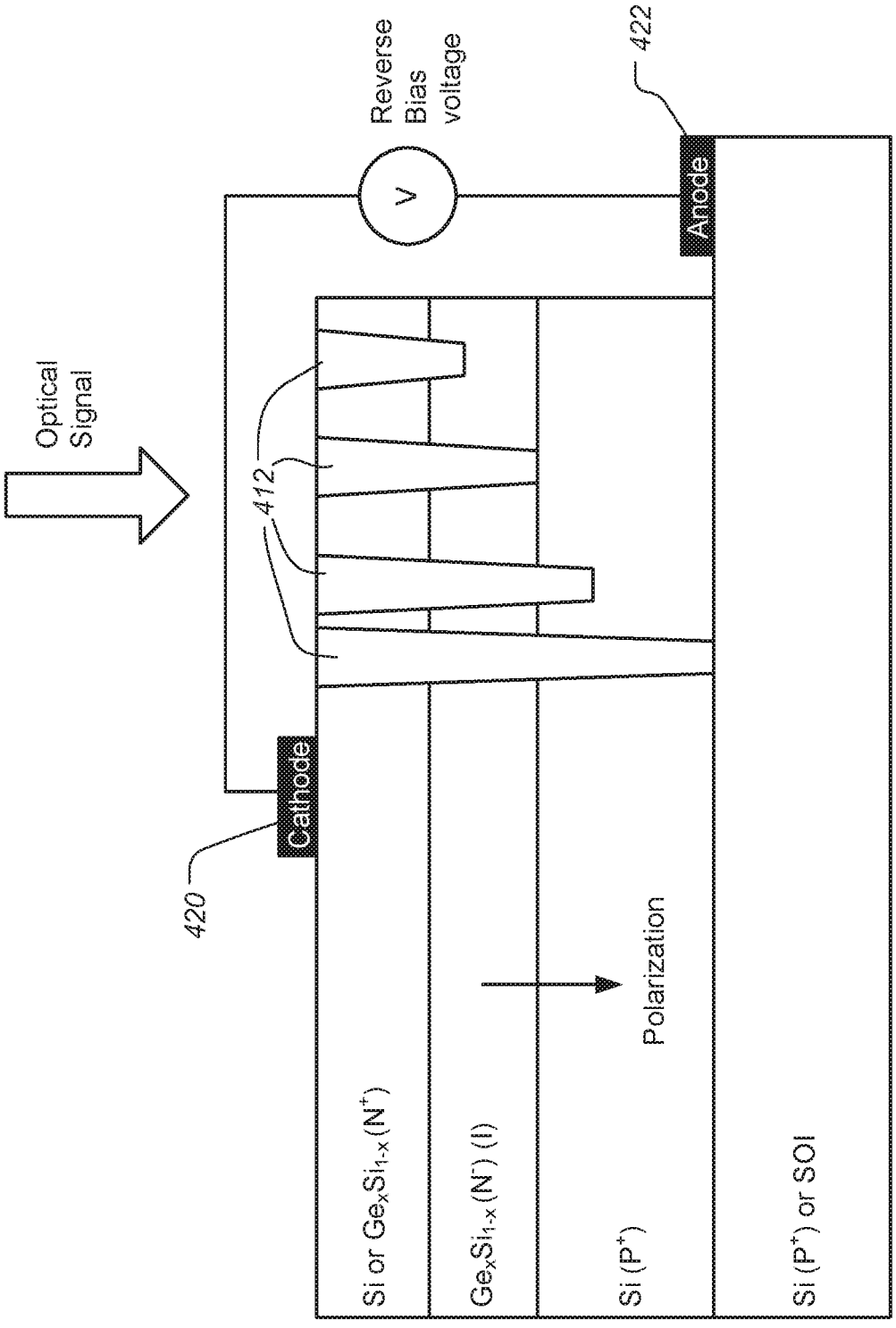

Reverse
Bias
voltage
V
422
Anode
Optical
Signal
412
Cathode
420
Polarization
Si or Ge_xSi_{1-x} (N^+)
Ge_xSi_{1-x} (N^-) (I)
Si (P^+)
Si (P^+) or SOI

FIG. 4

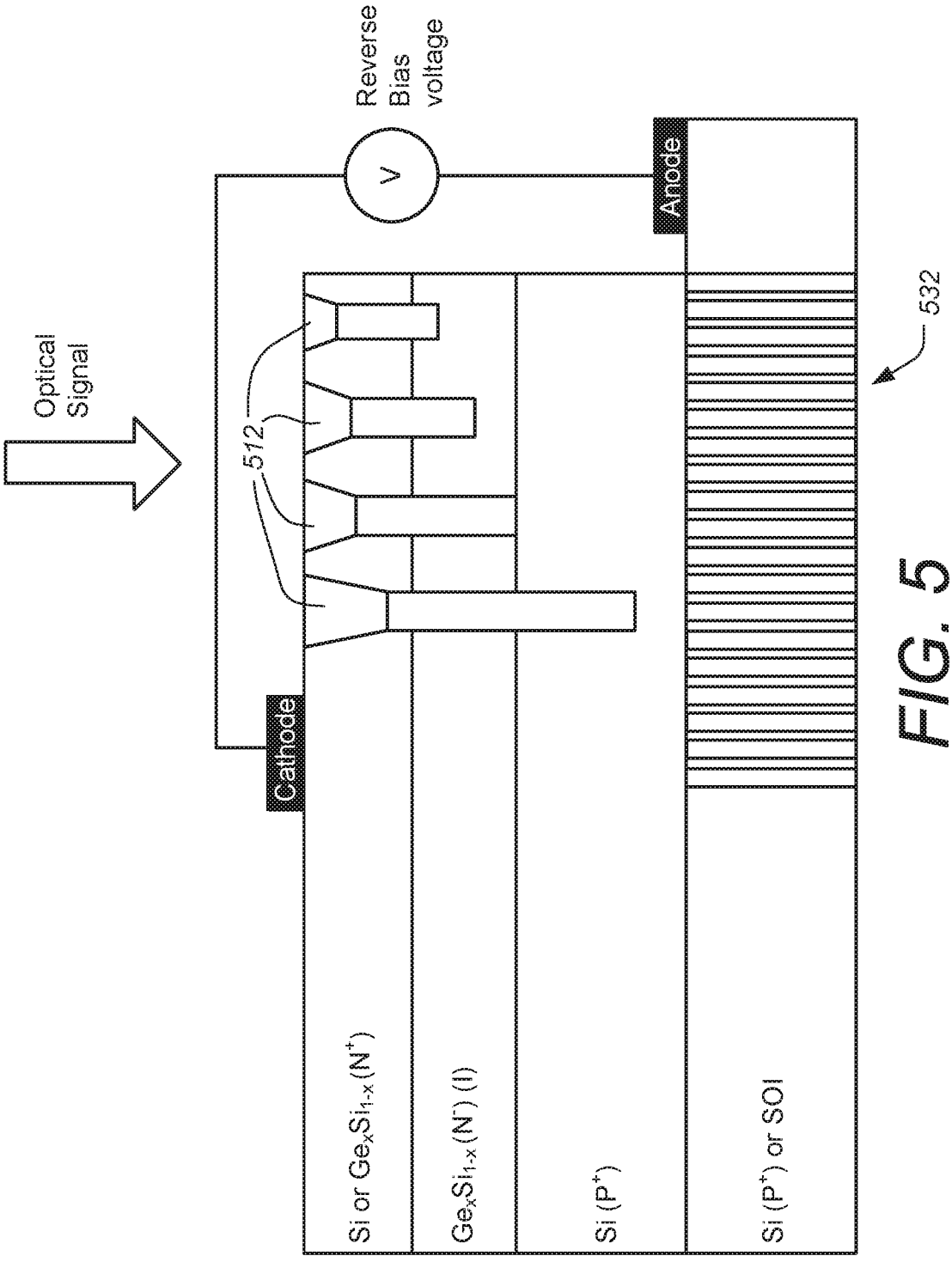

Reverse
Bias
voltage
V
Anode
Optical
Signal
512
532
Cathode
Si or $Ge_xSi_{1-x}(N^+)$
$Ge_xSi_{1-x}(N^-)$ (I)
Si (P^+)
Si (P^+) or SOI

FIG. 5



FIG. 6A

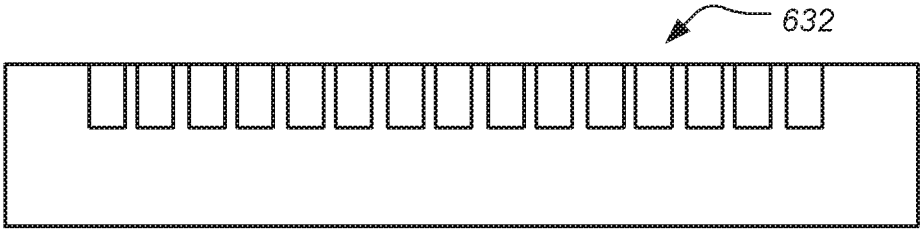


FIG. 6B

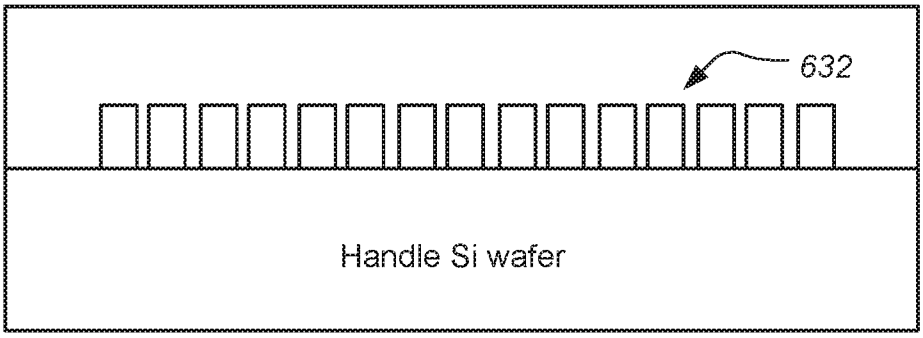


FIG. 6C

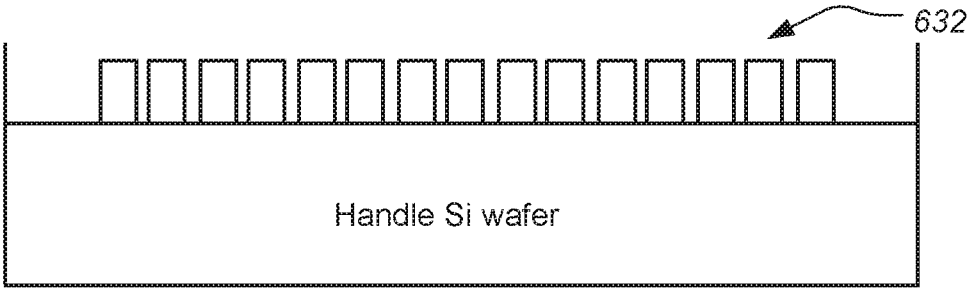


FIG. 6D

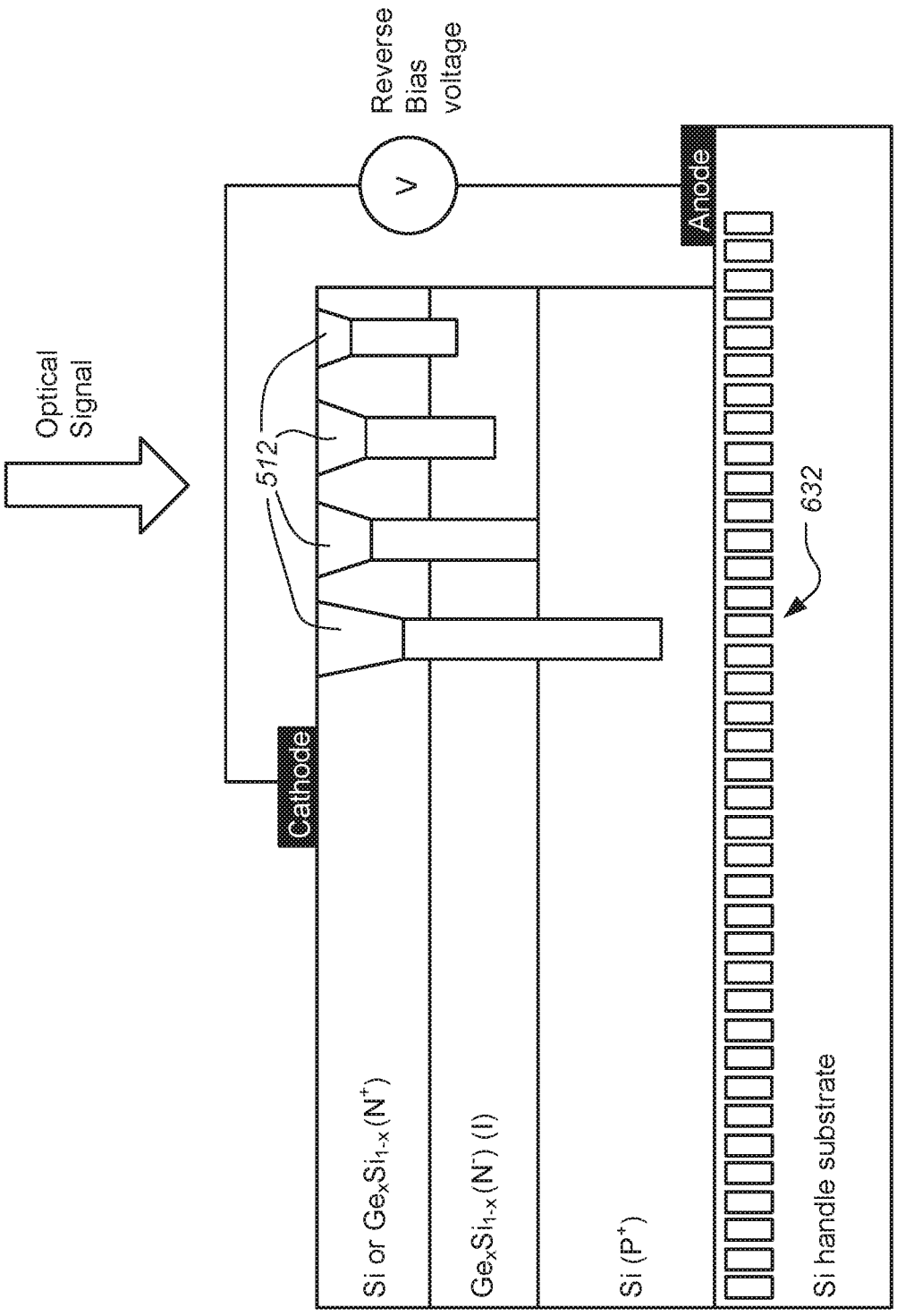

Reverse
Bias
voltage
V
Anode
Optical
Signal
512
632
Cathode
Si or $Ge_xSi_{1-x}(N^+)$
$Ge_xSi_{1-x}(N^-)$ (I)
Si (P^+)
Si handle substrate

FIG. 6E

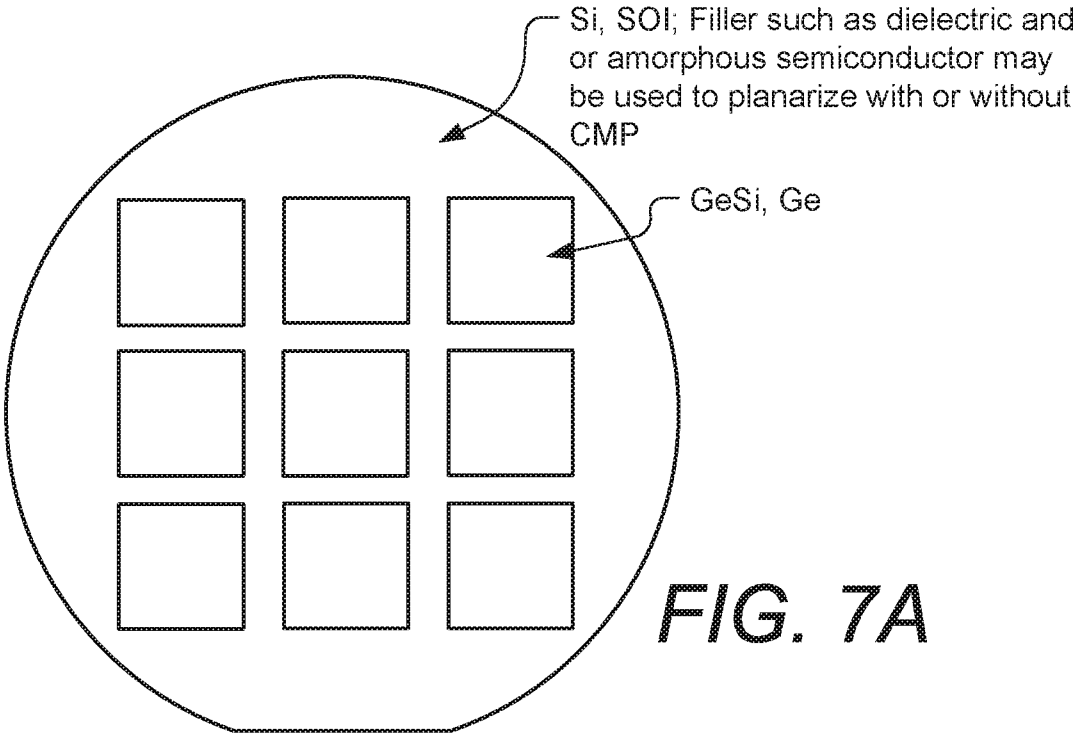

Si, SOI; Filler such as dielectric and or amorphous semiconductor may be used to planarize with or without CMP
GeSi, Ge

FIG. 7A

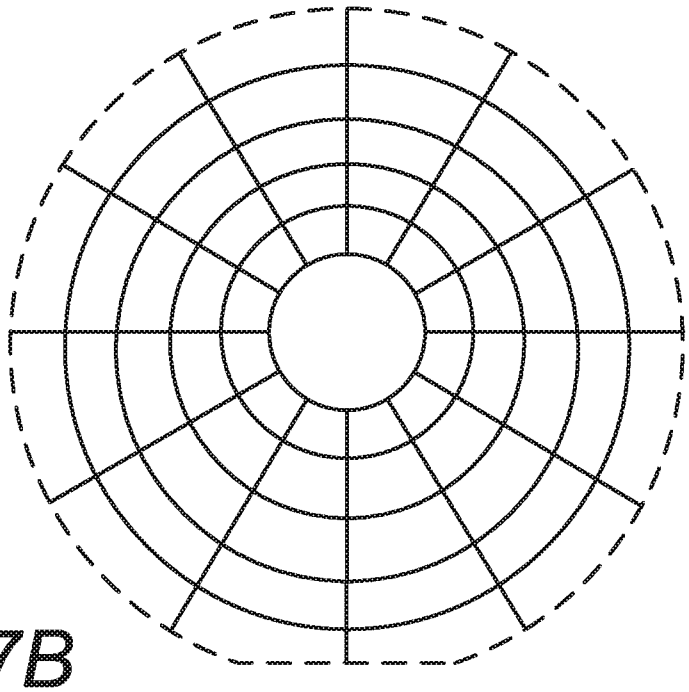


FIG. 7B

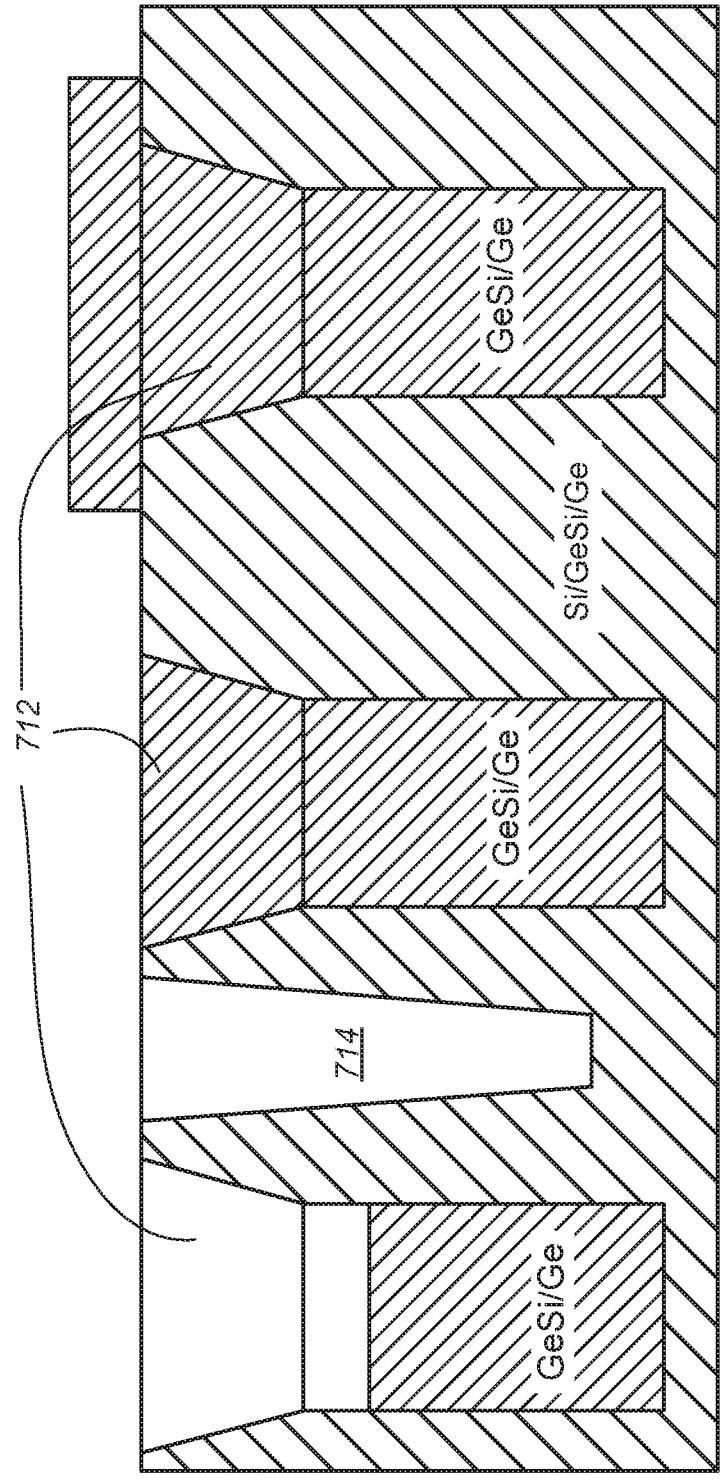


FIG. 7C

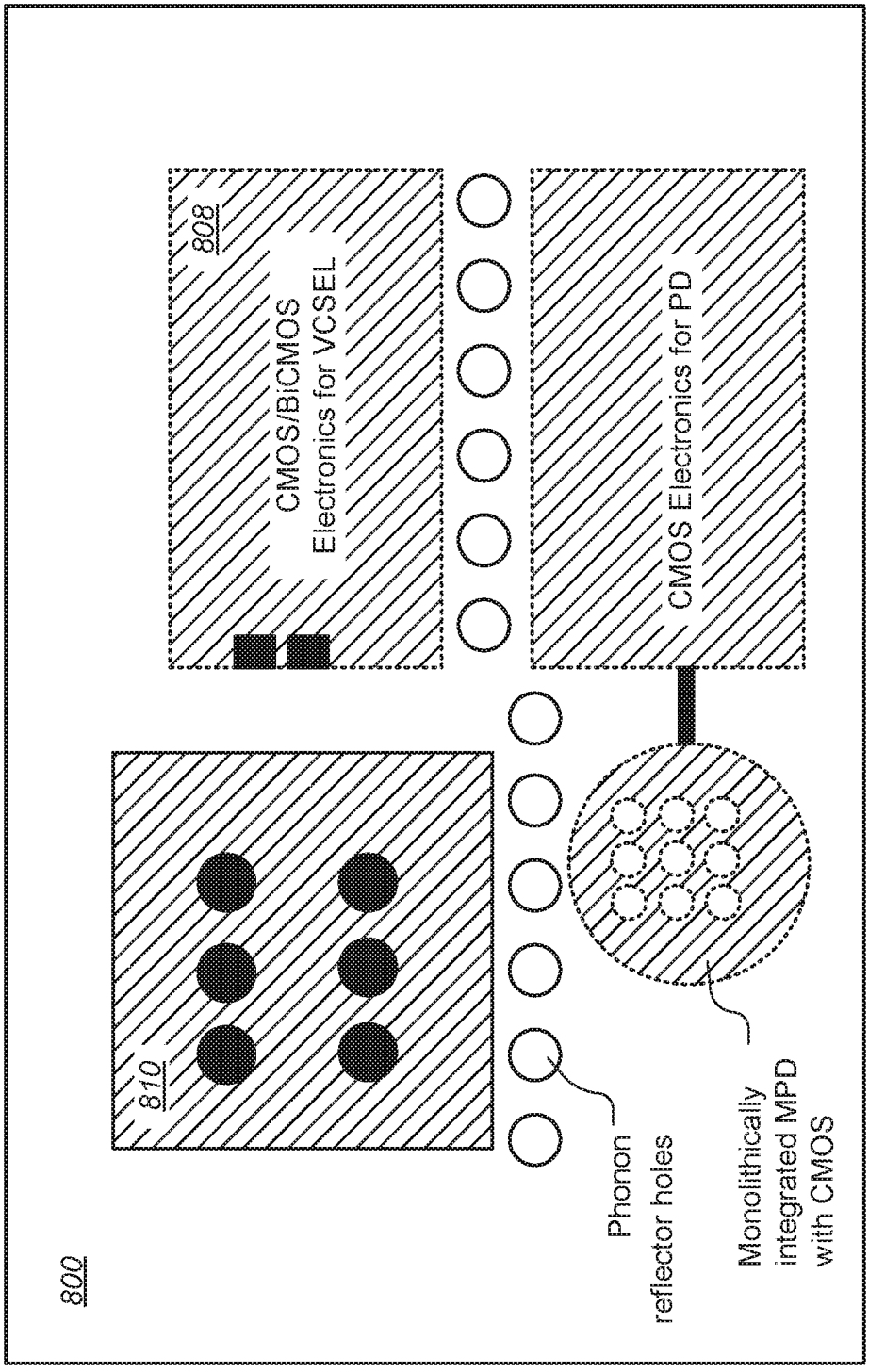

800
808
CMOS/BiCMOS
Electronics for VCSEL
CMOS Electronics for PD
810
Phonon
reflector holes
Monolithically
integrated MPD
with CMOS

FIG. 8

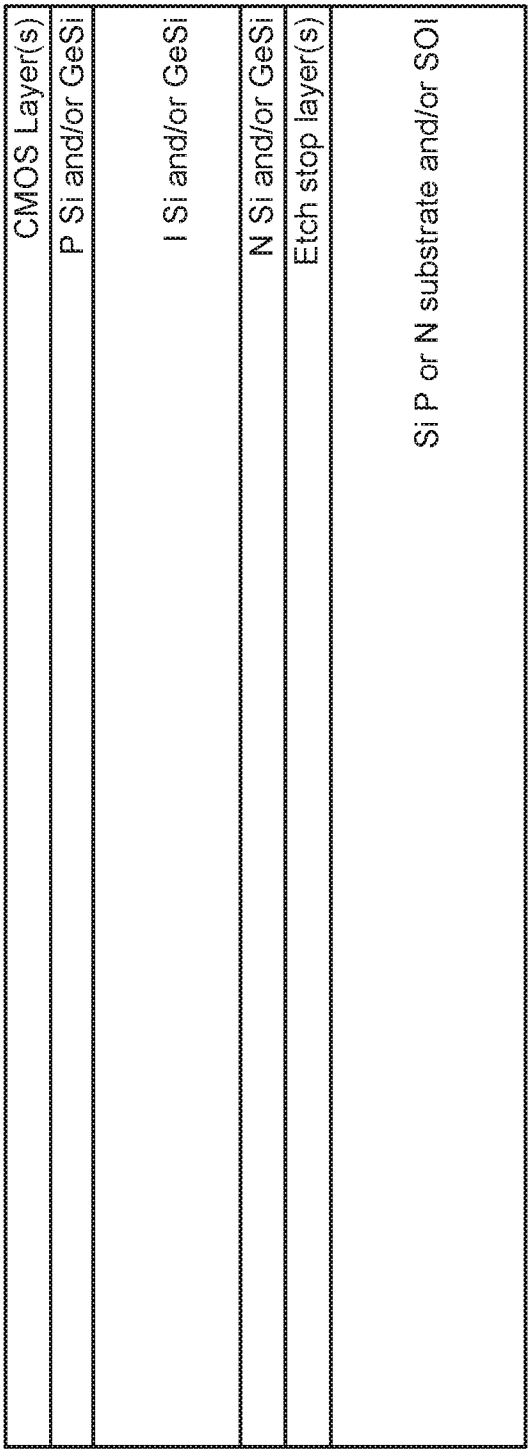

CMOS Layer(s)
P Si and/or GeSi
I Si and/or GeSi
N Si and/or GeSi
Etch stop layer(s)
Si P or N substrate and/or SOI

FIG. 9A

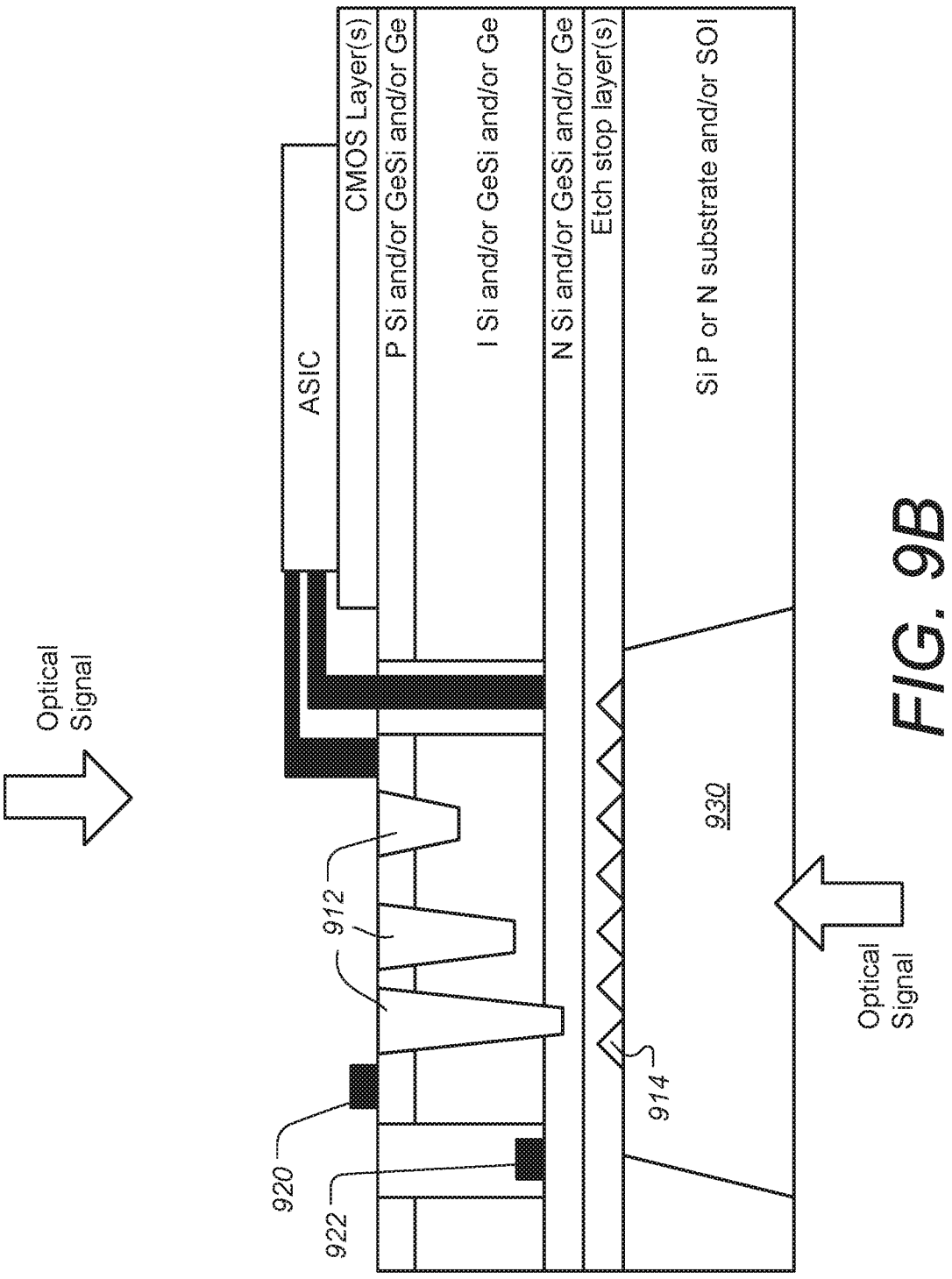

Optical Signal
ASIC
CMOS Layer(s)
P Si and/or GeSi and/or Ge
I Si and/or GeSi and/or Ge
N Si and/or GeSi and/or Ge
Etch stop layer(s)
Si P or N substrate and/or SOI
912
920
922
914
930
Optical Signal

FIG. 9B

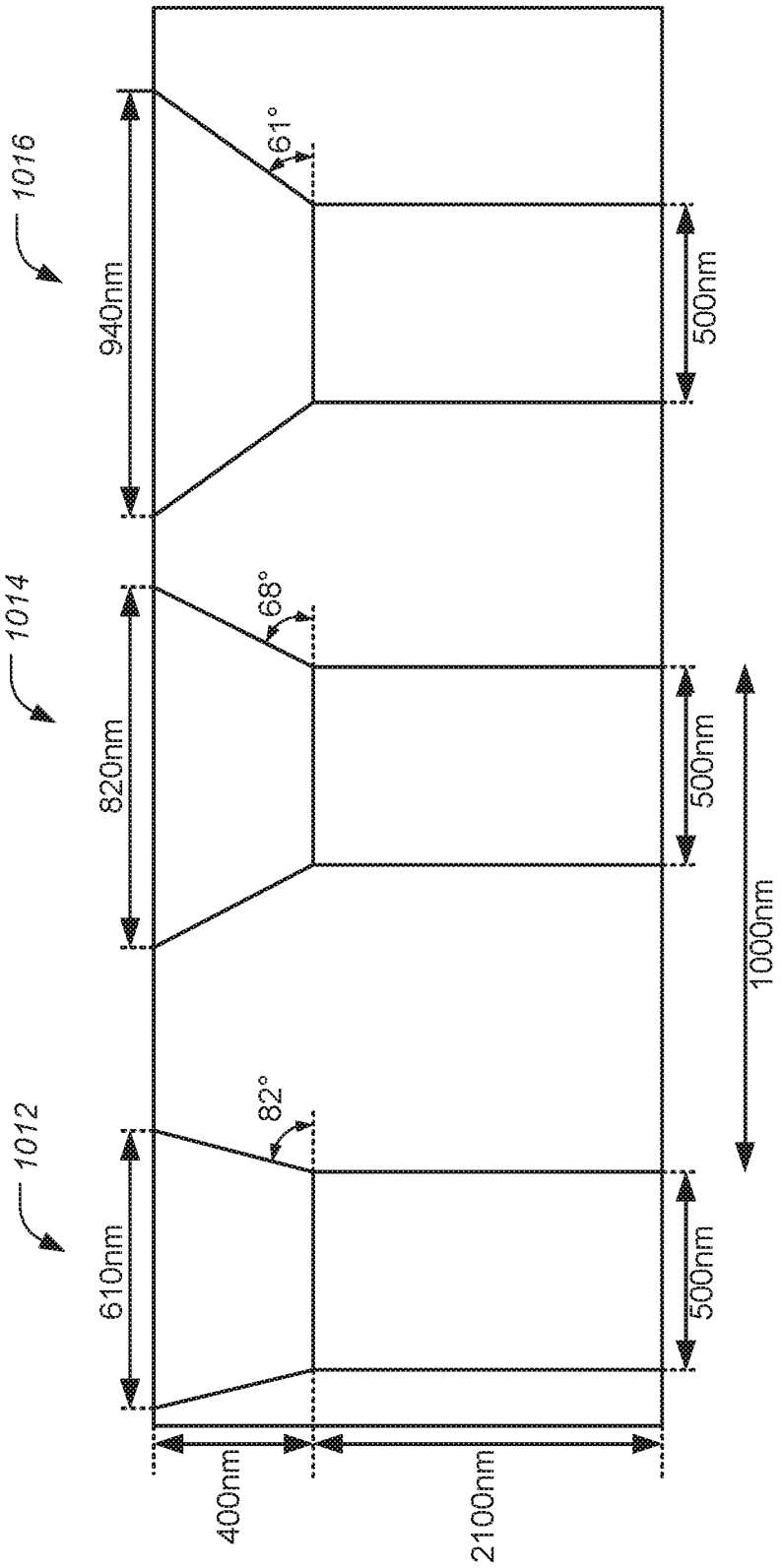

1016
940nm
61°
500nm
1014
820nm
68°
500nm
1000nm
1012
610nm
82°
500nm
400nm
2100nm

FIG. 10

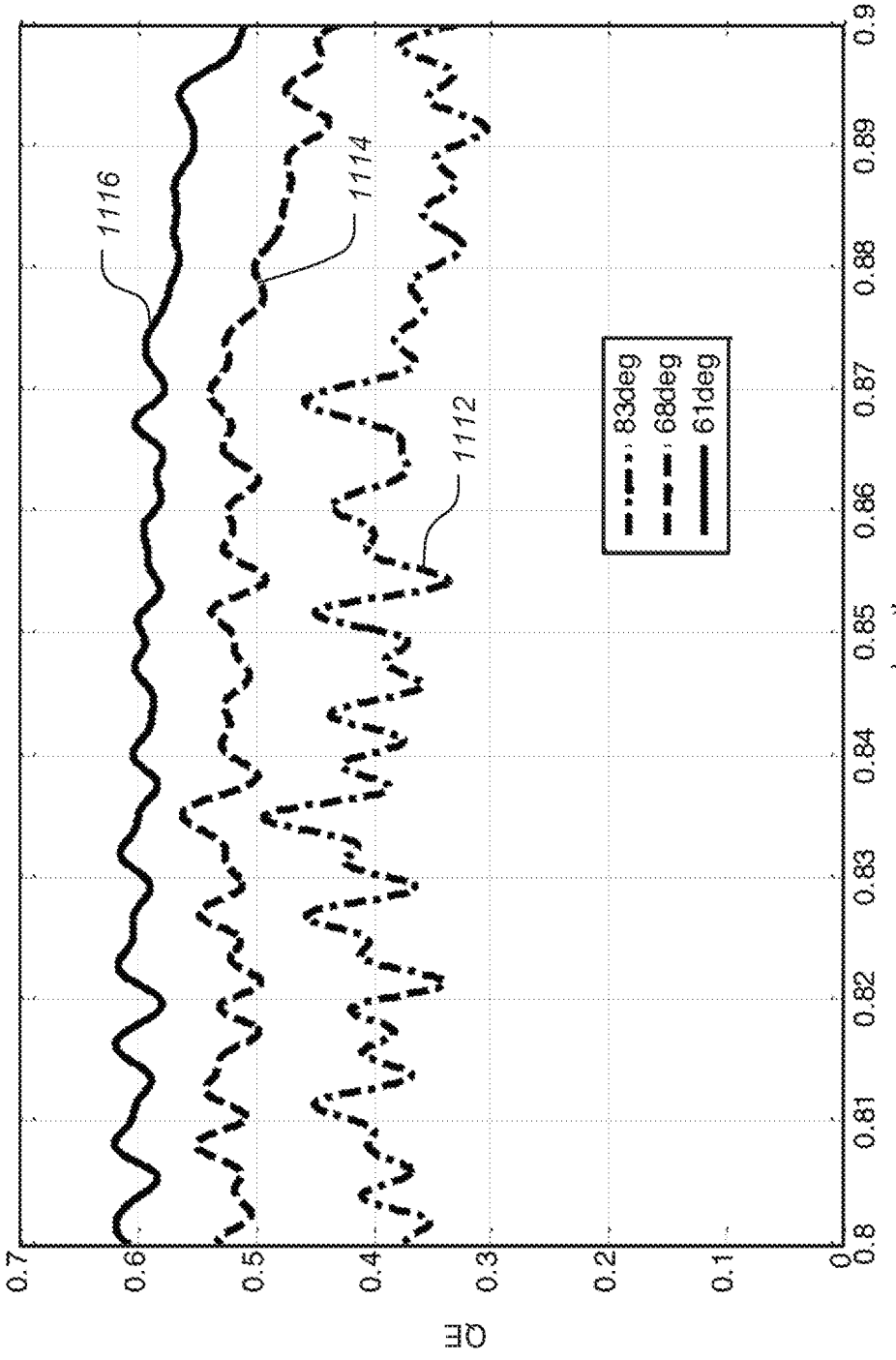

QE
wavelength, um
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9
1116
1114
1112
83deg
68deg
61deg

FIG. 11

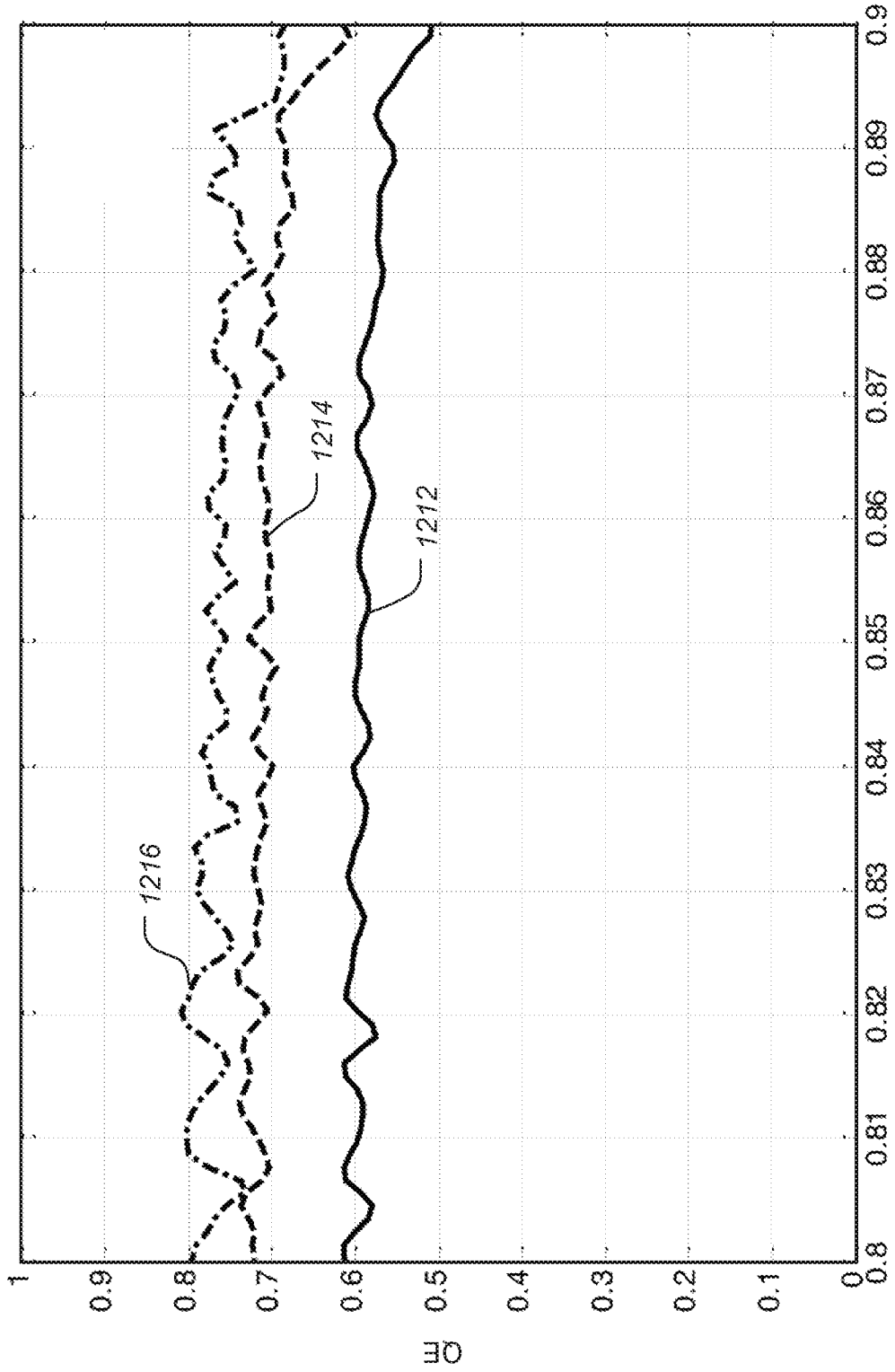

EQE
wavelength, um
1216
1214
1212
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9

FIG. 12A

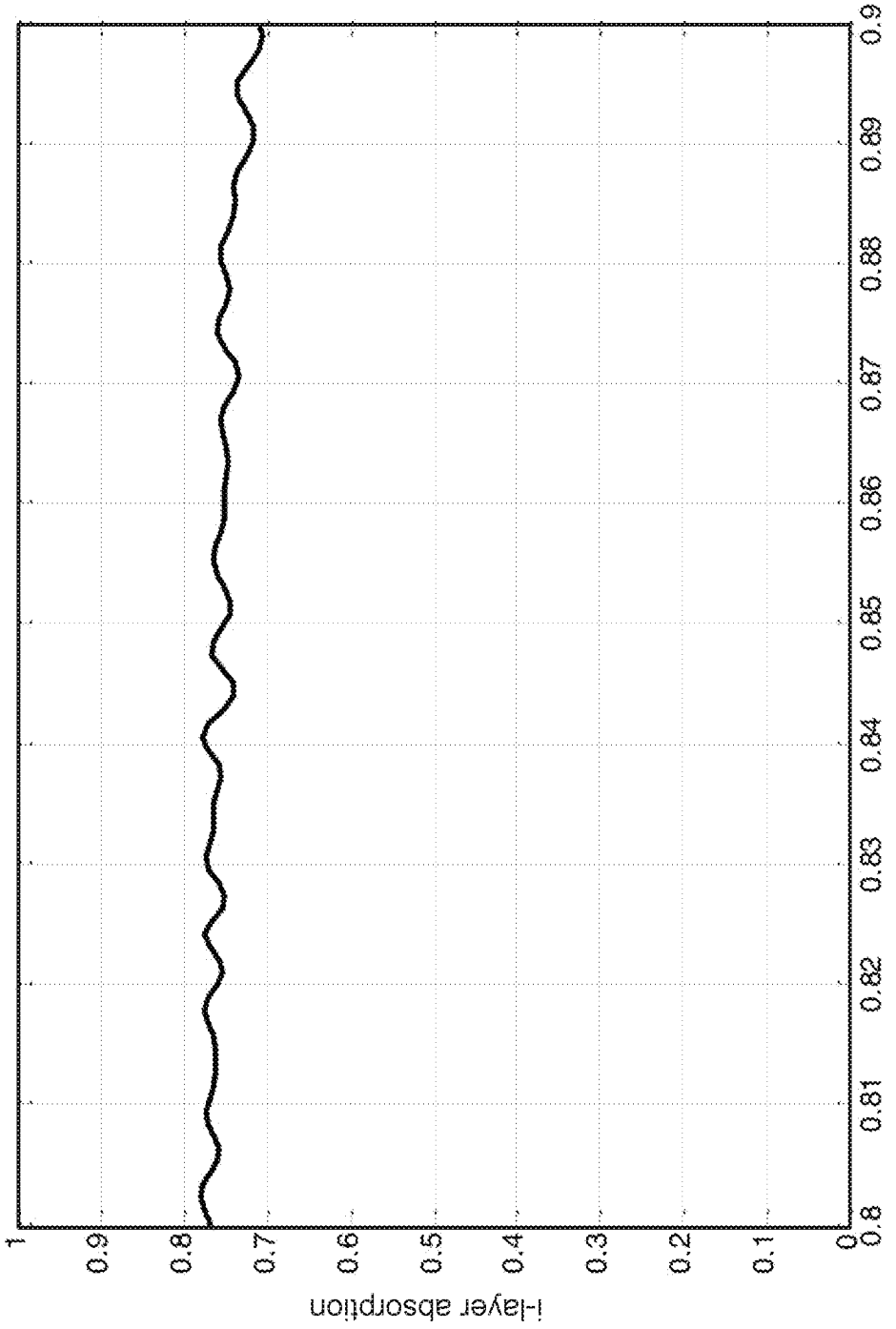

i-layer absorption
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9
wavelength, um

FIG. 12B

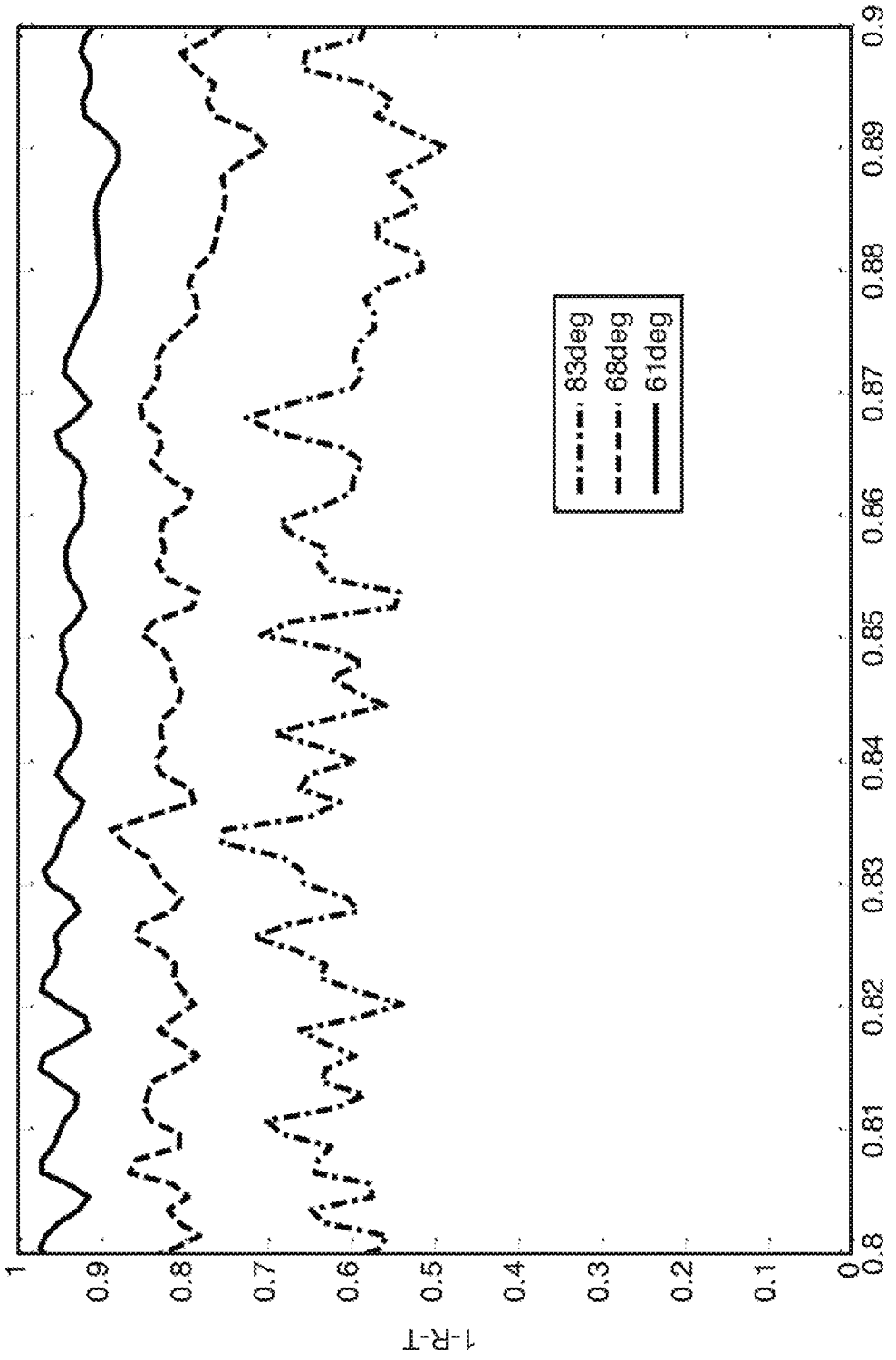

1-R-T
wavelength, um
83deg
68deg
61deg
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9

FIG. 13

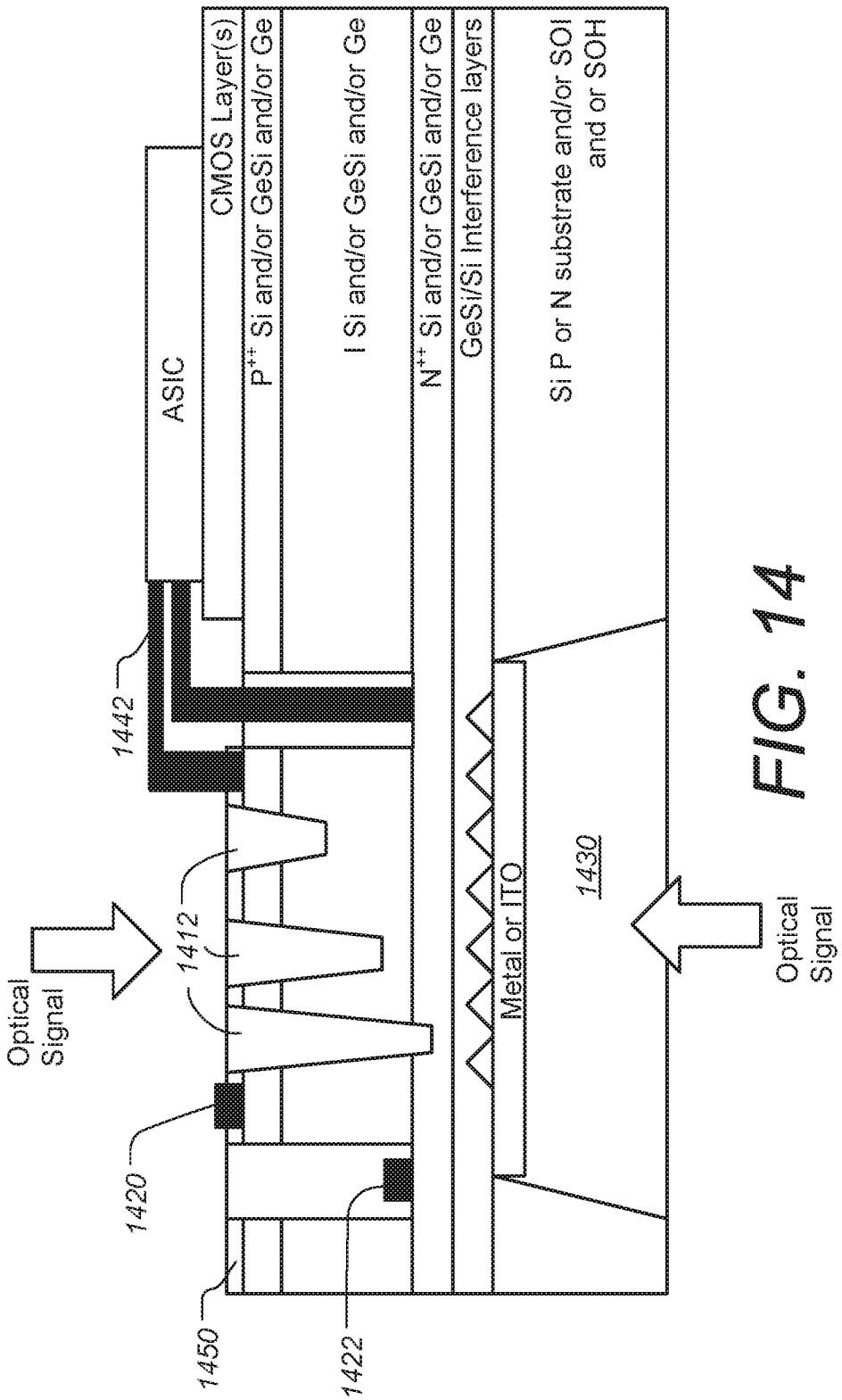

ASIC
CMOS Layer(s)
P++ Si and/or GeSi and/or Ge
I Si and/or GeSi and/or Ge
N++ Si and/or GeSi and/or Ge
GeSi/Si Interference layers
Si P or N substrate and/or SOI and or SOH
Metal or ITO
1430
1442
1412
1420
1450
1422
Optical Signal
Optical Signal

FIG. 14

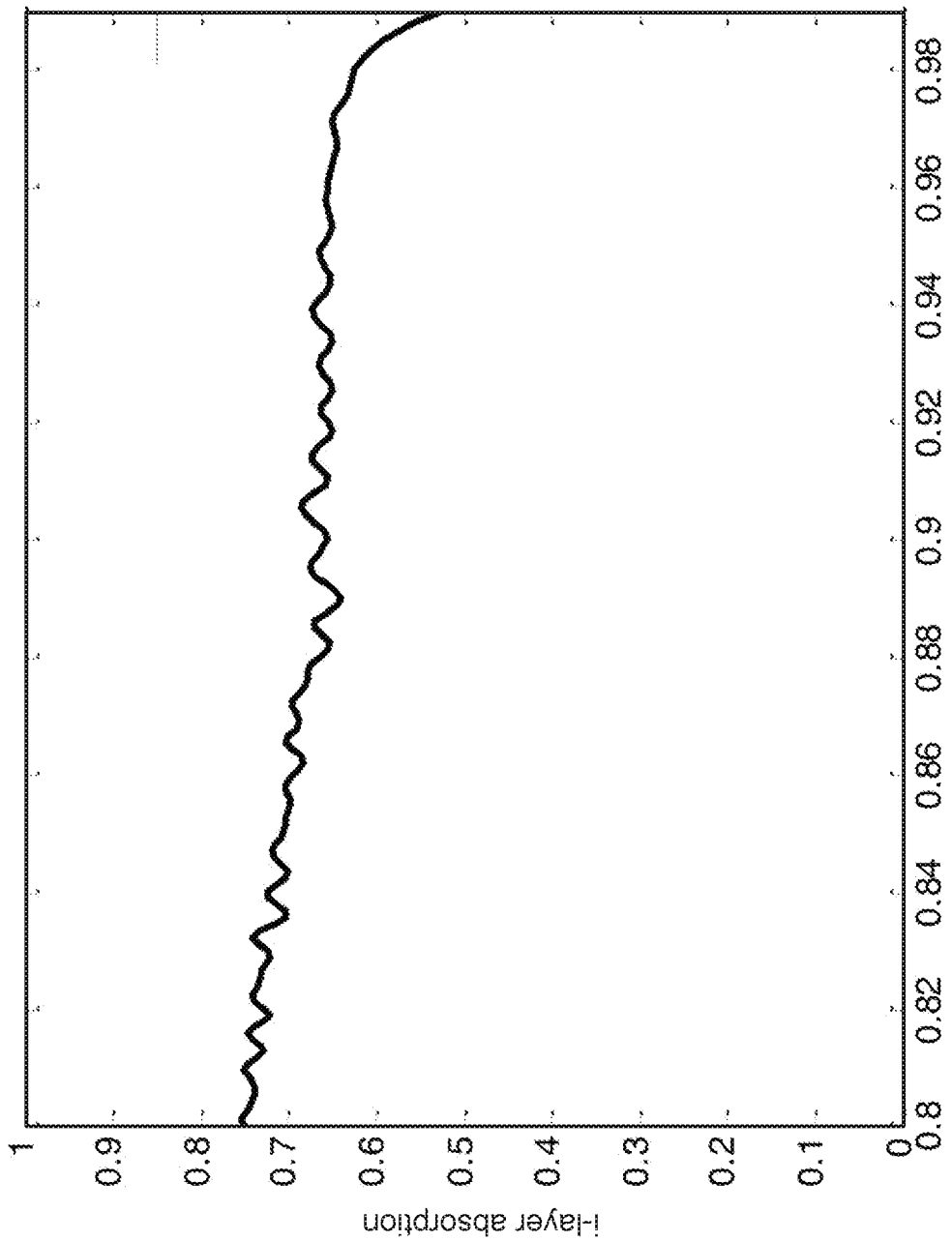

i-layer absorption
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98
wavelength, um

FIG. 15

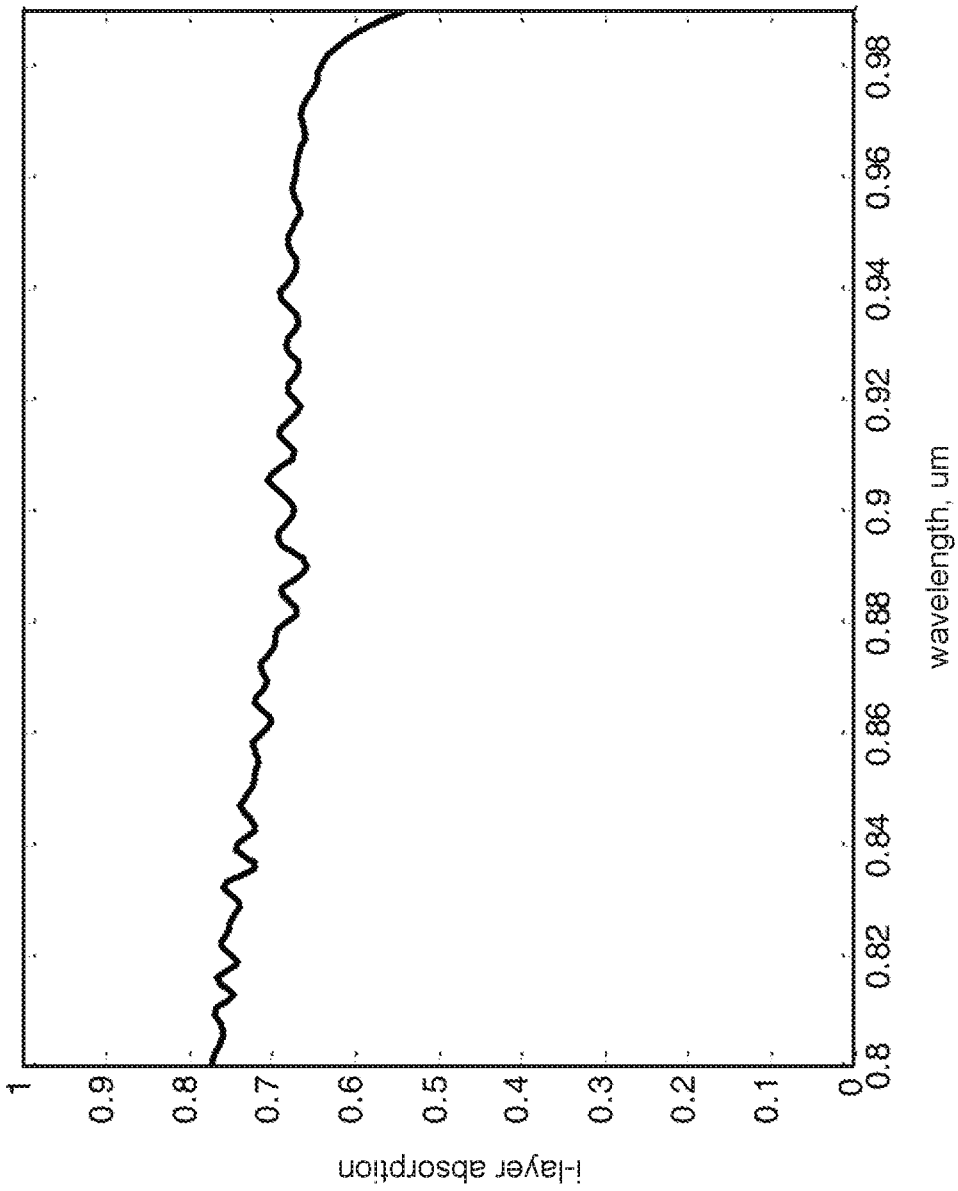

i-layer absorption
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98
wavelength, um

FIG. 16

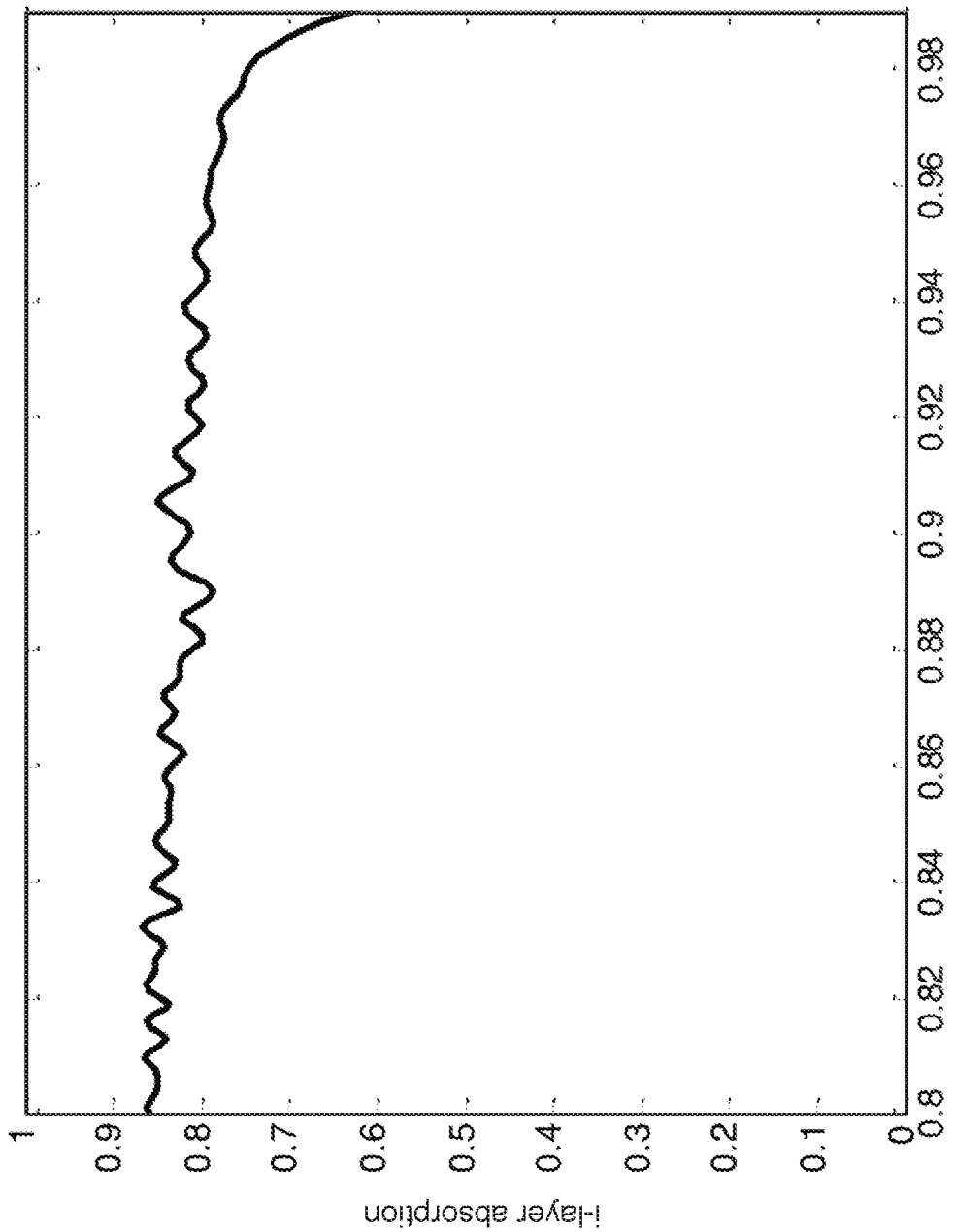

i-layer absorption
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98
wavelength, um

FIG. 17

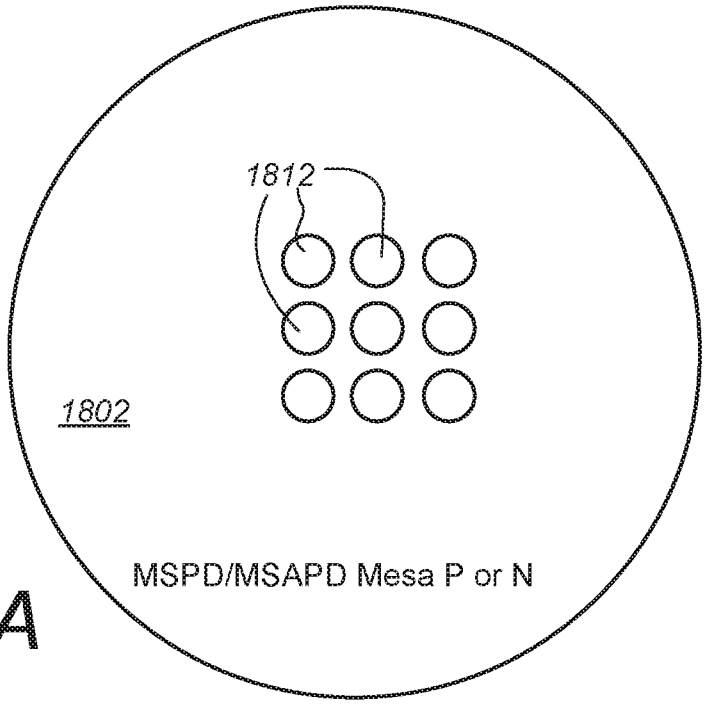


FIG. 18A

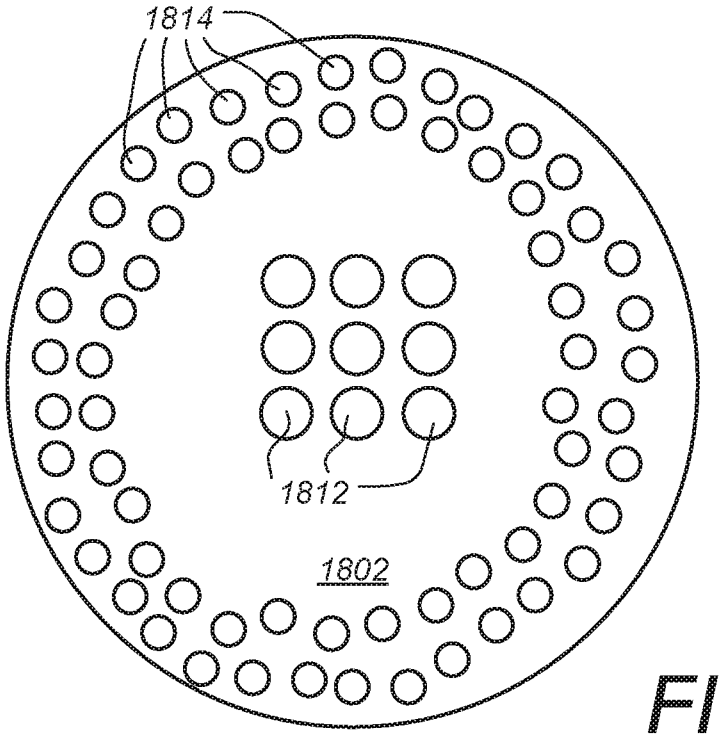


FIG. 18B

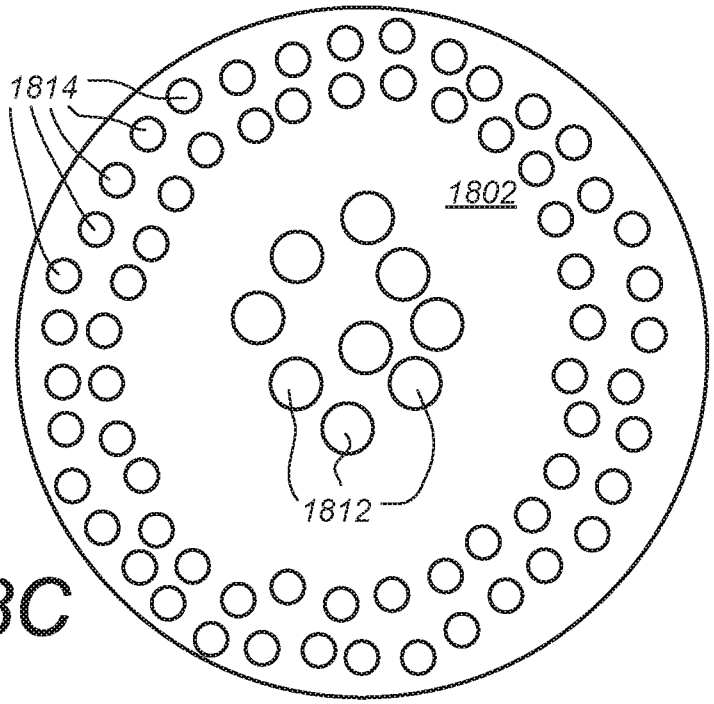


FIG. 18C

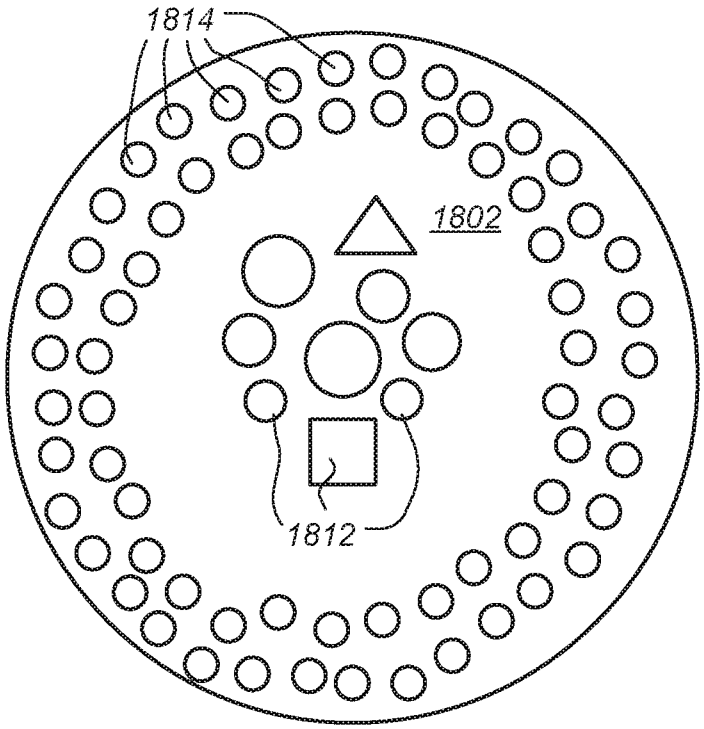


FIG. 18D

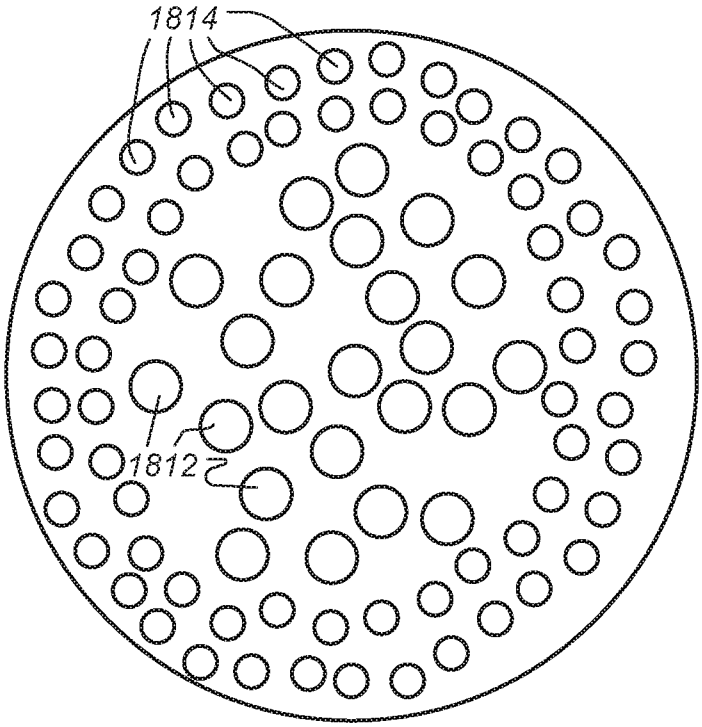


FIG. 18E

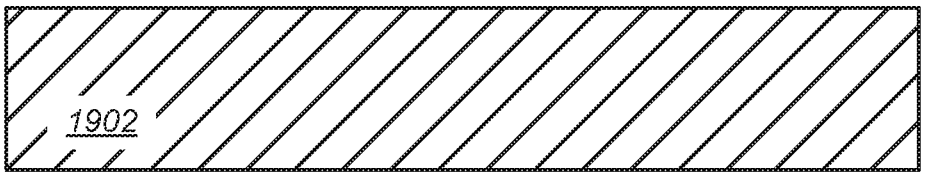


FIG. 19A

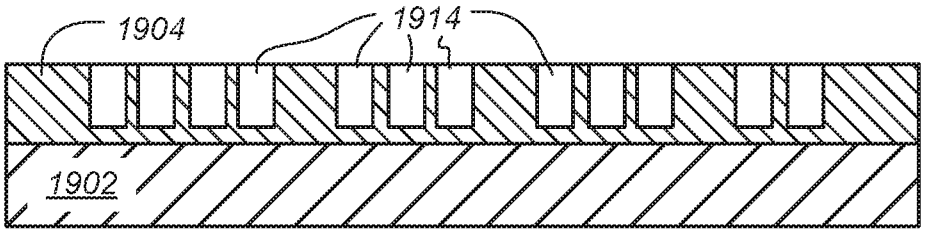


FIG. 19B

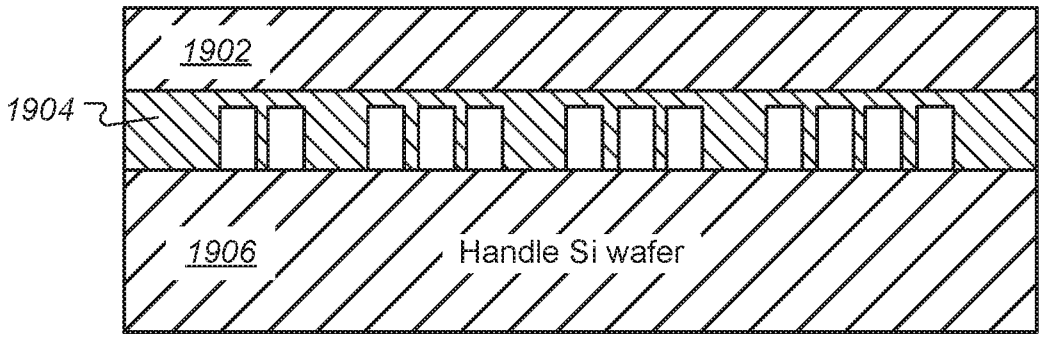


FIG. 19C

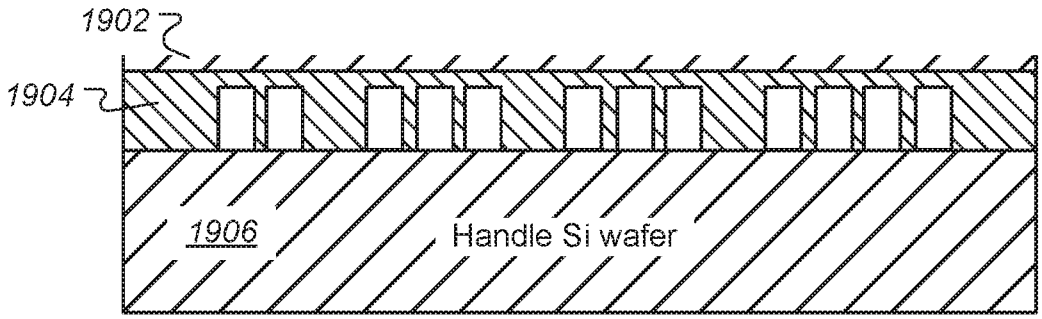


FIG. 19D

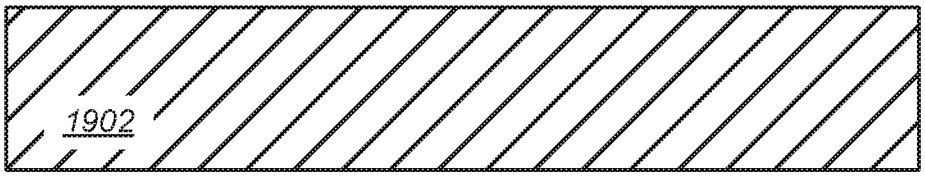


FIG. 19E

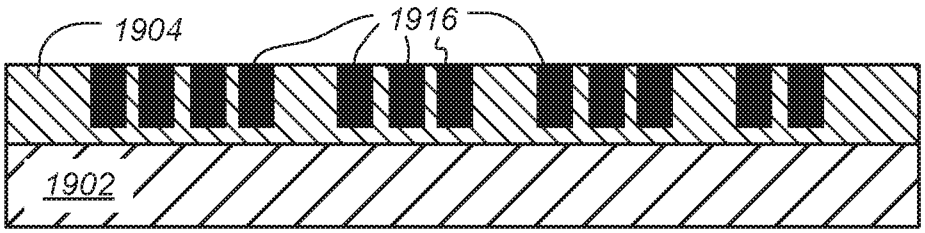


FIG. 19F

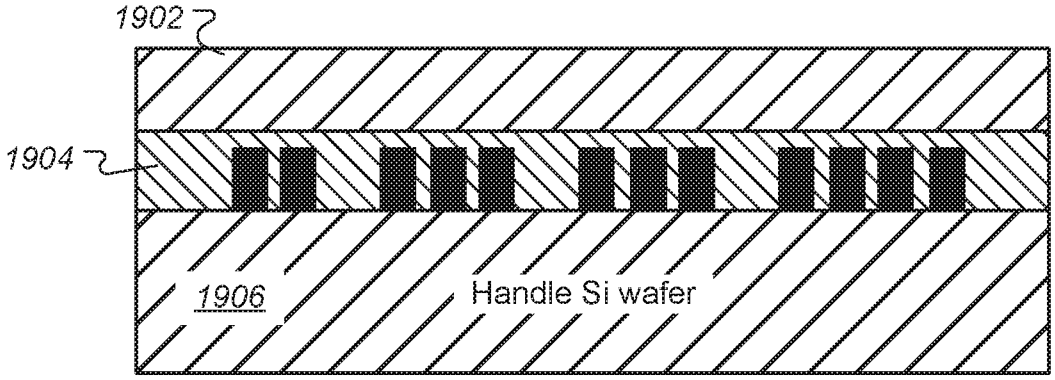


FIG. 19G

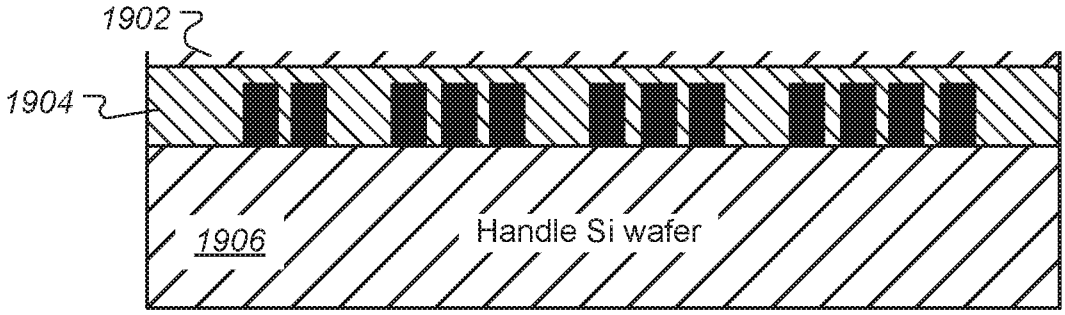


FIG. 19H

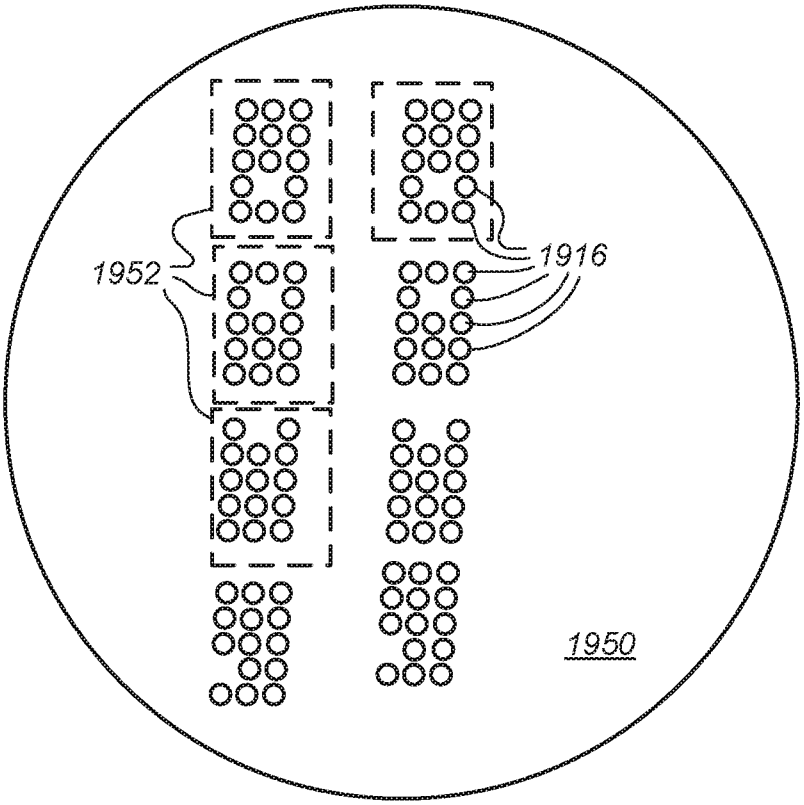


FIG. 19I

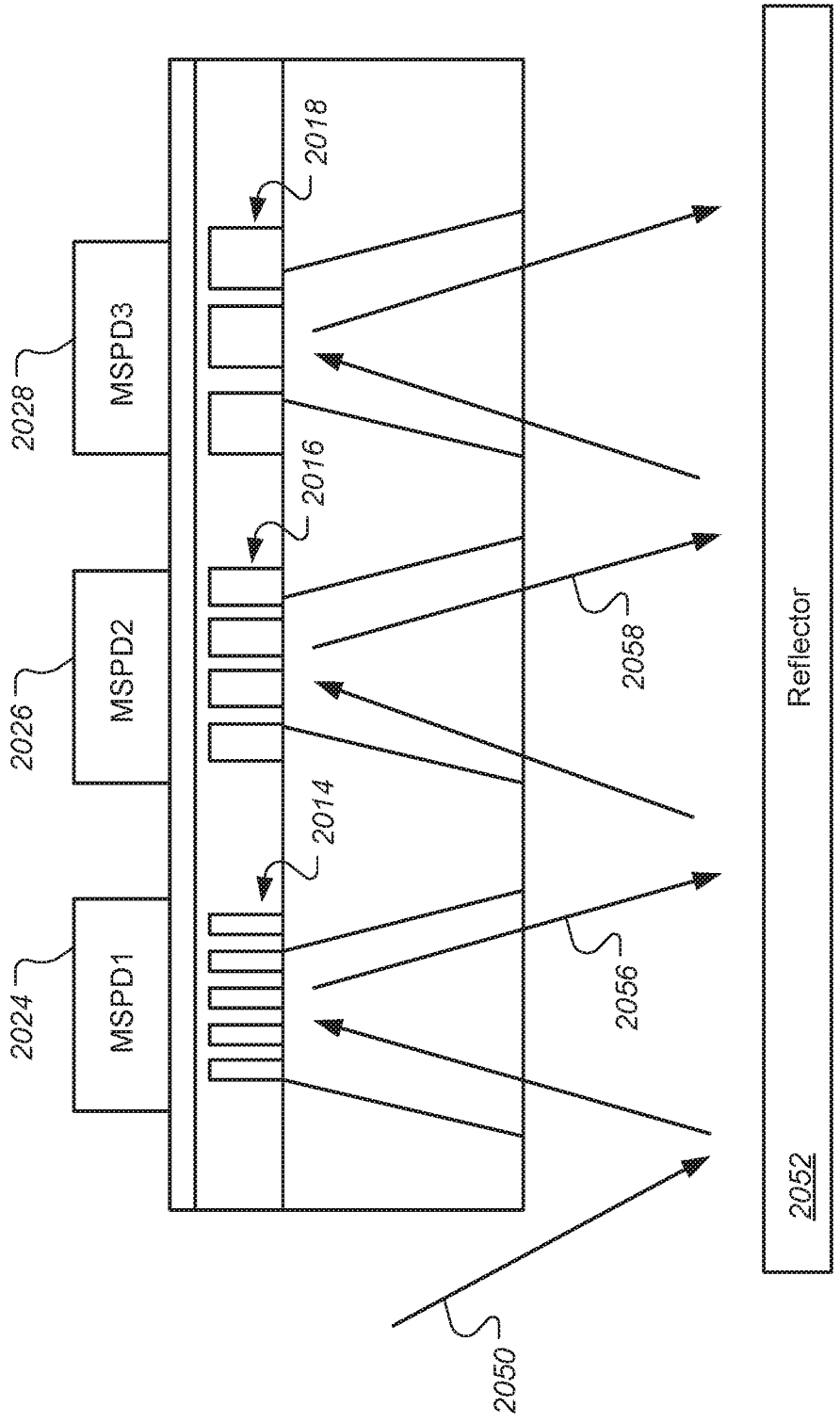

2018
2028
MSPD3
2016
2026
MSPD2
2058
2014
2024
MSPD1
2056
Reflector
2052
2050

FIG. 20

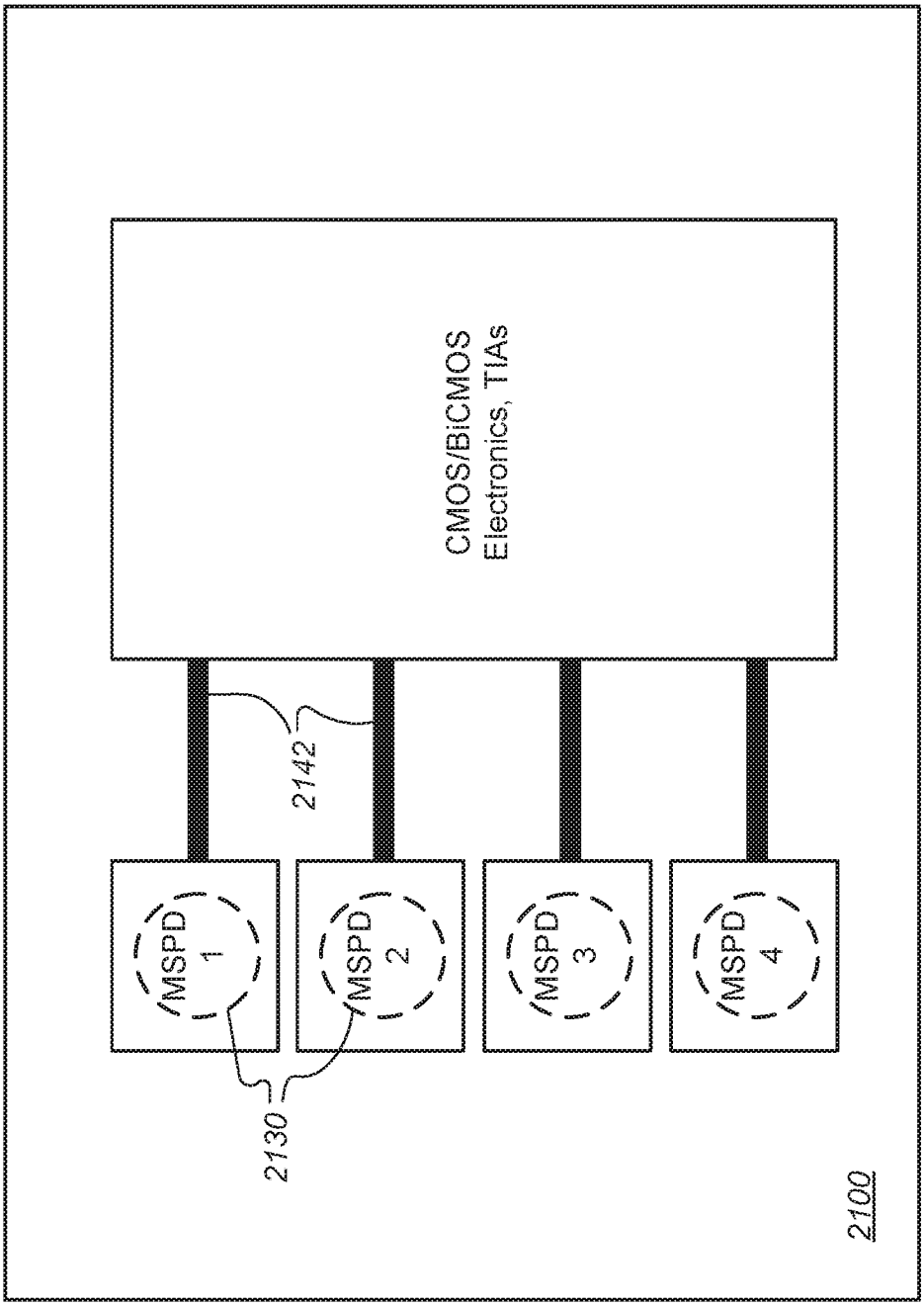

CMOS/BiCMOS
Electronics, TIAs
2142
MSPD 1
MSPD 2
MSPD 3
MSPD 4
2130
2100

FIG. 21

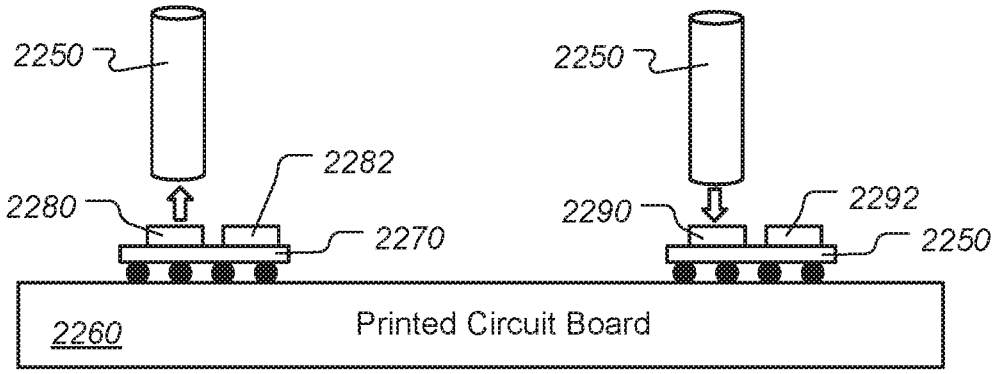


FIG. 22A
(prior art)

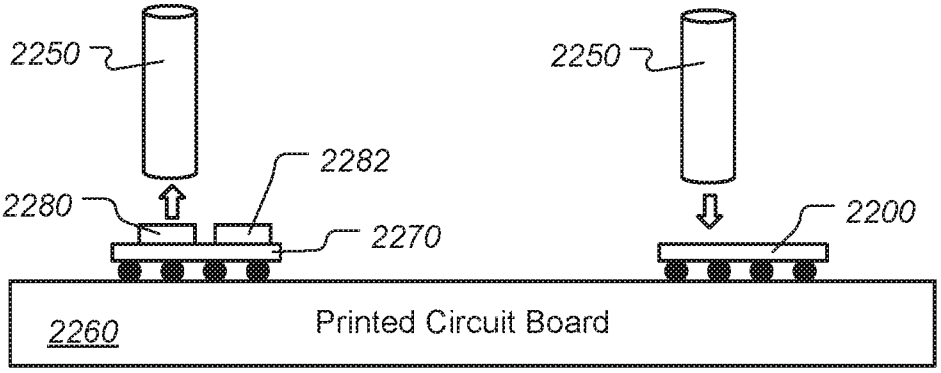


FIG. 22B

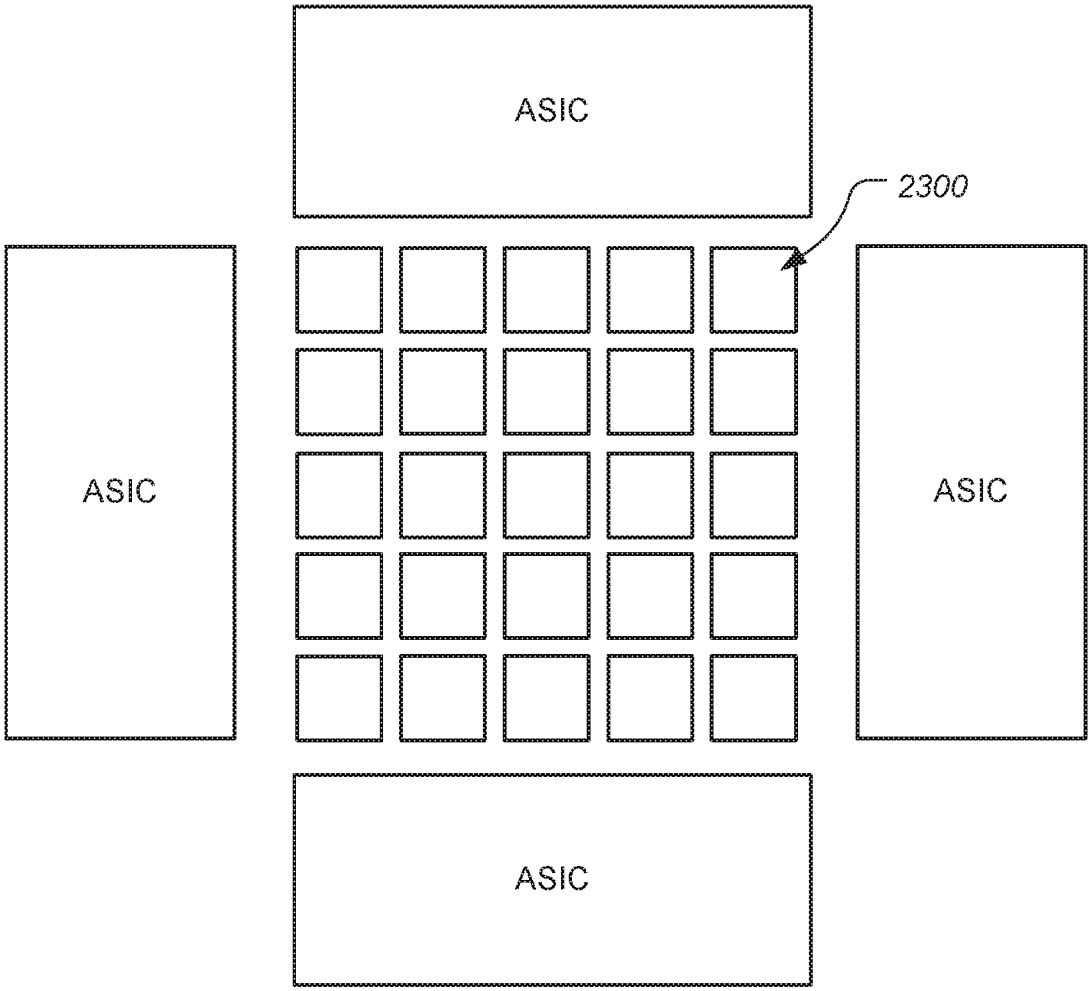


FIG. 23

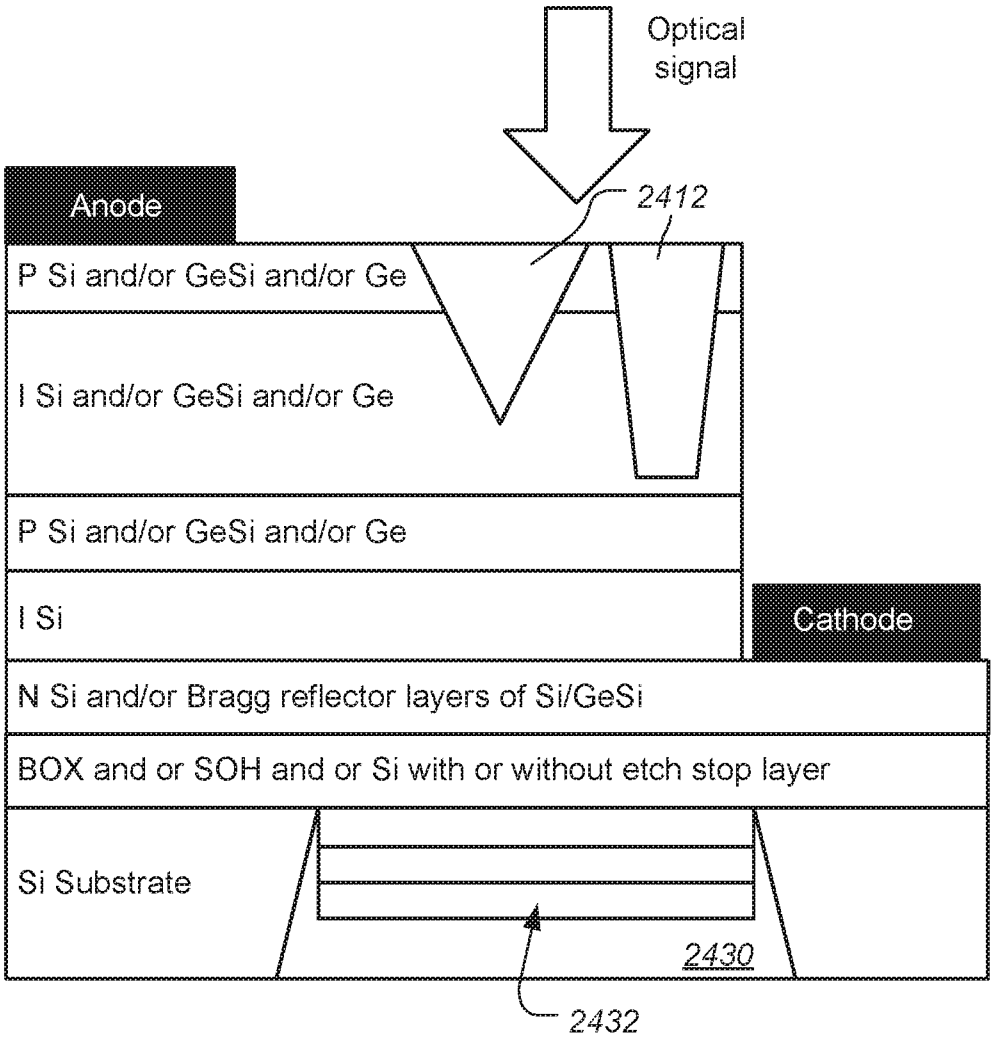

Optical signal
2412
Anode
P Si and/or GeSi and/or Ge
I Si and/or GeSi and/or Ge
P Si and/or GeSi and/or Ge
I Si
Cathode
N Si and/or Bragg reflector layers of Si/GeSi
BOX and or SOH and or Si with or without etch stop layer
Si Substrate
2430
2432

FIG. 24

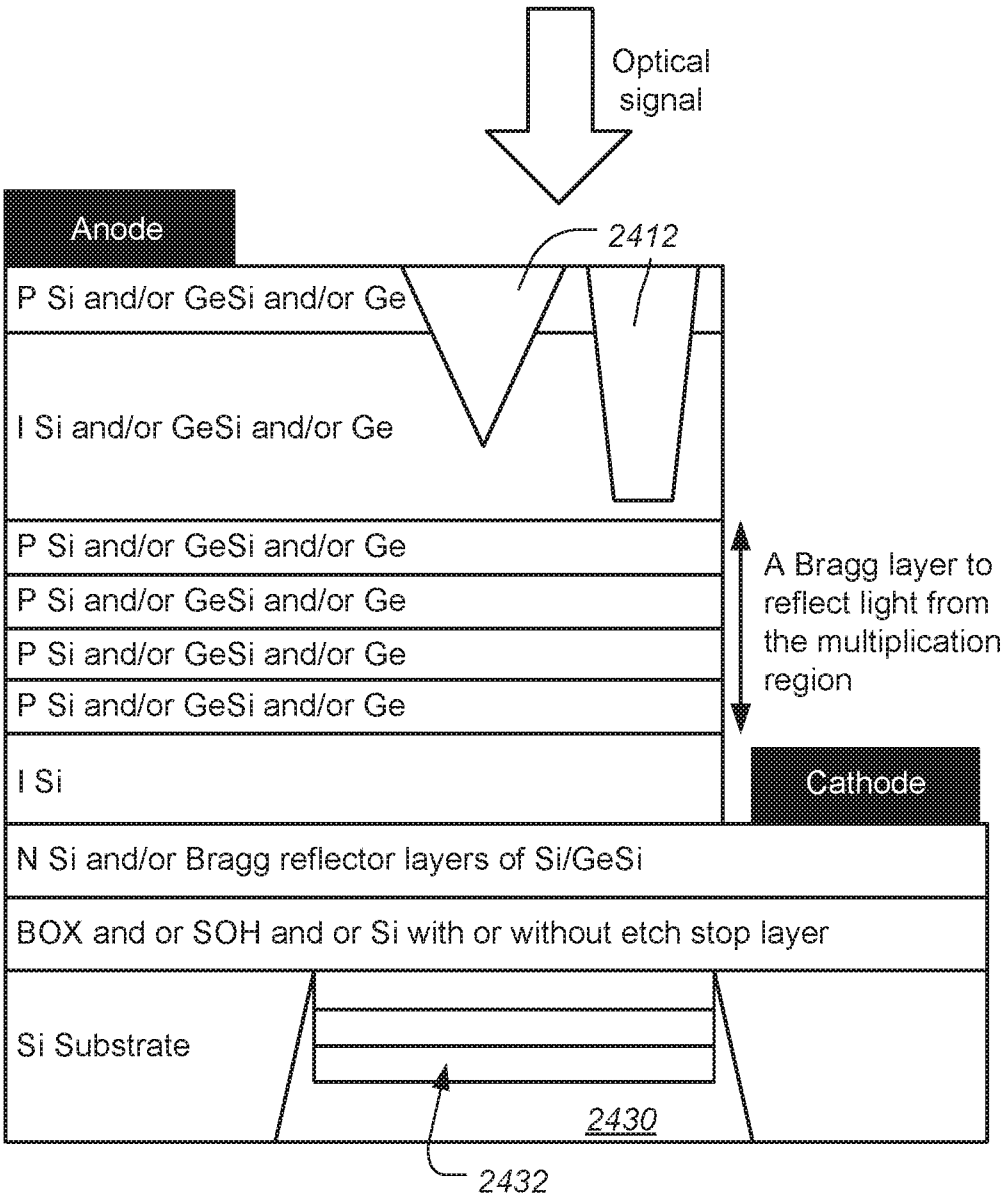

Optical signal
Anode
2412
P Si and/or GeSi and/or Ge
I Si and/or GeSi and/or Ge
P Si and/or GeSi and/or Ge
P Si and/or GeSi and/or Ge
P Si and/or GeSi and/or Ge
P Si and/or GeSi and/or Ge
A Bragg layer to reflect light from the multiplication region
I Si
Cathode
N Si and/or Bragg reflector layers of Si/GeSi
BOX and or SOH and or Si with or without etch stop layer
Si Substrate
2430
2432

FIG. 25

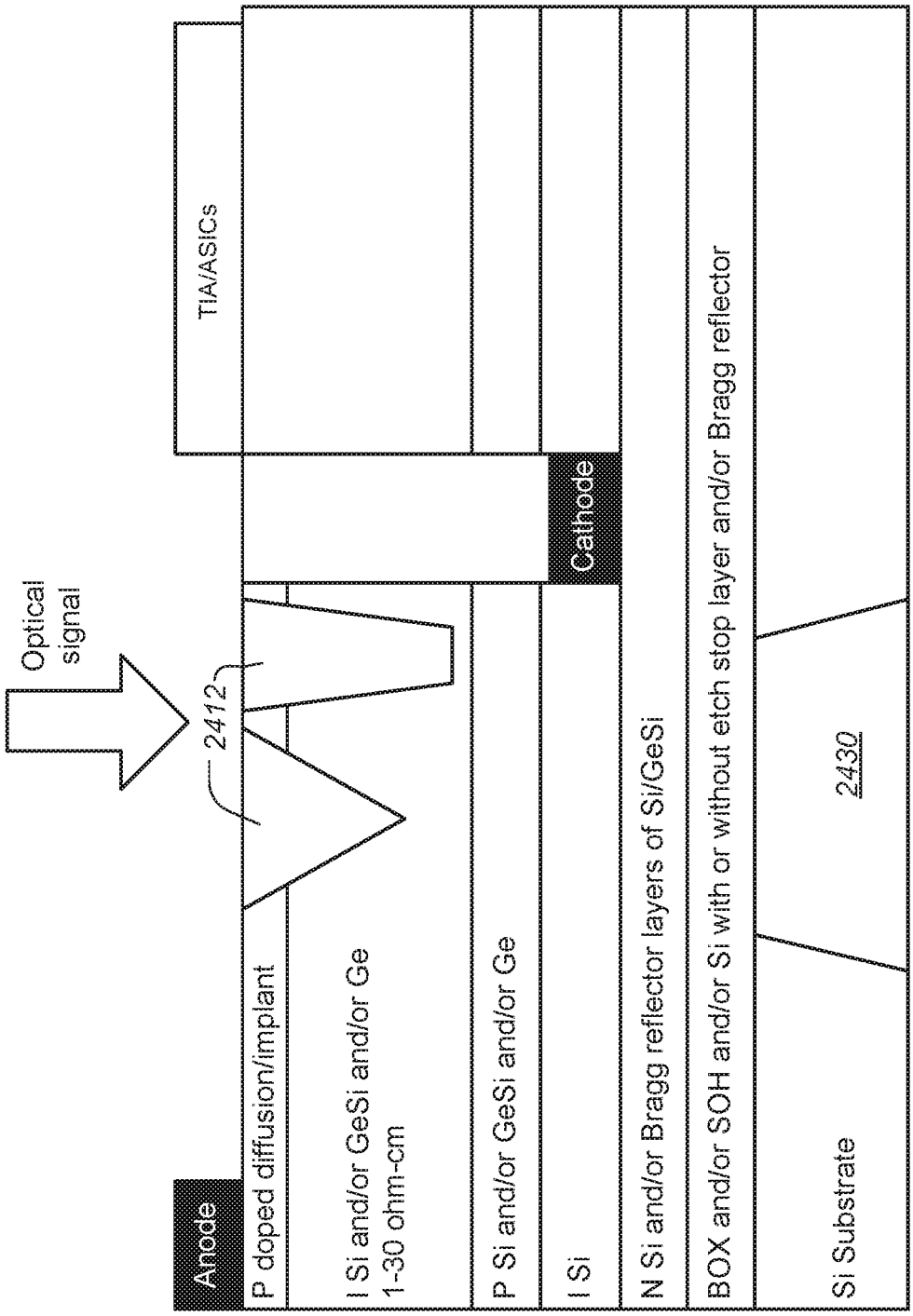

Optical signal
2412
TIA/ASICs
Anode
Cathode
P doped diffusion/implant
I Si and/or GeSi and/or Ge
1-30 ohm-cm
P Si and/or GeSi and/or Ge
I Si
N Si and/or Bragg reflector layers of Si/GeSi
BOX and/or SOH and/or Si with or without etch stop layer and/or Bragg reflector
Si Substrate
2430

FIG. 26

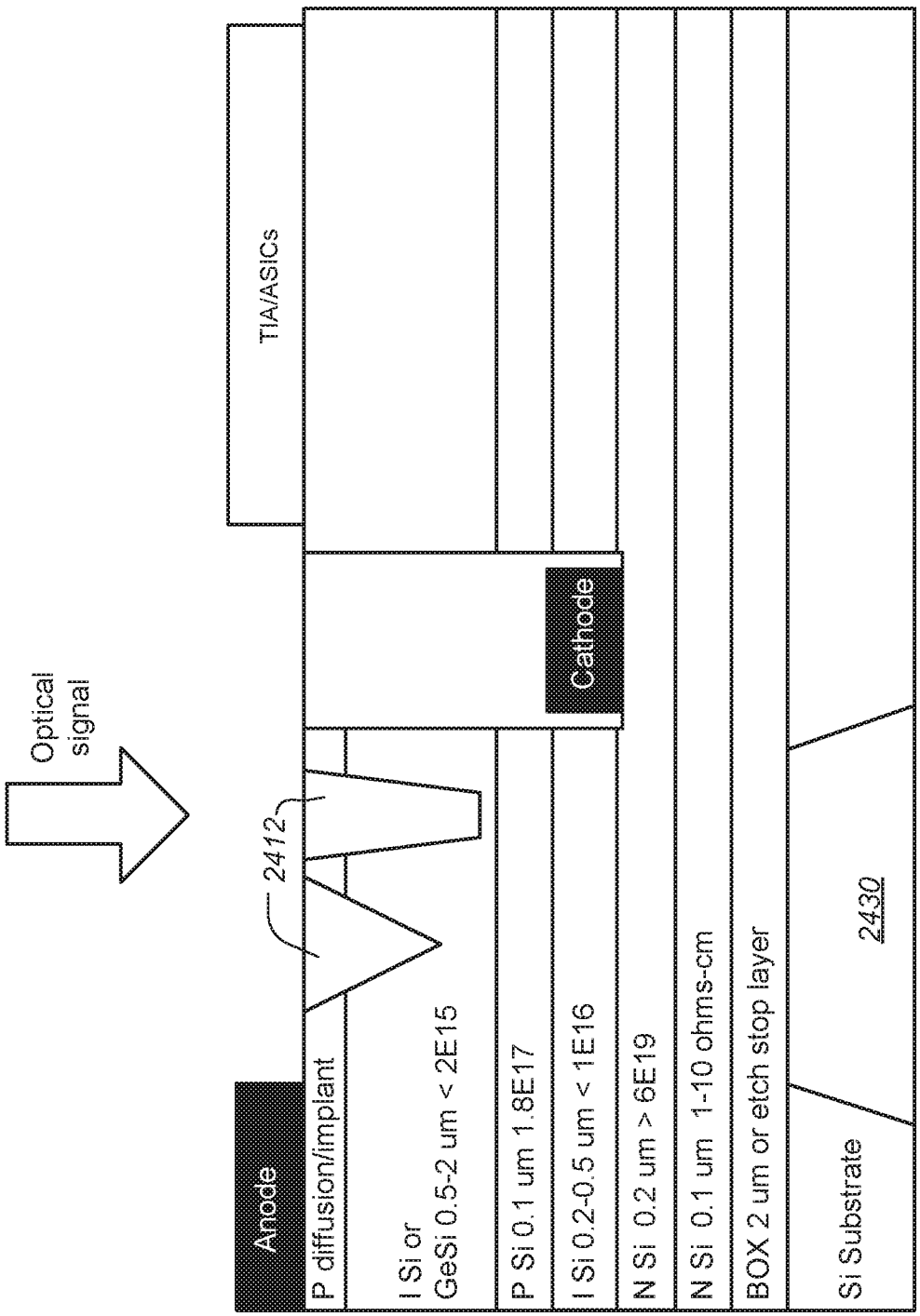

Optical signal
TIA/ASICs
Anode
Cathode
2412
2430
P diffusion/implant
I Si or GeSi 0.5-2 um < 2E15
P Si 0.1 um 1.8E17
I Si 0.2-0.5 um < 1E16
N Si 0.2 um > 6E19
N Si 0.1 um 1-10 ohms-cm
BOX 2 um or etch stop layer
Si Substrate

FIG. 27

d/p:700/1000nm	Responsivity (A/W) @980 nm	Responsivity (A/W) @990 nm
KOH-only	0.156	0.138
KOH+DRIE	0.142	0.116
61° tapered	0.144	0.130
68° tapered	0.122	0.111
83° tapered	0.112	0.096
90° straight	0.092	0.079
2 μm Si-theory	0.015	0.012

FIG. 28

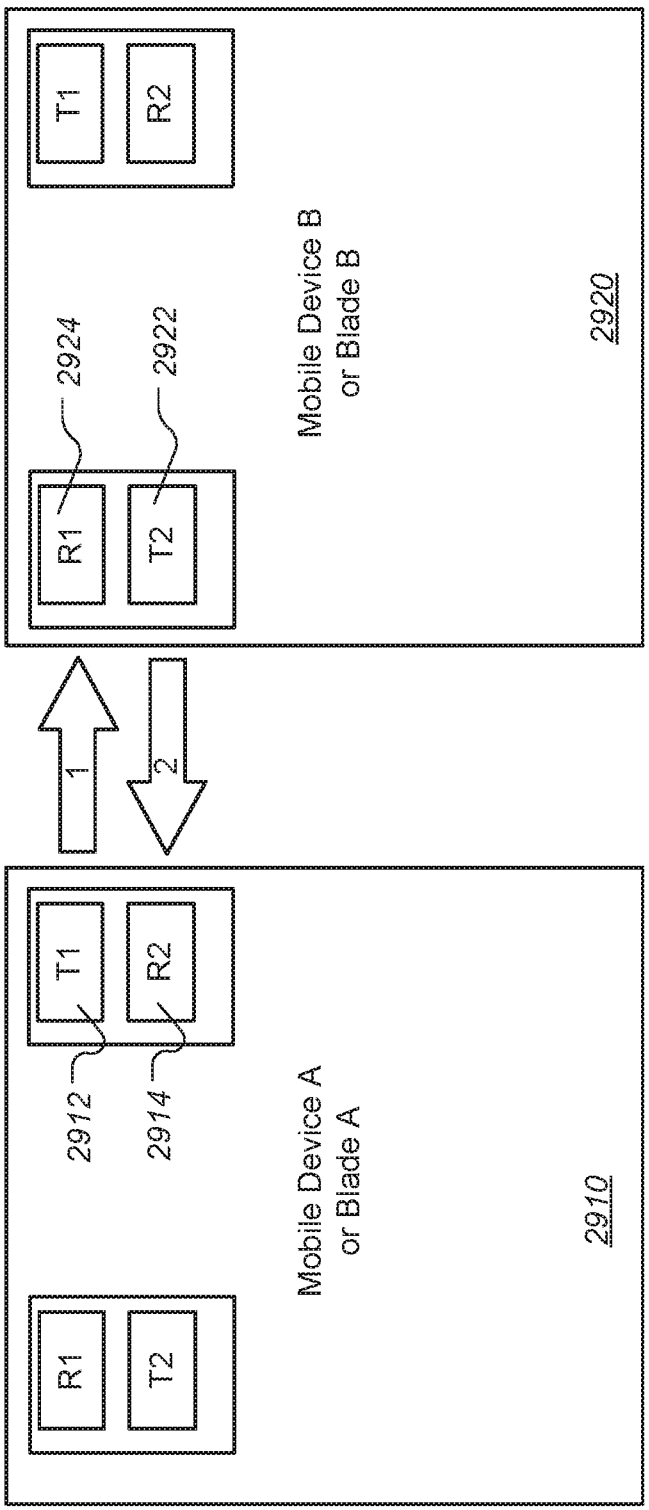

T1
R2
2924
2922
R1
T2
Mobile Device B
or Blade B
2920
1
2
T1
R2
2912
2914
R1
T2
Mobile Device A
or Blade A
2910

FIG. 29

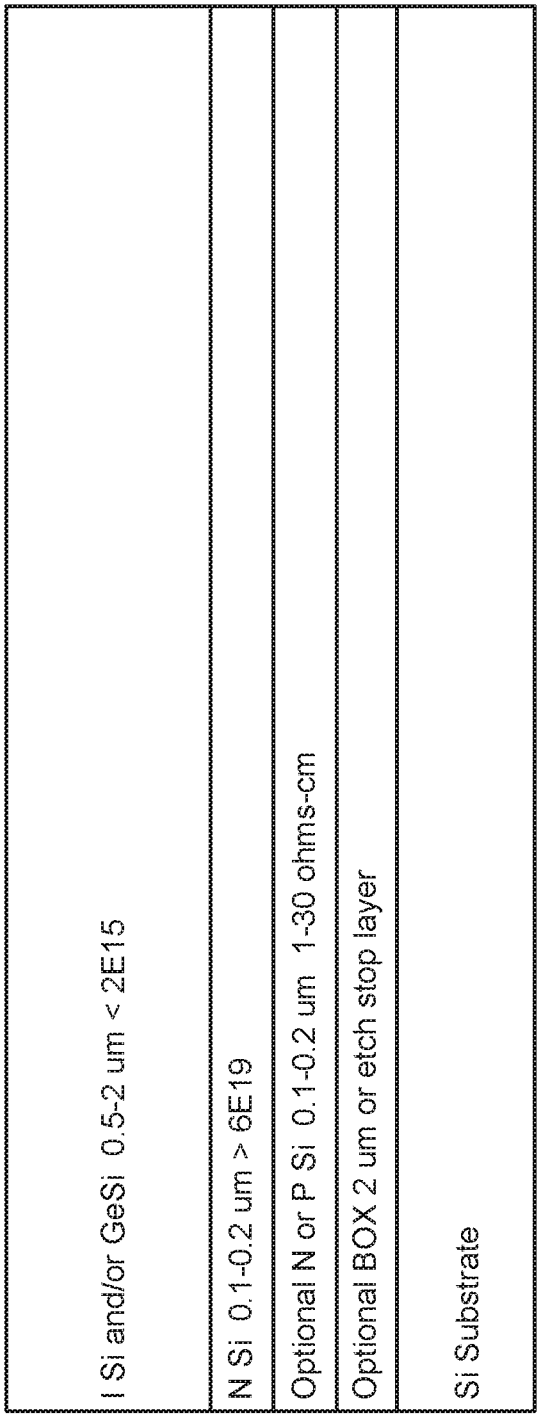

I Si and/or GeSi 0.5-2 um < 2E15
N Si 0.1-0.2 um > 6E19
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate

FIG. 30

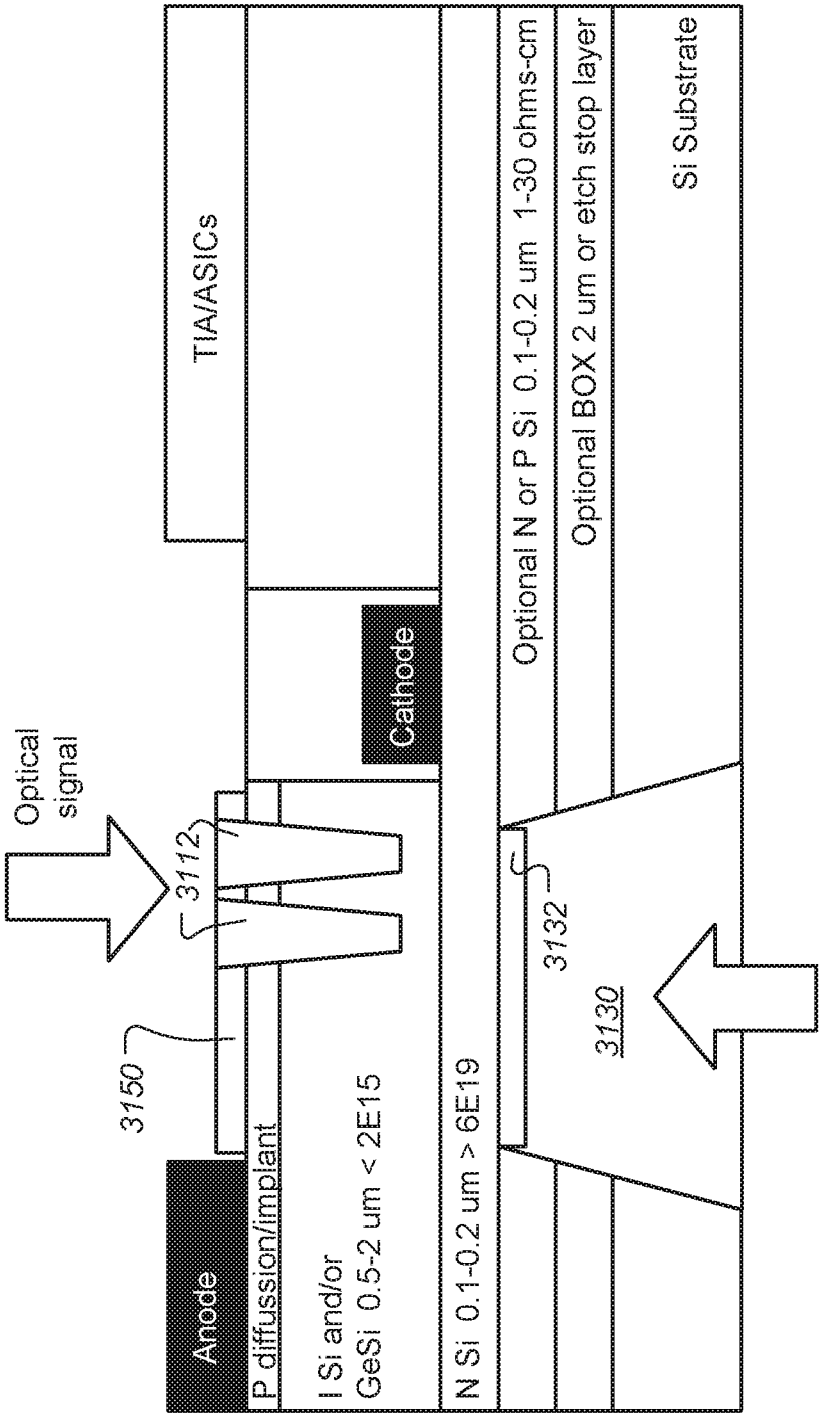

Optical signal
3112
3150
Anode
P diffussion/implant
I Si and/or
GeSi 0.5-2 um < 2E15
Cathode
N Si 0.1-0.2 um > 6E19
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate
3132
3130
TIA/ASICs

FIG. 31

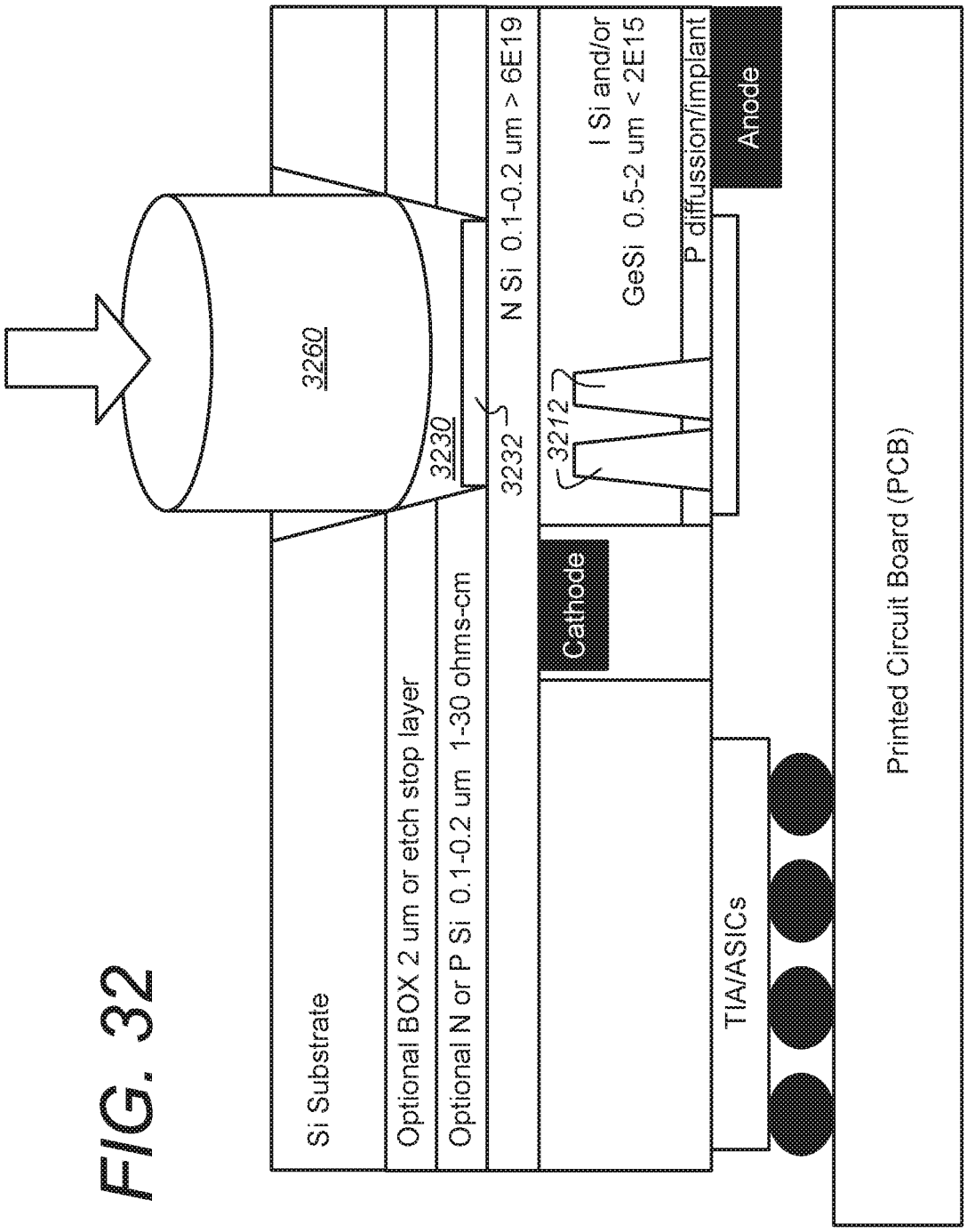

3260
3230
3232
3212
Si Substrate
Optional BOX 2 um or etch stop layer
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
N Si 0.1-0.2 um > 6E19
I Si and/or
GeSi 0.5-2 um < 2E15
P diffussion/implant
Anode
Cathode
TIA/ASICs
Printed Circuit Board (PCB)

FIG. 32

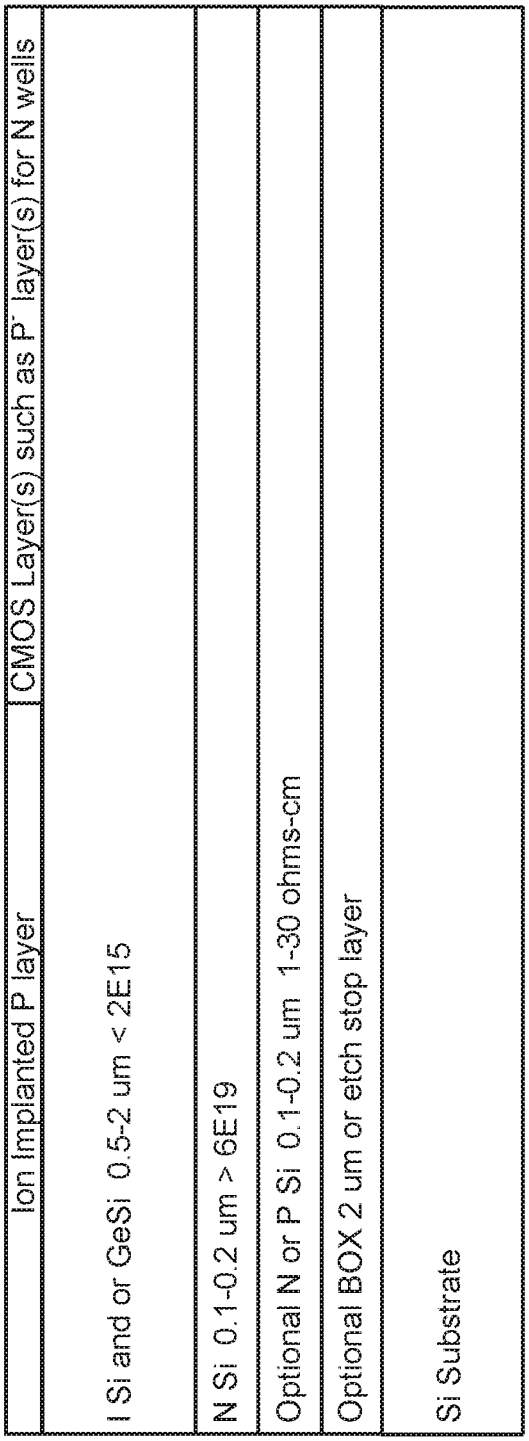

Ion Implanted P layer
CMOS Layer(s) such as P+ layer(s) for N wells
I Si and or GeSi 0.5-2 um < 2E15
N Si 0.1-0.2 um > 6E19
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate

FIG. 33

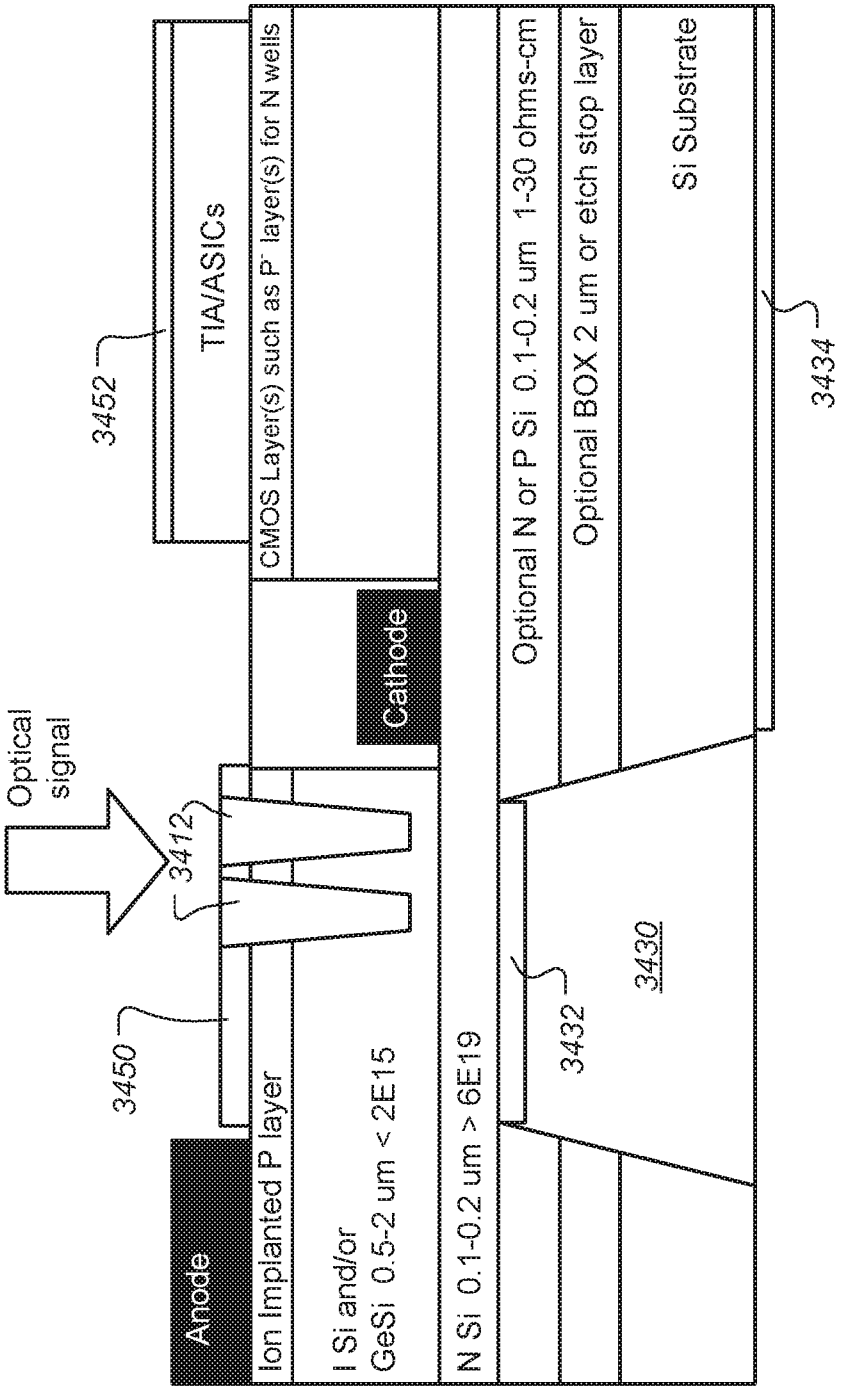

Optical signal
3412
3450
3452
3434
3430
3432
Anode
Ion Implanted P layer
I Si and/or GeSi 0.5-2 um < 2E15
N Si 0.1-0.2 um > 6E19
Cathode
CMOS Layer(s) such as P+ layer(s) for N wells
TIA/ASICs
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate

FIG. 34

CMOS/BiCMOS Layer(s)
I Si and or GeSi 0.5-2 um < 2E15
P Si and or GeSi 0.1 um 1.8E17
I Si 0.5 um < 1E16
N Si 0.1-0.2 um > 6E19
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate

FIG. 35

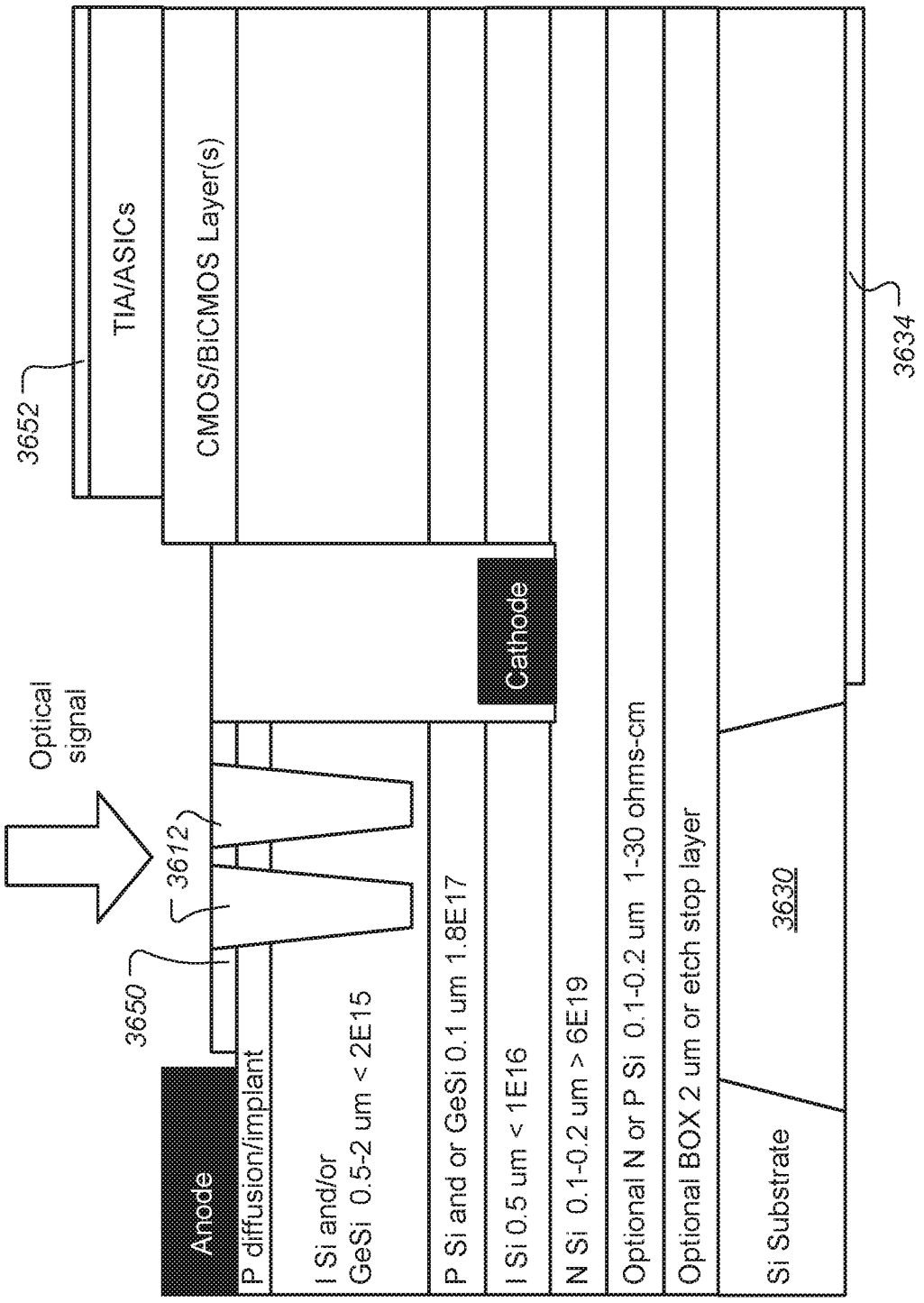

3652
TIA/ASICs
CMOS/BiCMOS Layer(s)
3634
Optical signal
3612
3650
Anode
P diffusion/implant
I Si and/or GeSi 0.5-2 um < 2E15
P Si and or GeSi 0.1 um 1.8E17
I Si 0.5 um < 1E16
Cathode
N Si 0.1-0.2 um > 6E19
Optional N or P Si 0.1-0.2 um 1-30 ohms-cm
Optional BOX 2 um or etch stop layer
Si Substrate
3630

FIG. 36

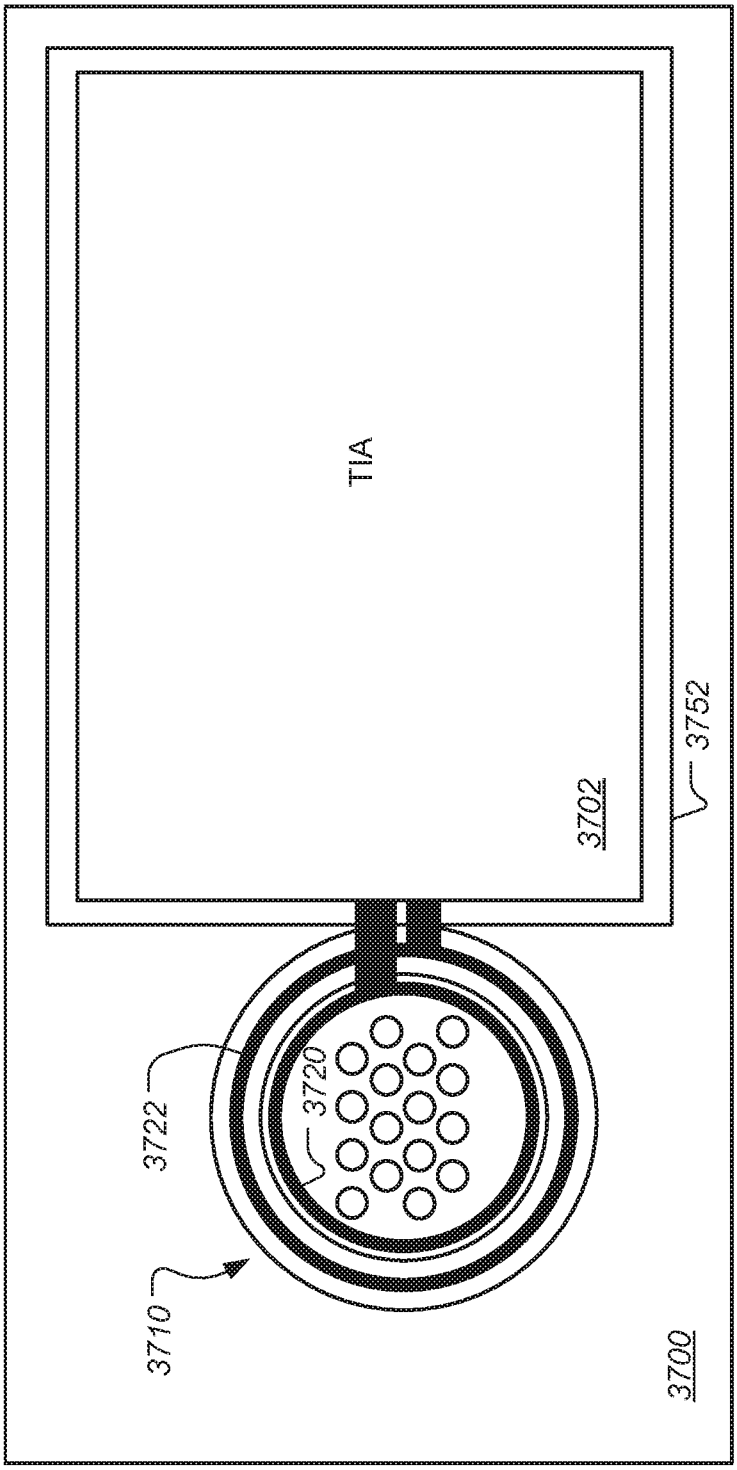


FIG. 37

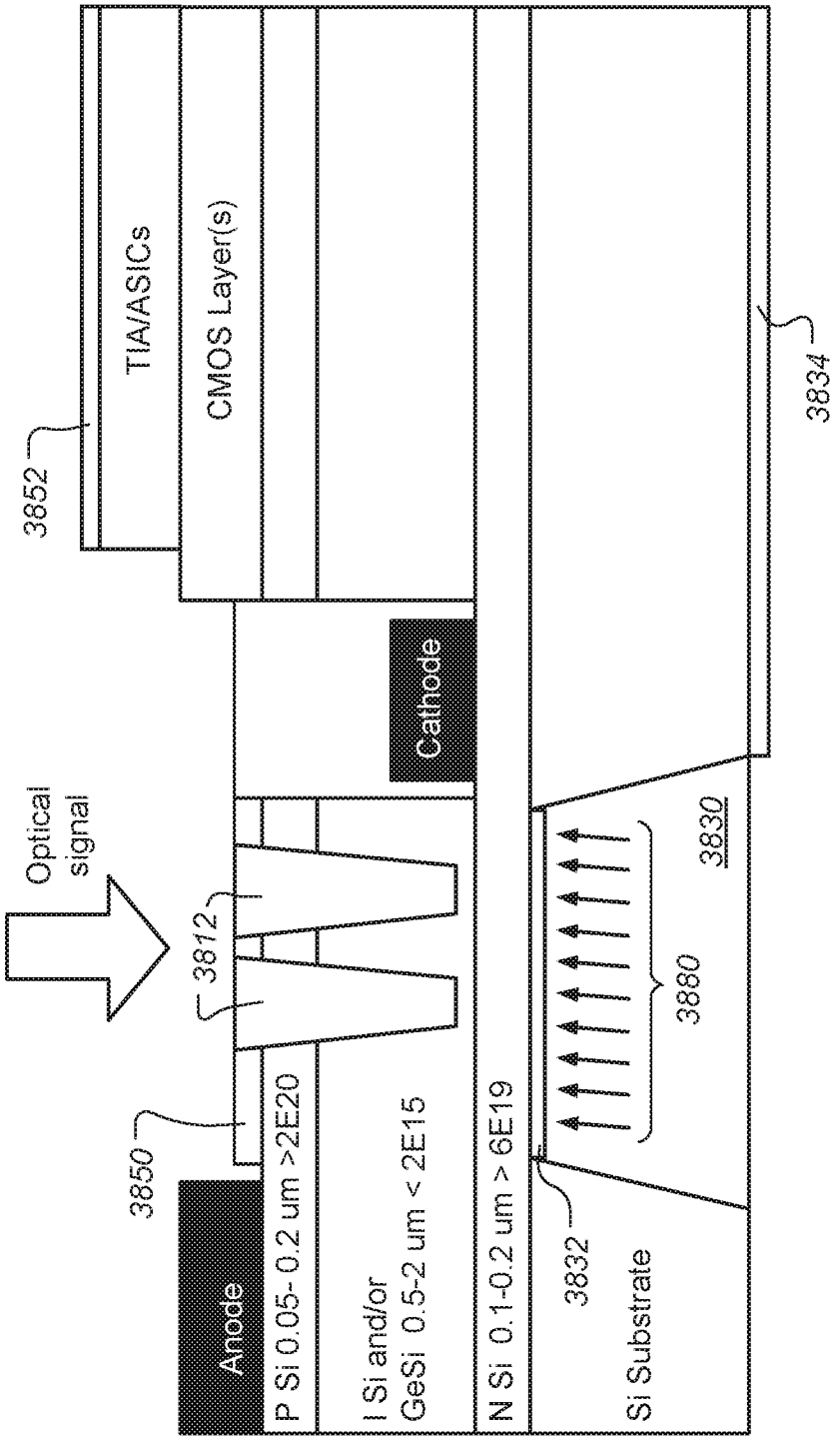

TIA/ASICs
CMOS Layer(s)
3852
3834
Optical signal
3812
Cathode
3850
Anode
P Si 0.05- 0.2 um >2E20
I Si and/or
GeSi 0.5-2 um < 2E15
N Si 0.1-0.2 um > 6E19
3880
3830
3832
Si Substrate

FIG. 38

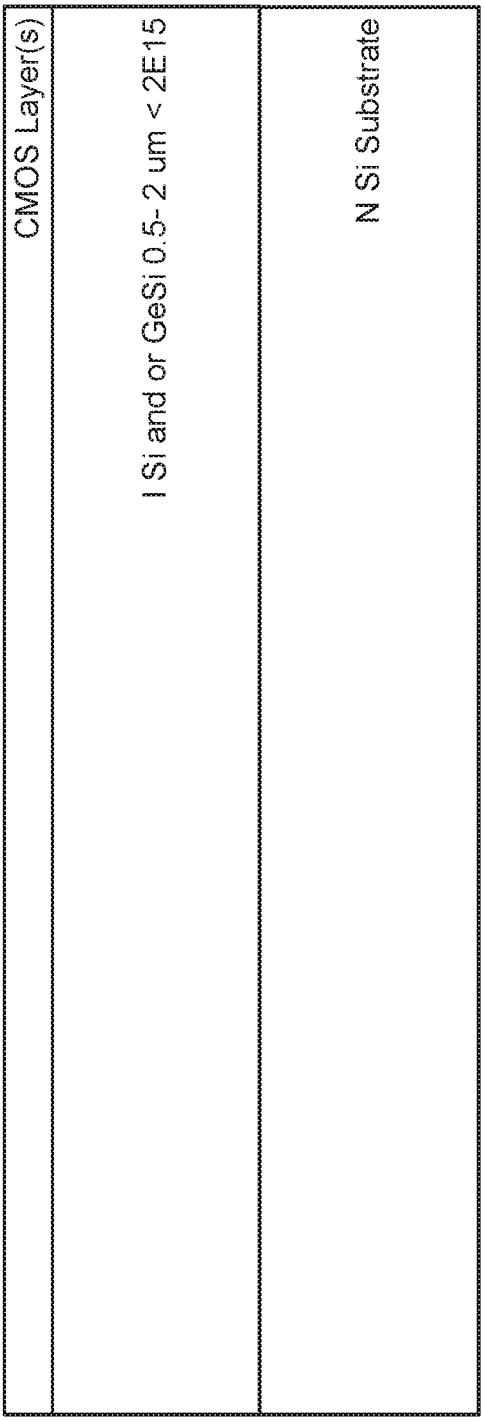


FIG. 39

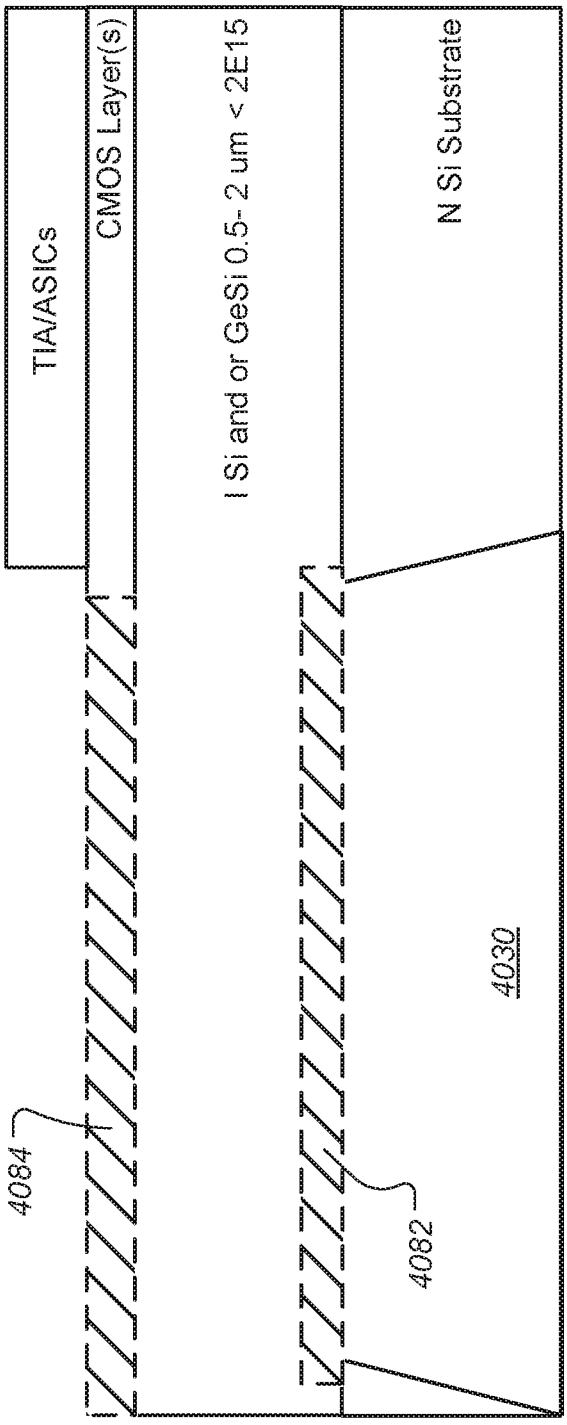

TIA/ASICs
CMOS Layer(s)
I Si and or GeSi 0.5- 2 um < 2E15
N Si Substrate
4030
4084
4082

FIG. 40

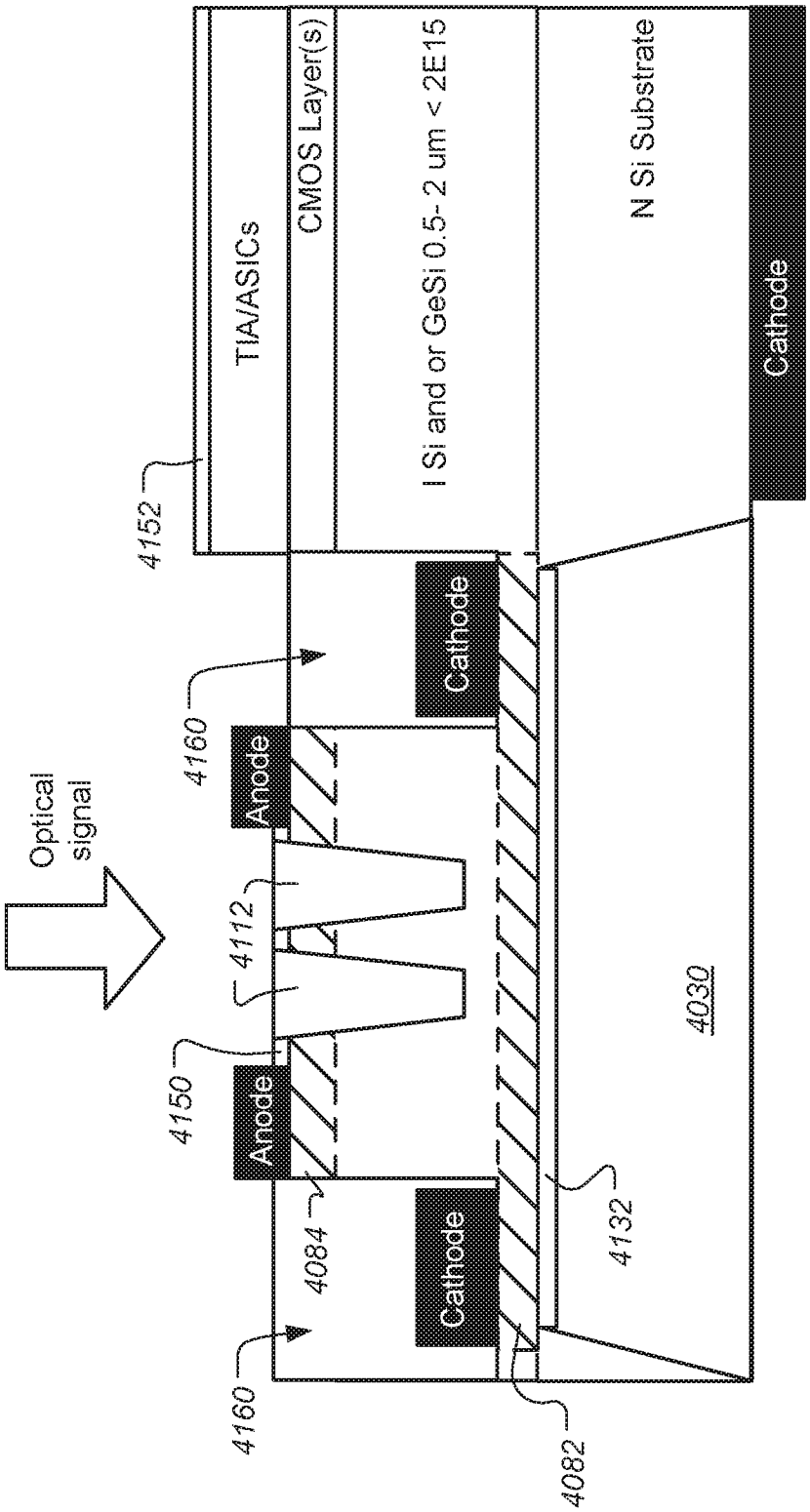

TIA/ASICs
CMOS Layer(s)
I Si and or GeSi 0.5- 2 um < 2E15
N Si Substrate
Cathode
4152
4160
Anode
Cathode
Optical signal
4112
4150
Anode
4084
Cathode
4132
4030
4160
4082

FIG. 41

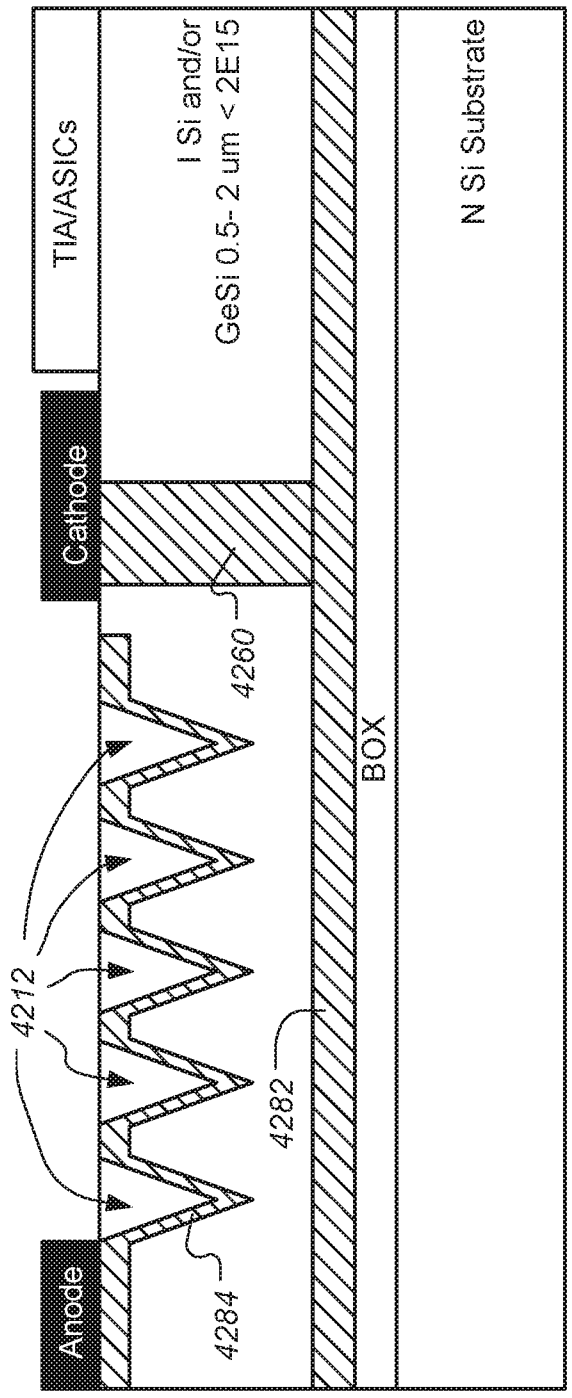

TIA/ASICs
I Si and/or
GeSi 0.5- 2 um < 2E15
N Si Substrate
Cathode
Anode
BOX
4260
4212
4282
4284

FIG. 42

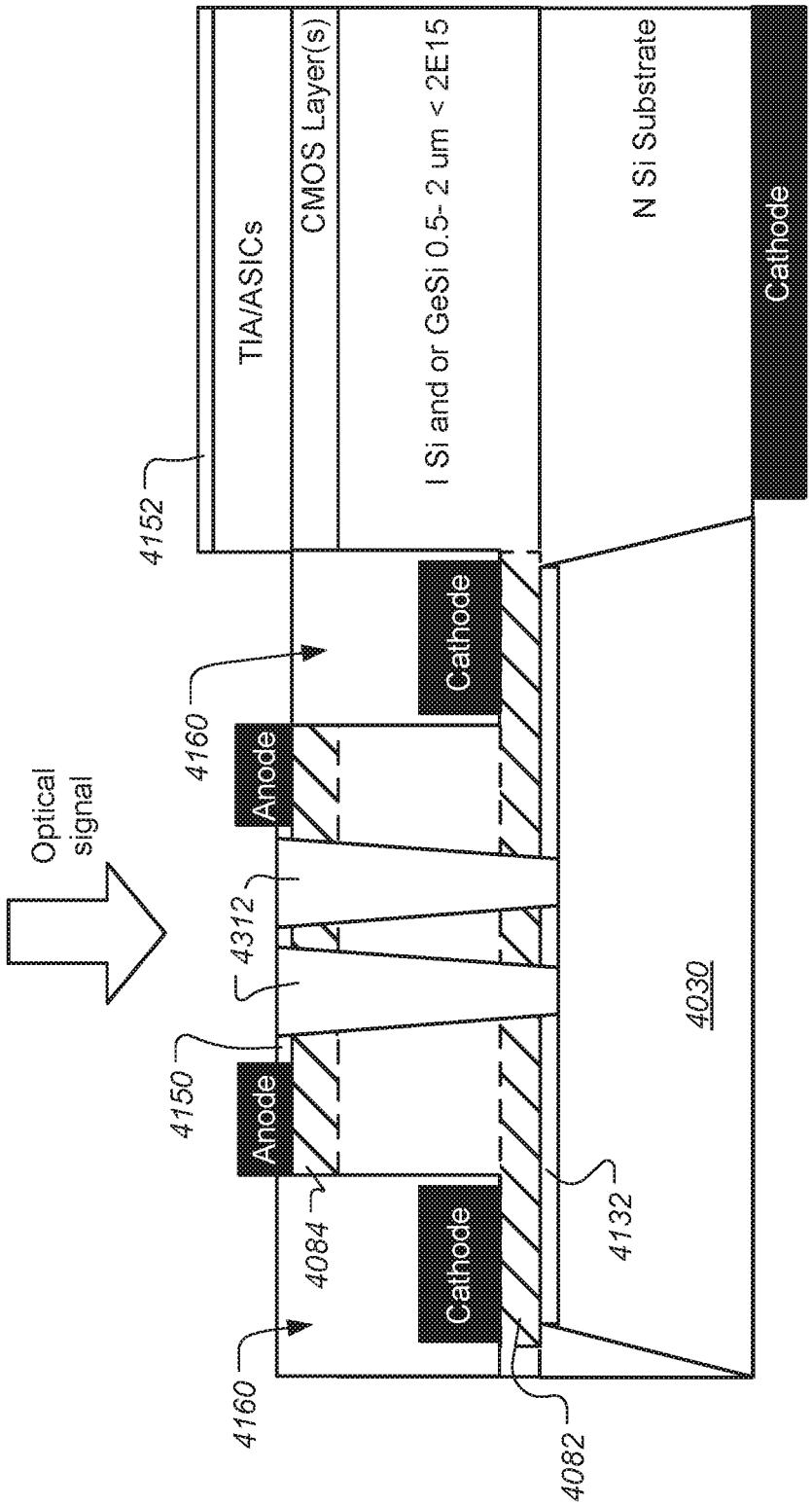

TIA/ASICs
CMOS Layer(s)
I Si and or GeSi 0.5- 2 um < 2E15
N Si Substrate
Cathode
4152
4160
Anode
Cathode
Optical signal
4312
4150
Anode
4084
Cathode
4160
4082
4132
4030

FIG. 43

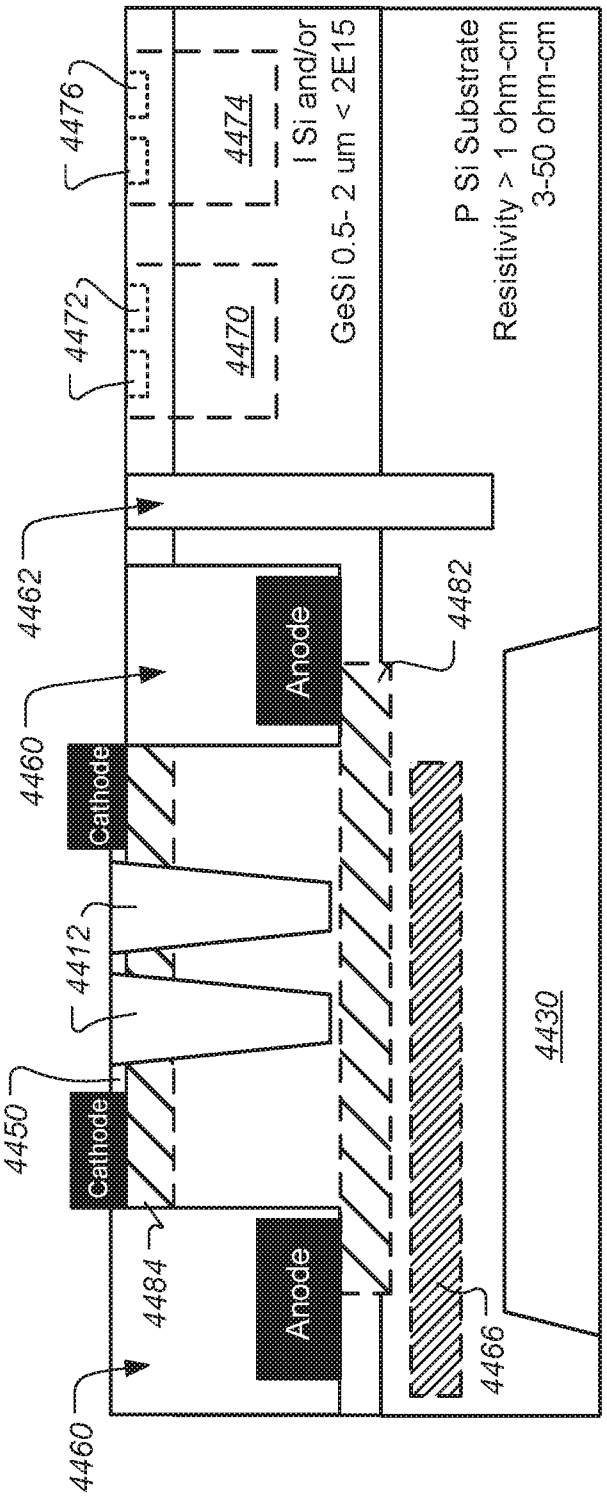

4476
4474
I Si and/or
GeSi 0.5- 2 um < 2E15
4472
4470
P Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4462
4482
Anode
4460
Cathode
4412
4450
Cathode
4484
Anode
4430
4466
4460

FIG. 44A

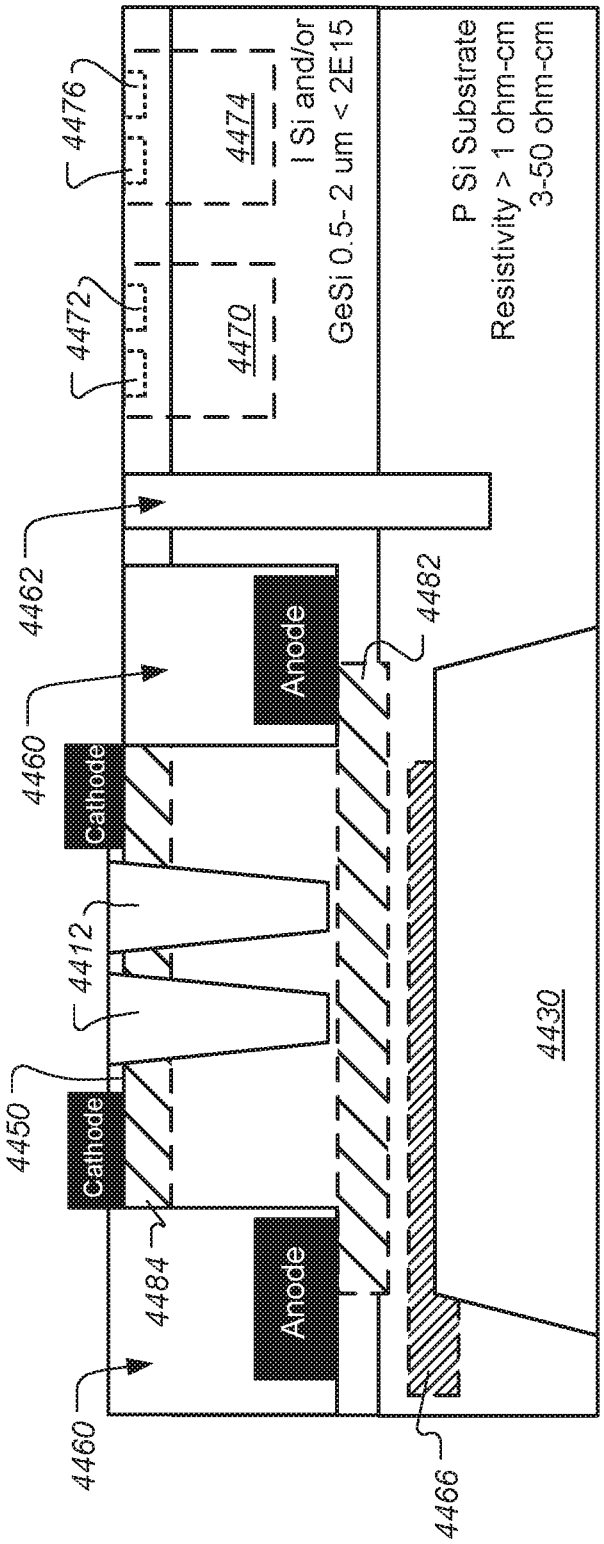

4476
4474
4472
4470
I Si and/or
GeSi 0.5- 2 um < 2E15
P Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4462
4482
4460
Anode
Cathode
4412
4450
Cathode
4430
4484
Anode
4460
4466

FIG. 44B

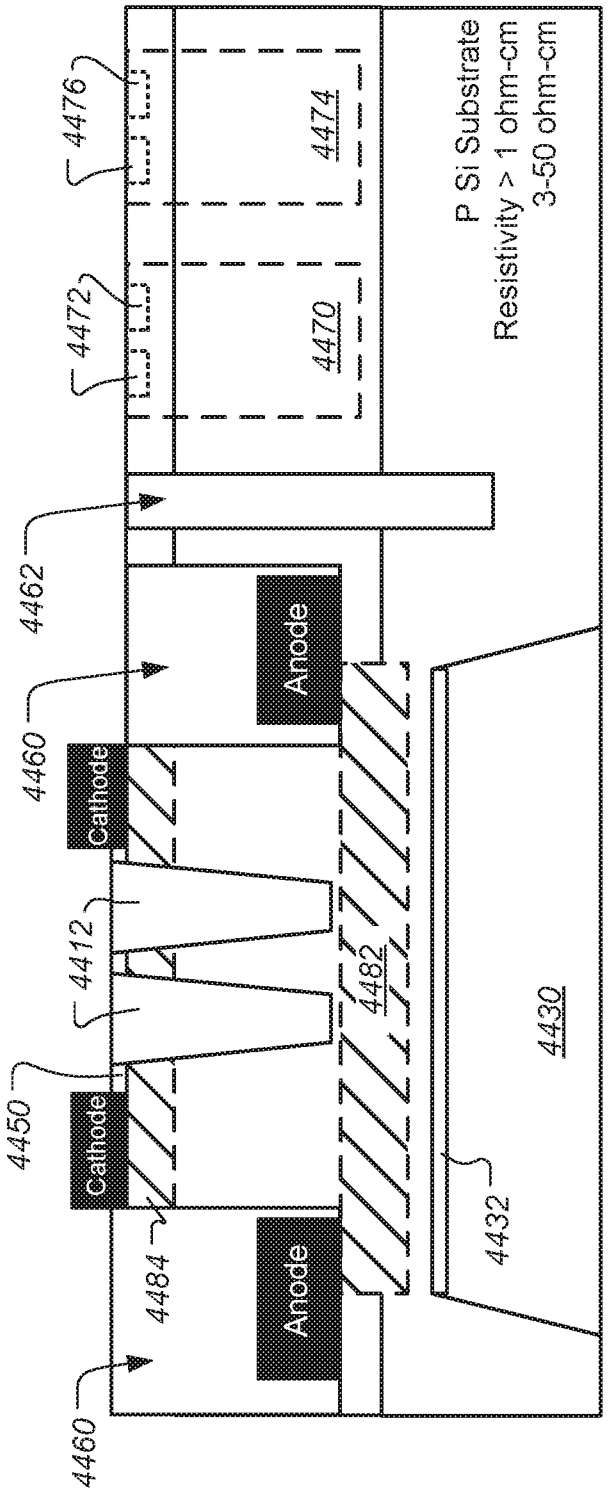

4476
4474
4472
4470
P Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4462
4460
Anode
Cathode
4412
4482
4450
Cathode
4430
4484
Anode
4432
4460

FIG. 44C

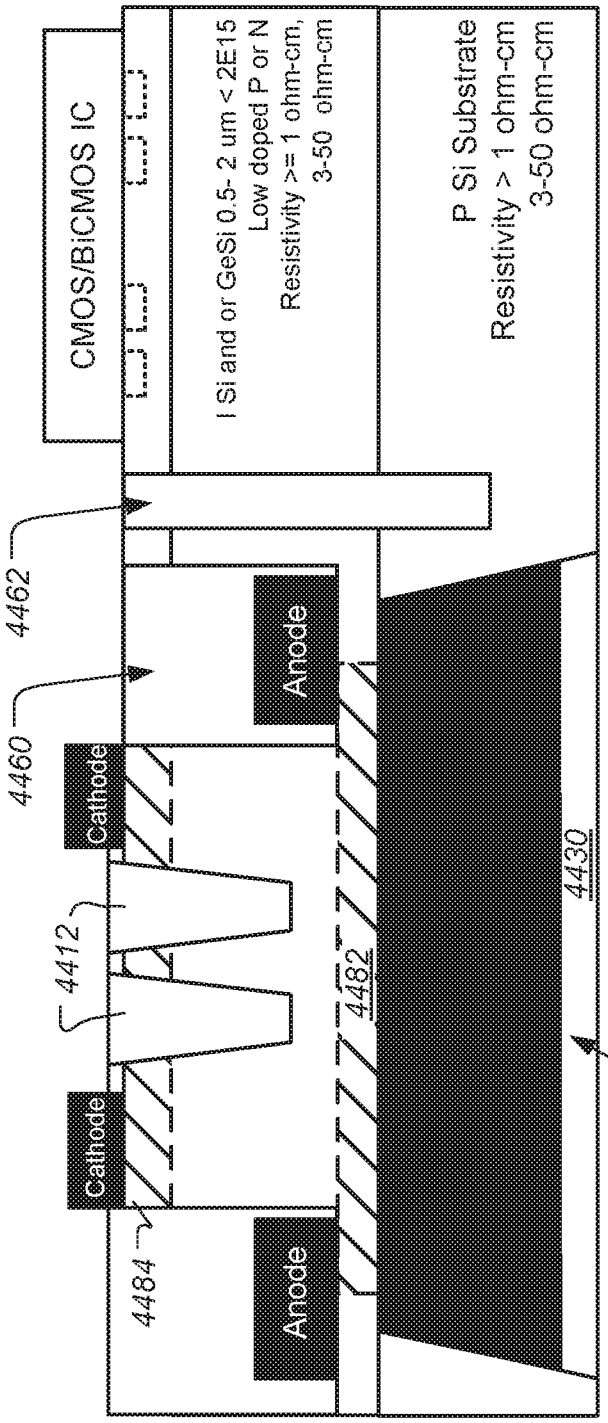

CMOS/BiCMOS IC
I Si and or GeSi 0.5- 2 um < 2E15
Low doped P or N
Resistivity >= 1 ohm-cm,
3-50 ohm-cm
P Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4462
4460
Cathode
Anode
4412
4482
4430
Cathode
Anode
4484
4532

FIG. 45

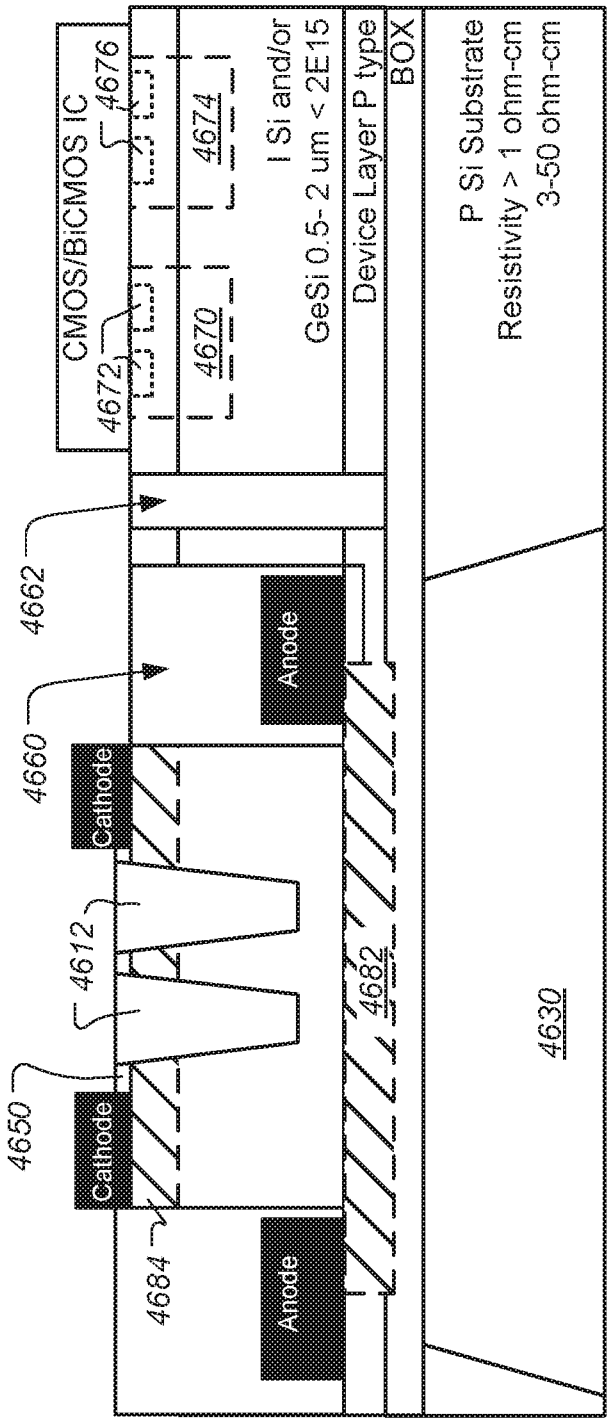

CMOS/BiCMOS IC
4676
4674
4672
4670
I Si and/or
GeSi 0.5- 2 um < 2E15
Device Layer P type
BOX
P Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4662
4660
4612
4650
4684
Anode
Cathode
Cathode
Anode
4682
4630

FIG. 46

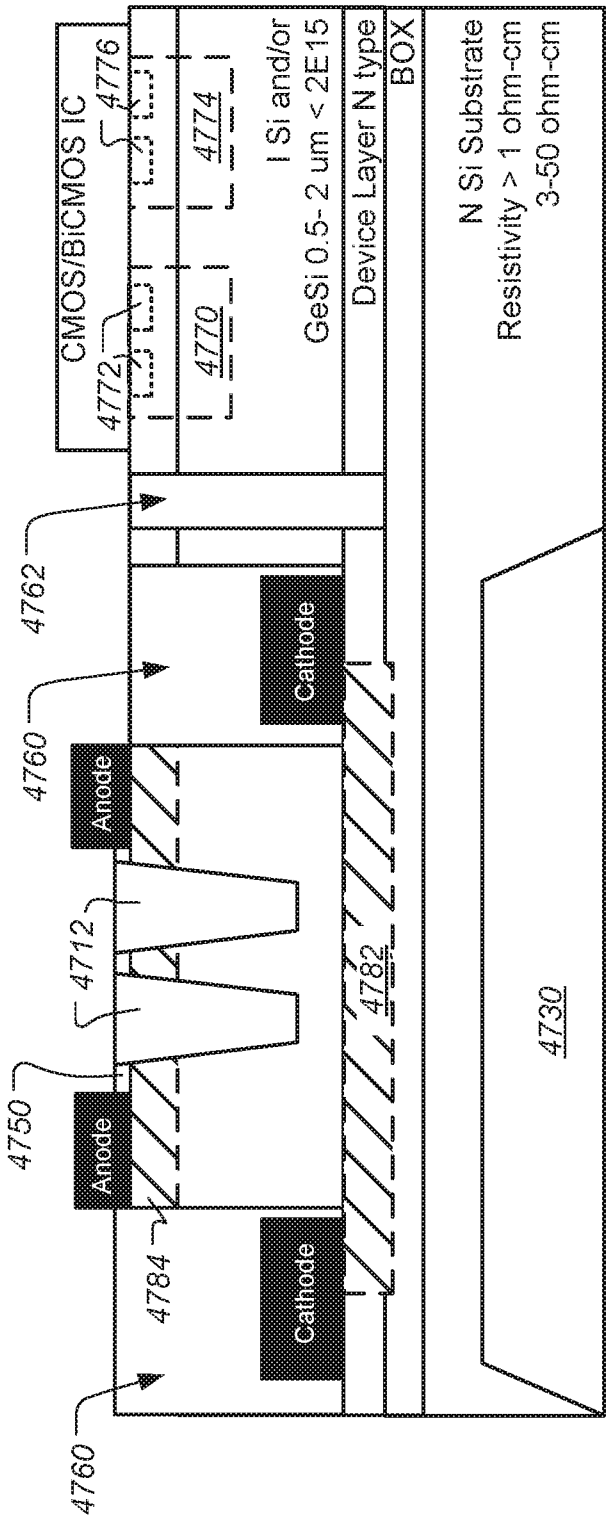

CMOS/BiCMOS IC
4776
4774
I Si and/or
GeSi 0.5- 2 um < 2E15
4770
4772
Device Layer N type
BOX
N Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4762
4760
Anode
Cathode
4712
4782
4730
4750
Anode
Cathode
4784
4760

FIG. 47

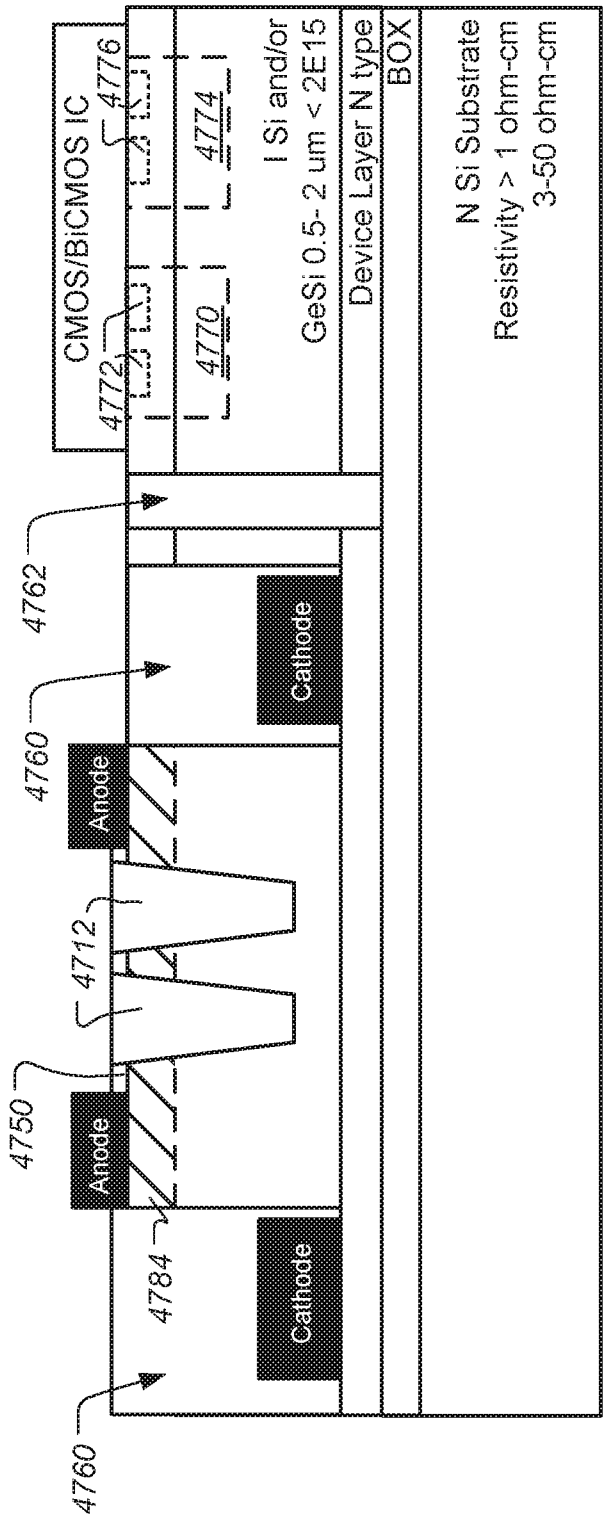

CMOS/BiCMOS IC
4772
4776
4774
4770
I Si and/or
GeSi 0.5- 2 um < 2E15
Device Layer N type
BOX
N Si Substrate
Resistivity > 1 ohm-cm
3-50 ohm-cm
4762
4760
Anode
Cathode
4712
4750
Anode
Cathode
4784
4760

FIG. 48

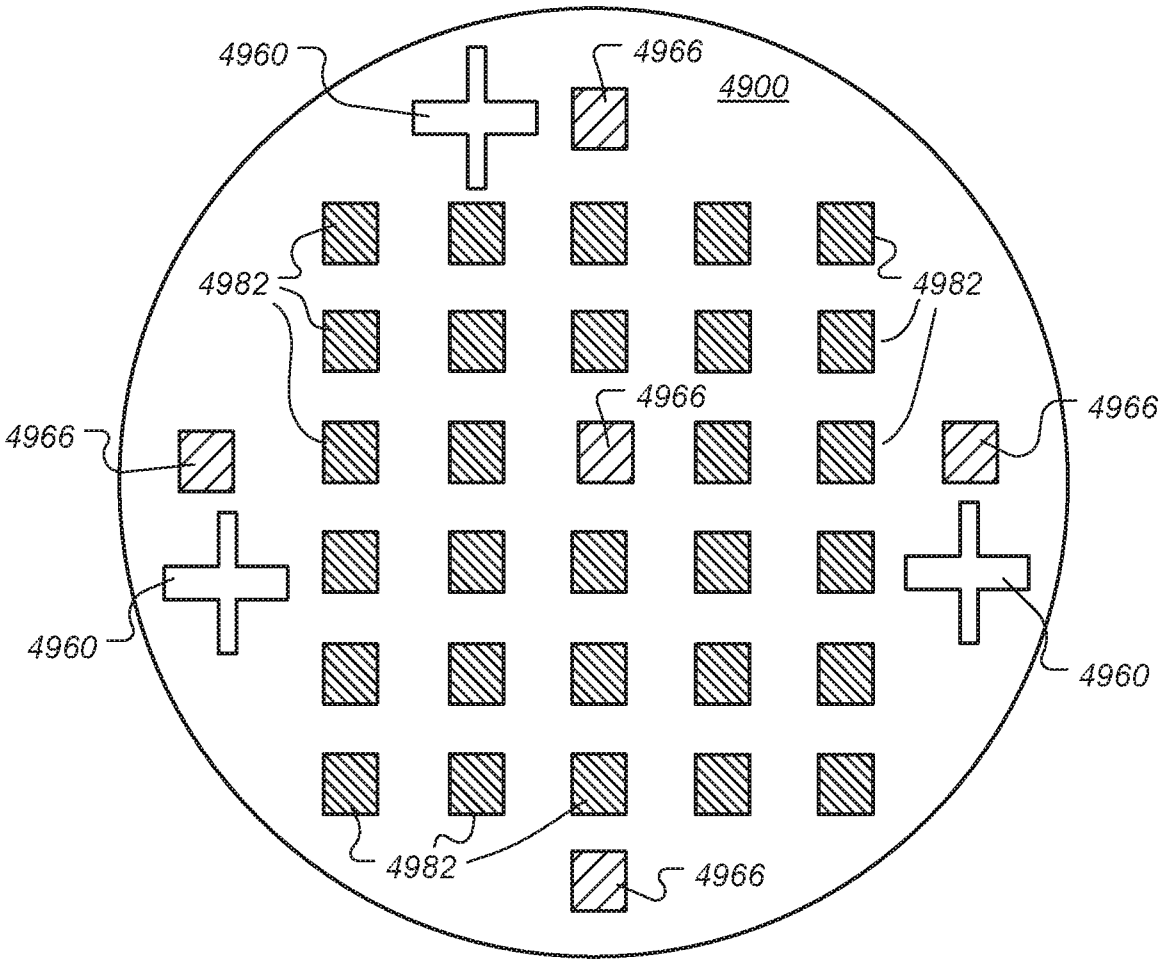


FIG. 49

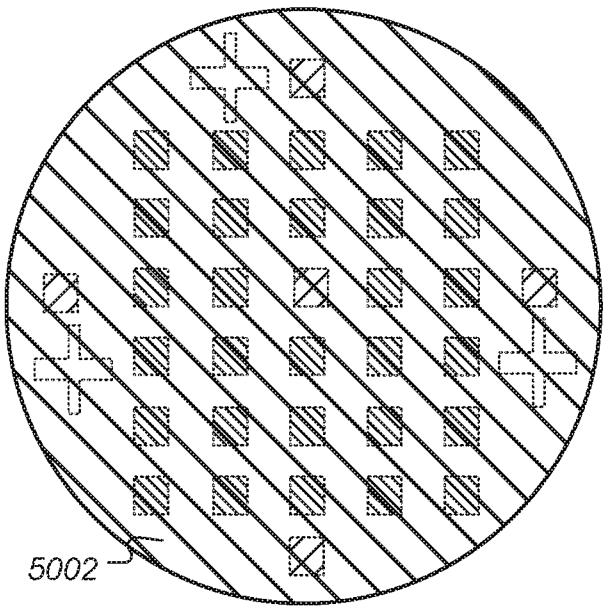


FIG. 50A

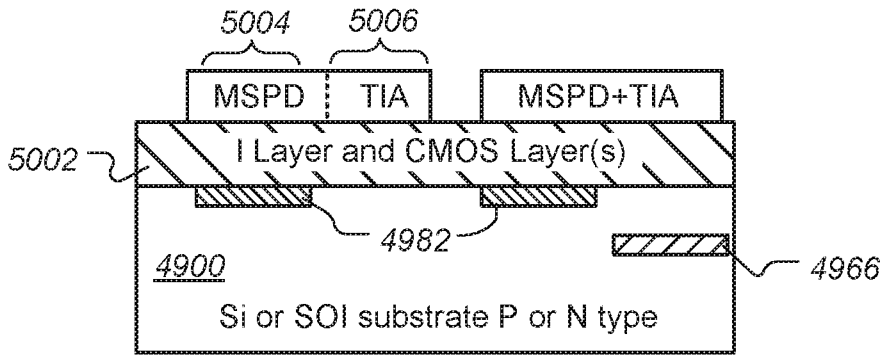


FIG. 50B

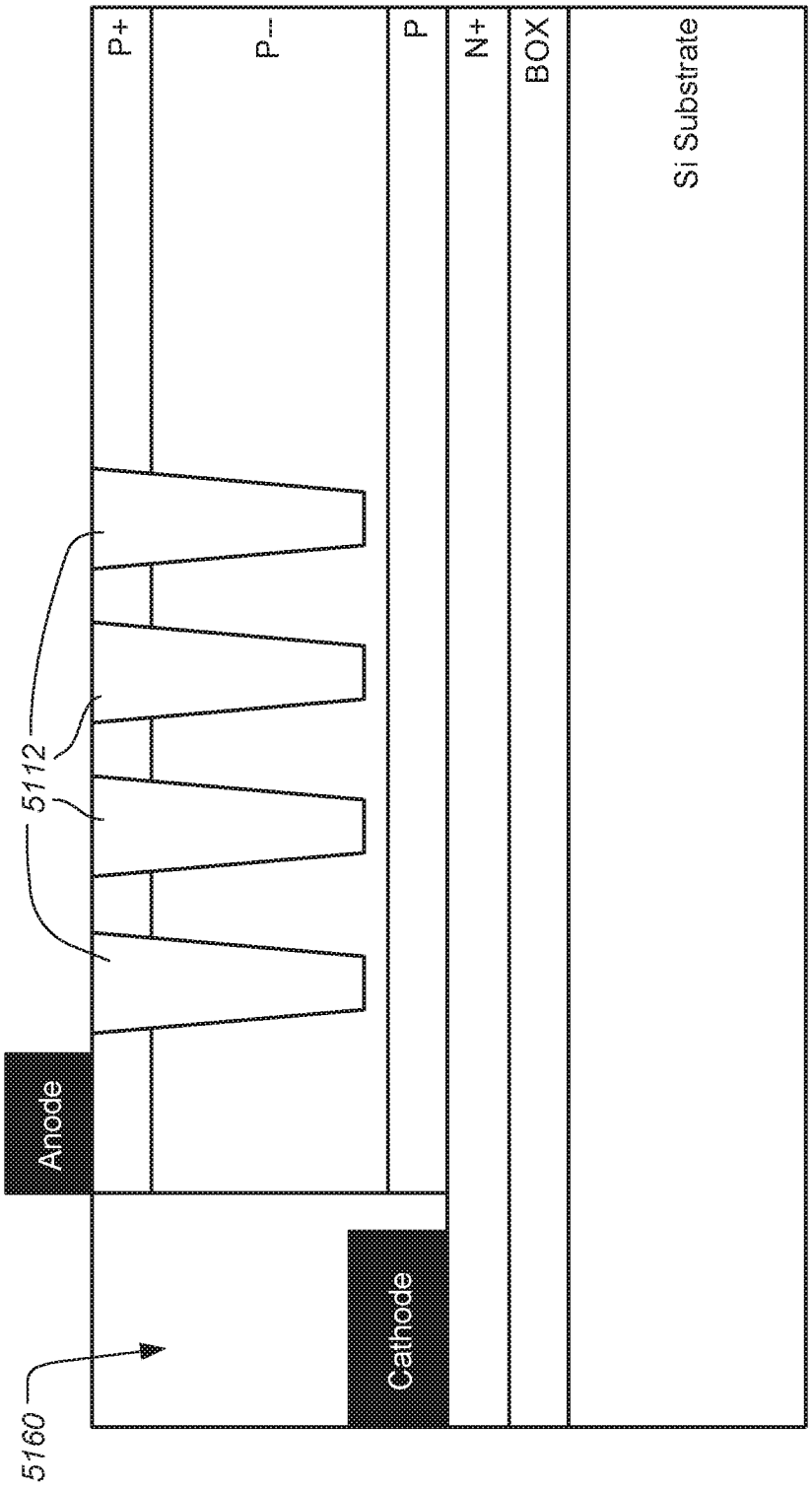


FIG. 51

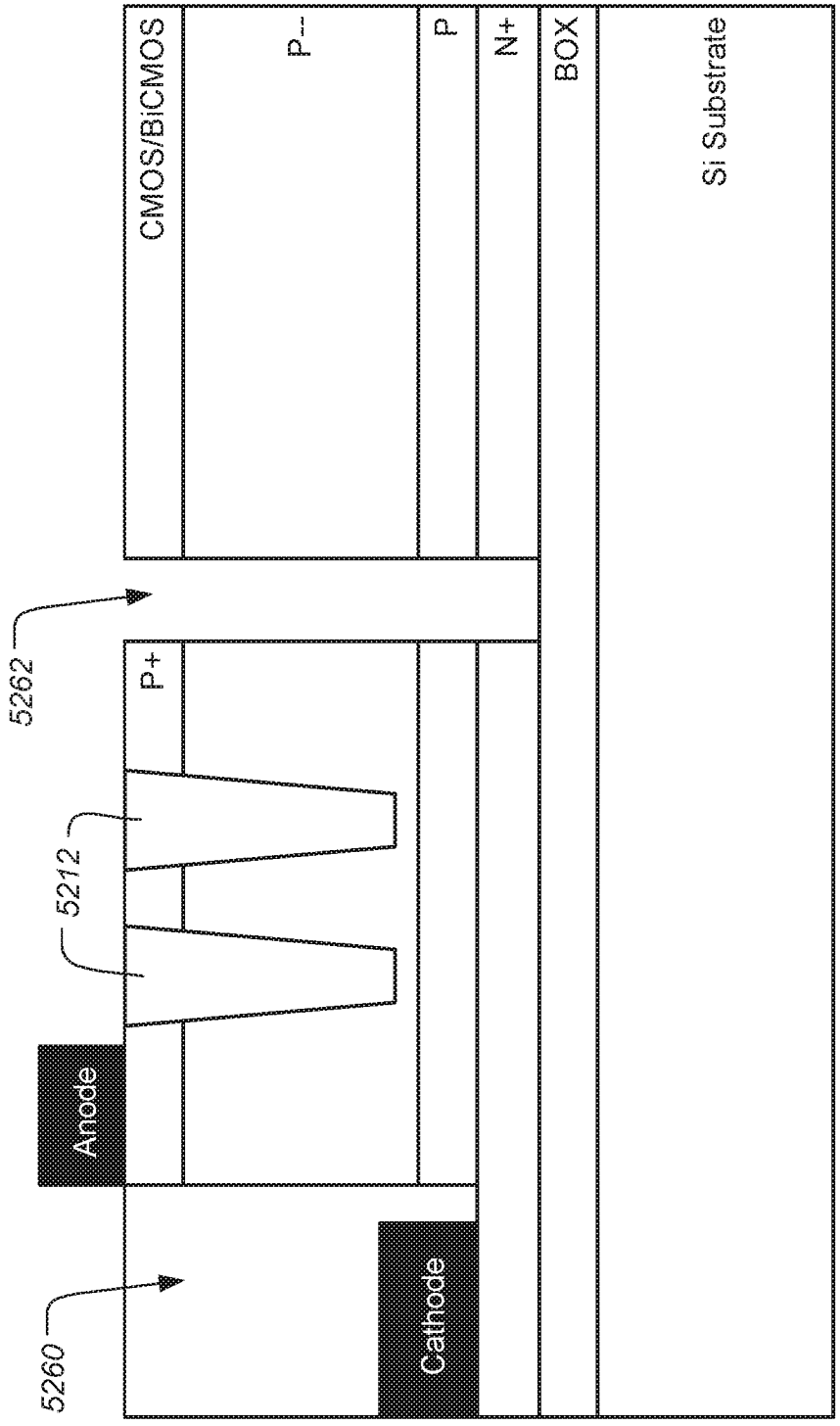

CMOS/BiCMOS
P--
P
N+
BOX
Si Substrate
P+
5262
5212
Anode
Cathode
5260

FIG. 52

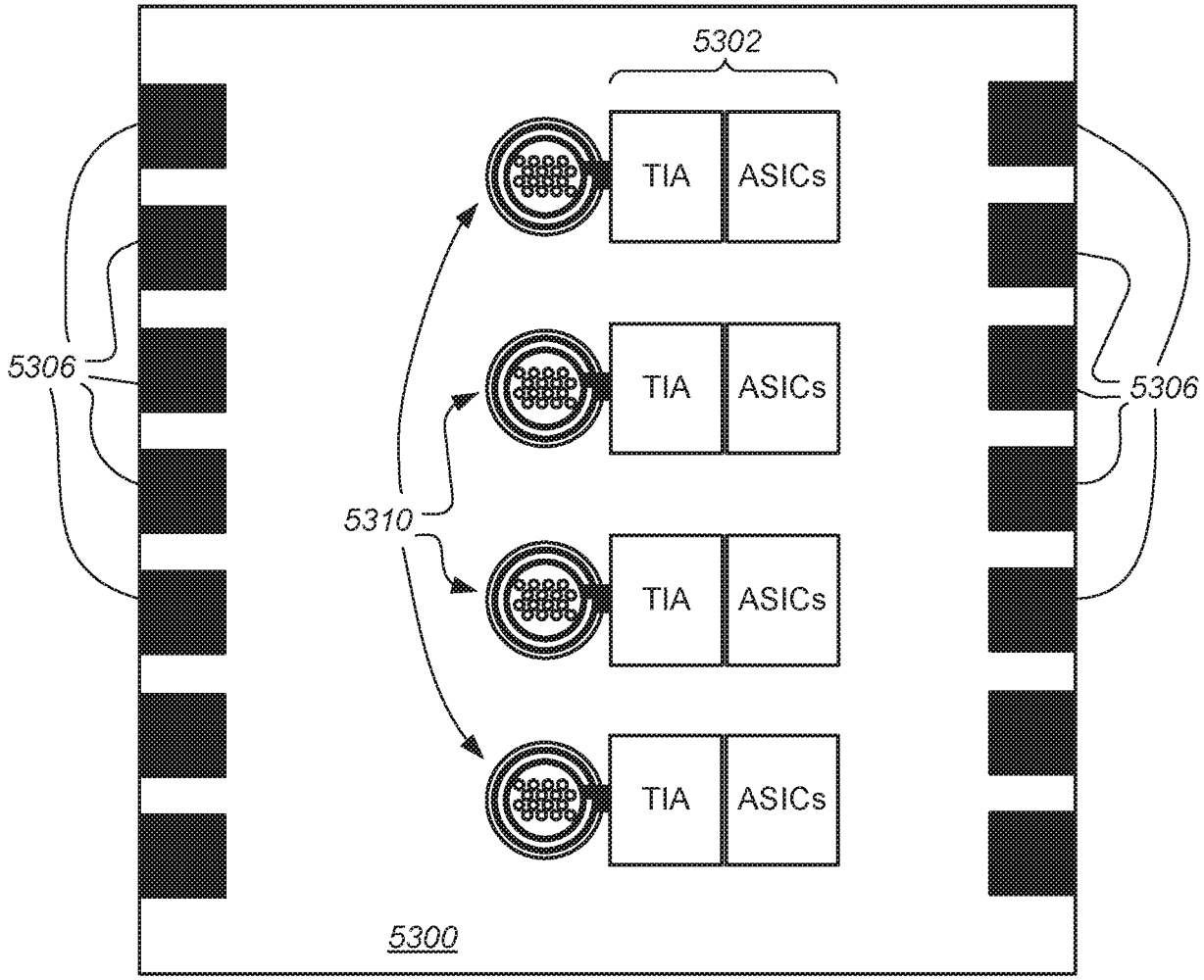

5302
TIA
ASICs
TIA
ASICs
TIA
ASICs
TIA
ASICs
5306
5306
5310
5300

FIG. 53

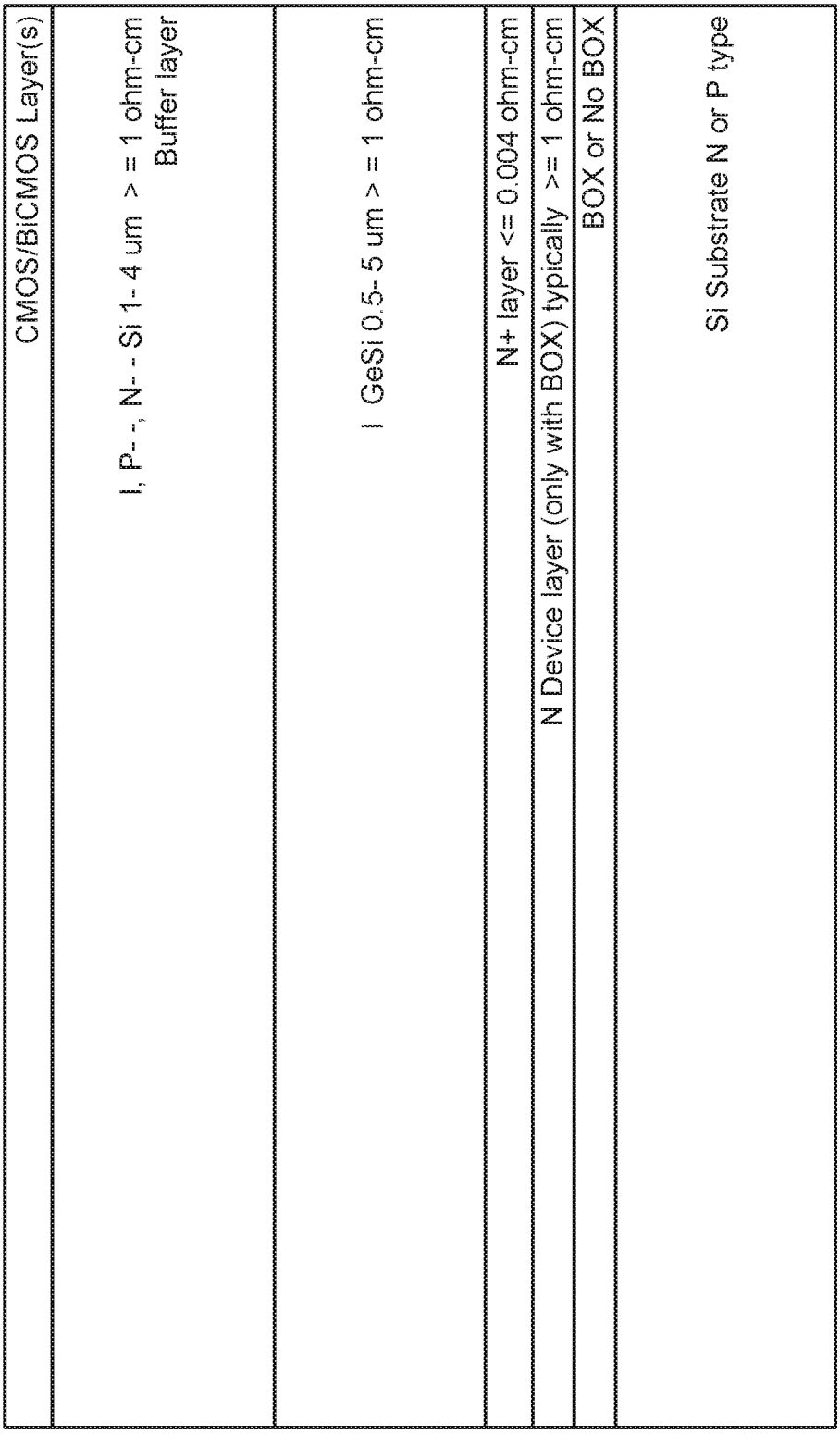

CMOS/BiCMOS Layer(s)
I, P- -, N- - Si 1- 4 um > = 1 ohm-cm
Buffer layer
I GeSi 0.5- 5 um > = 1 ohm-cm
N+ layer <= 0.004 ohm-cm
N Device layer (only with BOX) typically >= 1 ohm-cm
BOX or No BOX
Si Substrate N or P type

FIG. 54

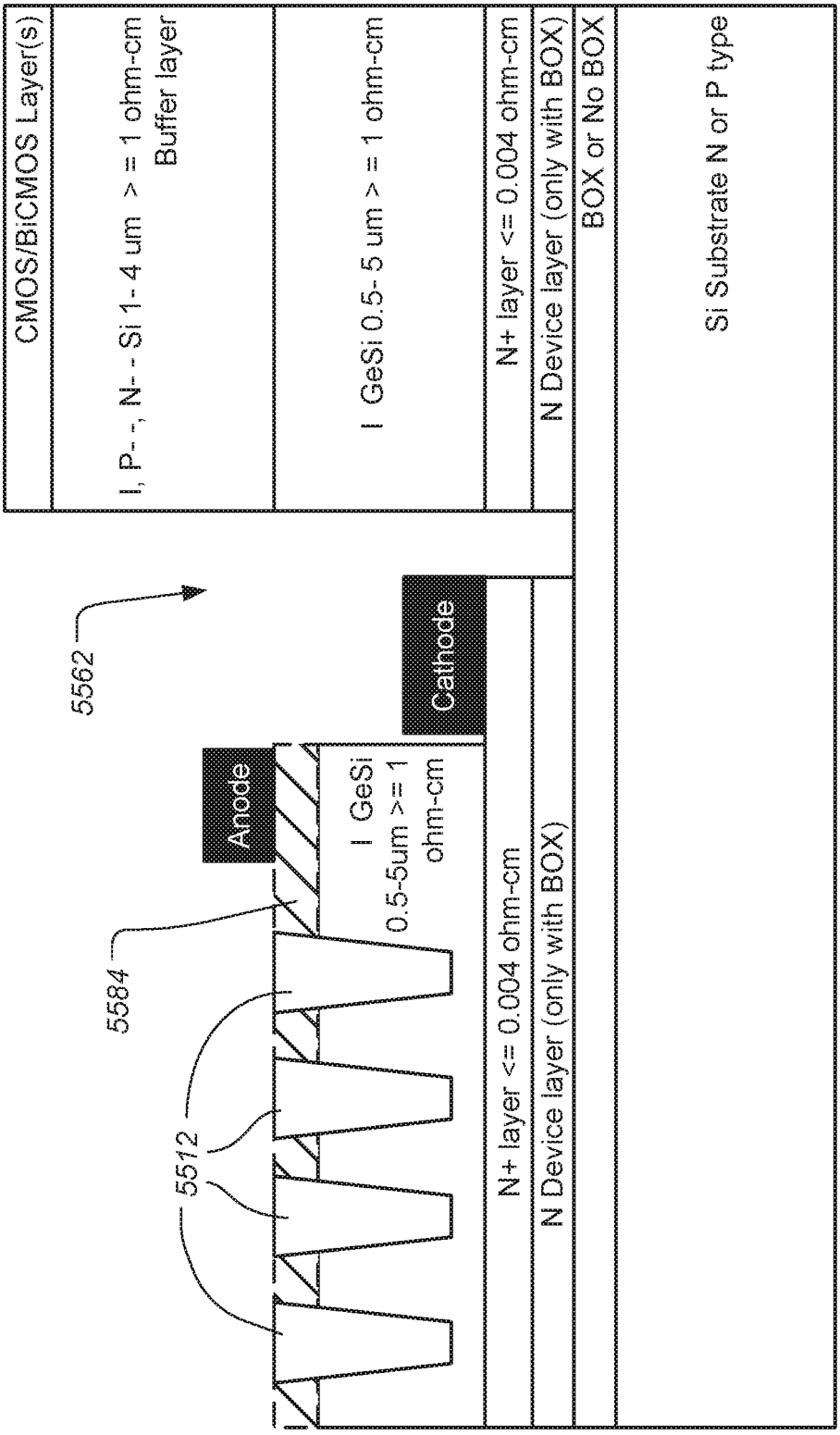

CMOS/BiCMOS Layer(s)
I, P- -, N- - Si 1- 4 um > = 1 ohm-cm
Buffer layer
I GeSi 0.5- 5 um > = 1 ohm-cm
N+ layer <= 0.004 ohm-cm
N Device layer (only with BOX)
BOX or No BOX
Si Substrate N or P type
5562
Cathode
Anode
I GeSi
0.5-5um > = 1
ohm-cm
5584
5512
N+ layer <= 0.004 ohm-cm
N Device layer (only with BOX)

FIG. 55

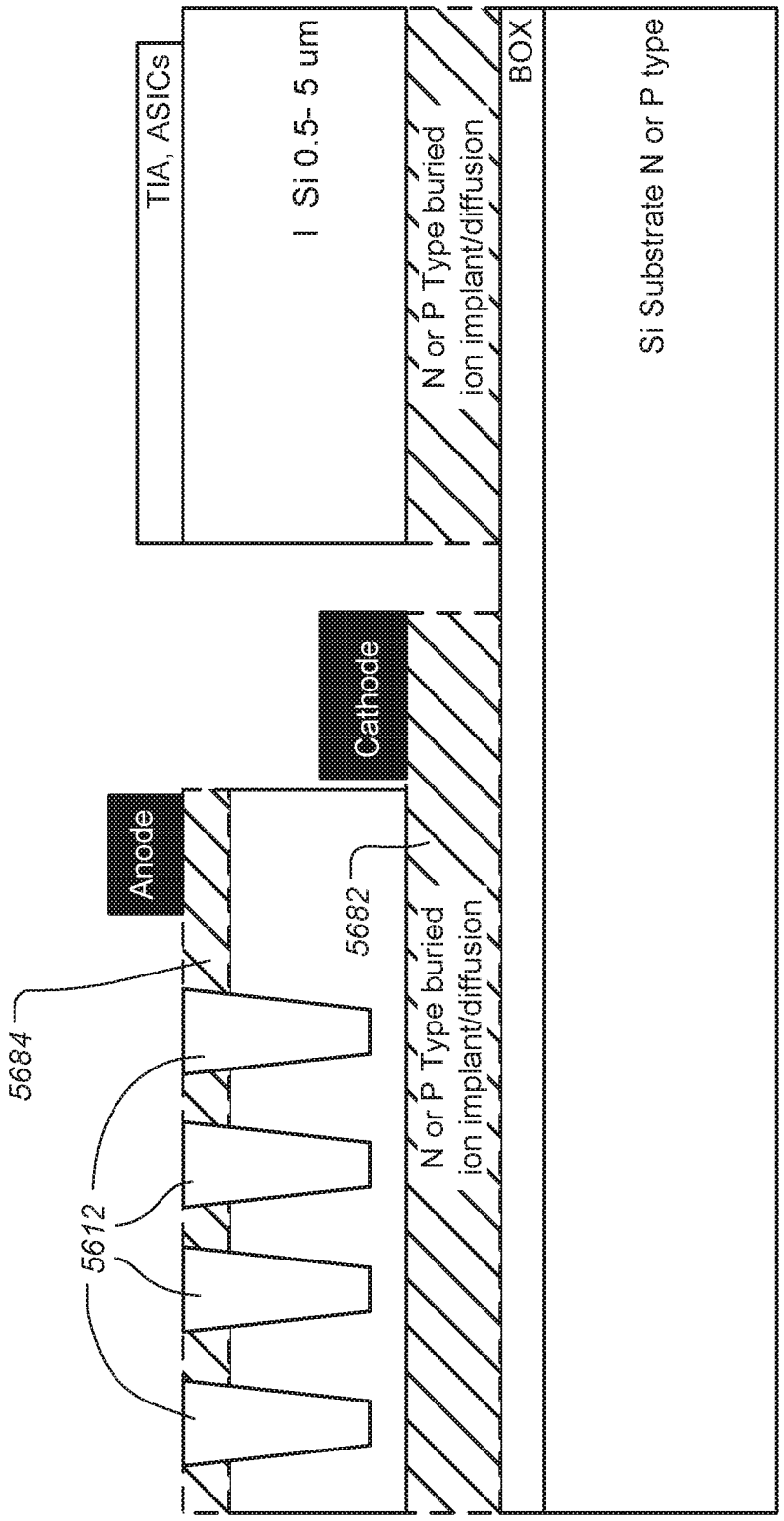

TIA, ASICs
I Si 0.5- 5 um
N or P Type buried ion implant/diffusion
BOX
Si Substrate N or P type
Cathode
Anode
5682
5684
5612
N or P Type buried ion implant/diffusion

FIG. 56

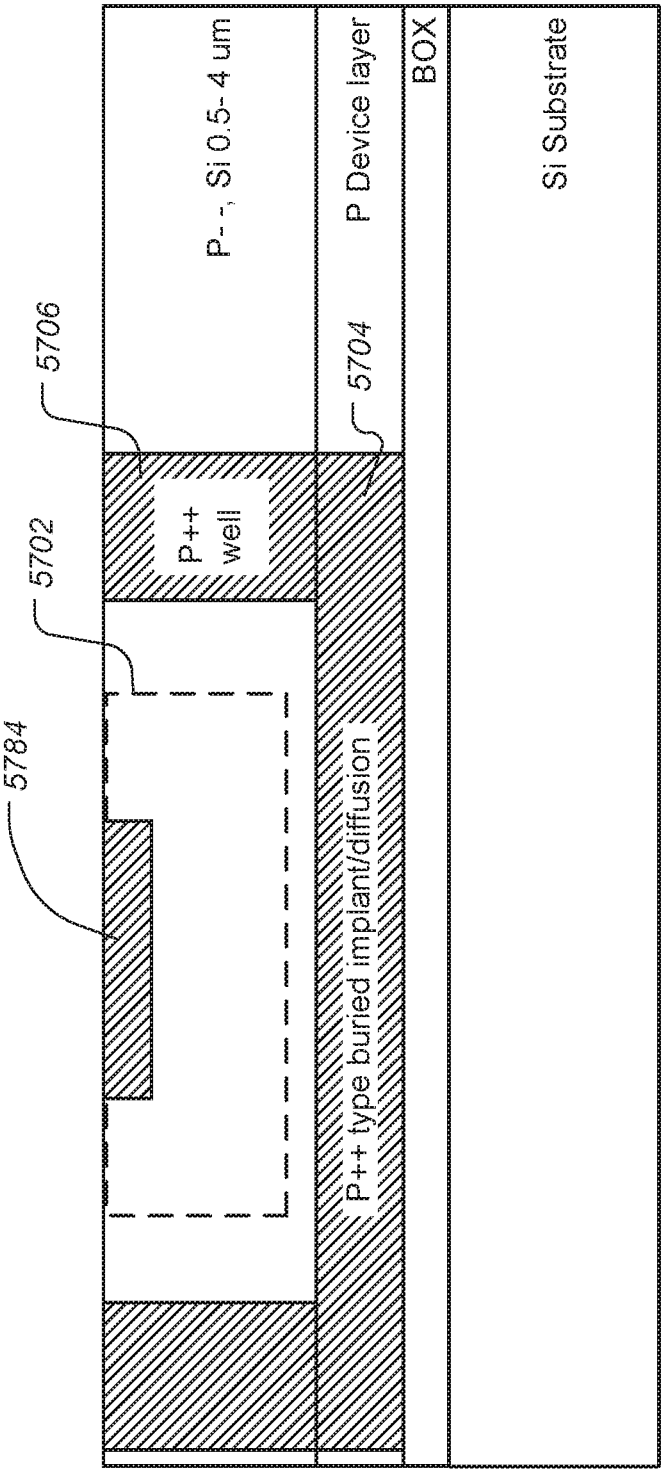

P- -, Si 0.5- 4 um
P Device layer
BOX
Si Substrate
5706
5704
P++
well
5702
5784
P++ type buried implant/diffusion

FIG. 57

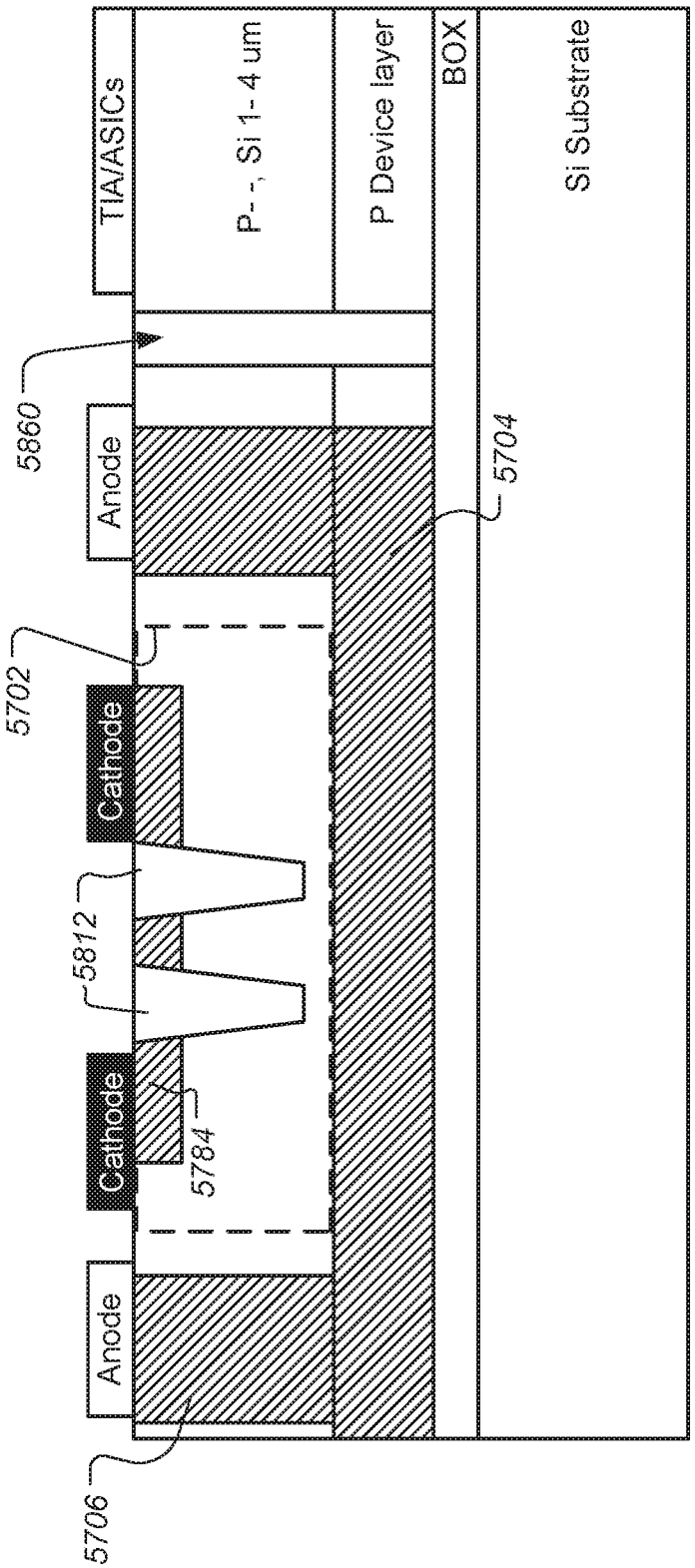

TIA/ASICs
P- -, Si 1- 4 um
P Device layer
BOX
Si Substrate
5860
Anode
5704
5702
Cathode
5812
Cathode
5784
Anode
5706

FIG. 58

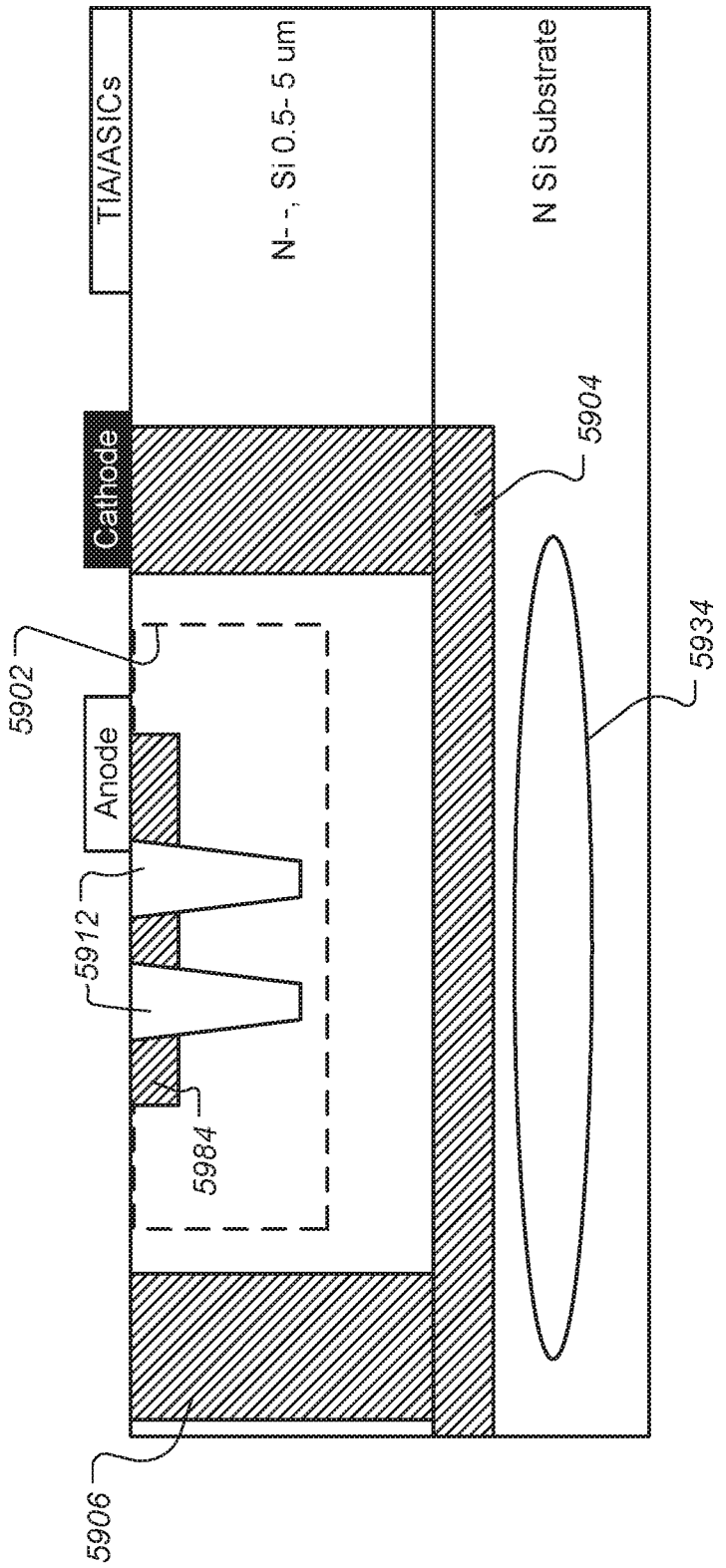

TIA/ASICs
N- -, Si 0.5- 5 um
N Si Substrate
Cathode
Anode
5902
5904
5906
5912
5934
5984

FIG. 59A

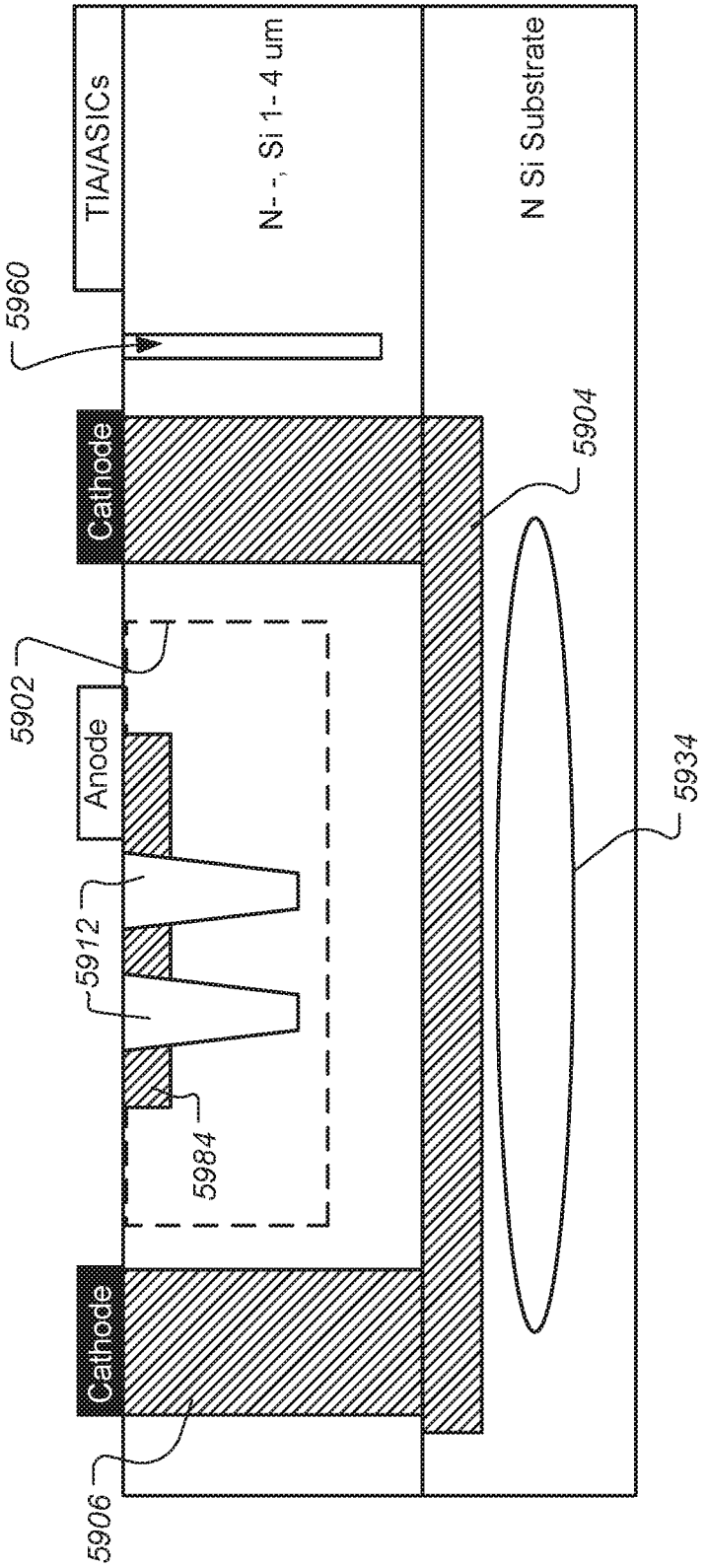

TIA/ASICs
N- -, Si 1- 4 um
N Si Substrate
5960
Cathode
5904
5902
Anode
5912
5984
5934
Cathode
5906

FIG. 59B

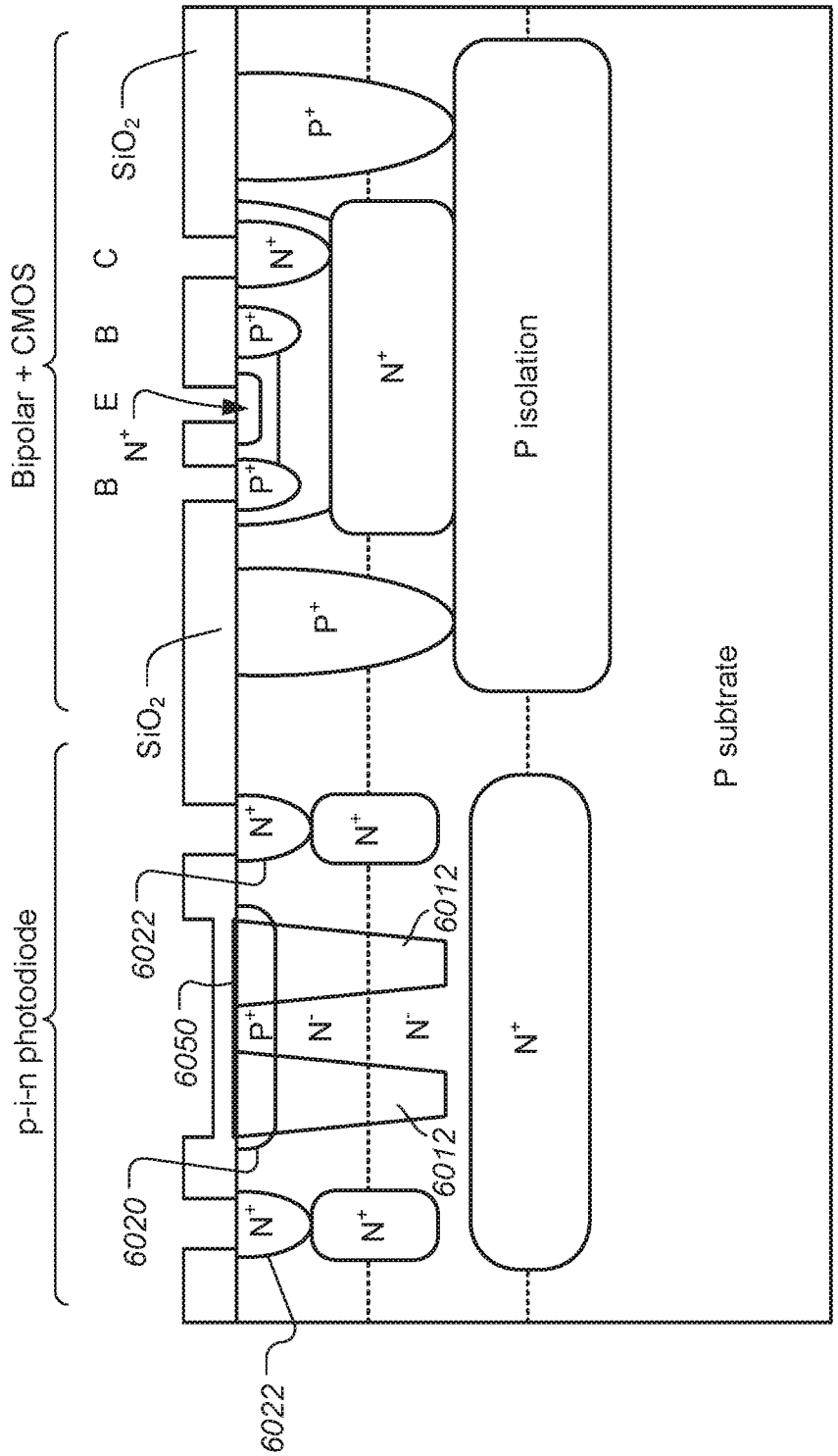

Bipolar + CMOS
p-i-n photodiode
SiO_2
SiO_2
B
E
B
C
N^+
P^+
N^+
P^+
N^+
P^+
N^+
P^+
N^+
N^+
N^+
N^-
N^-
N^+
P isolation
P subtrate
6022
6050
6020
6022
6012
6012

FIG. 60

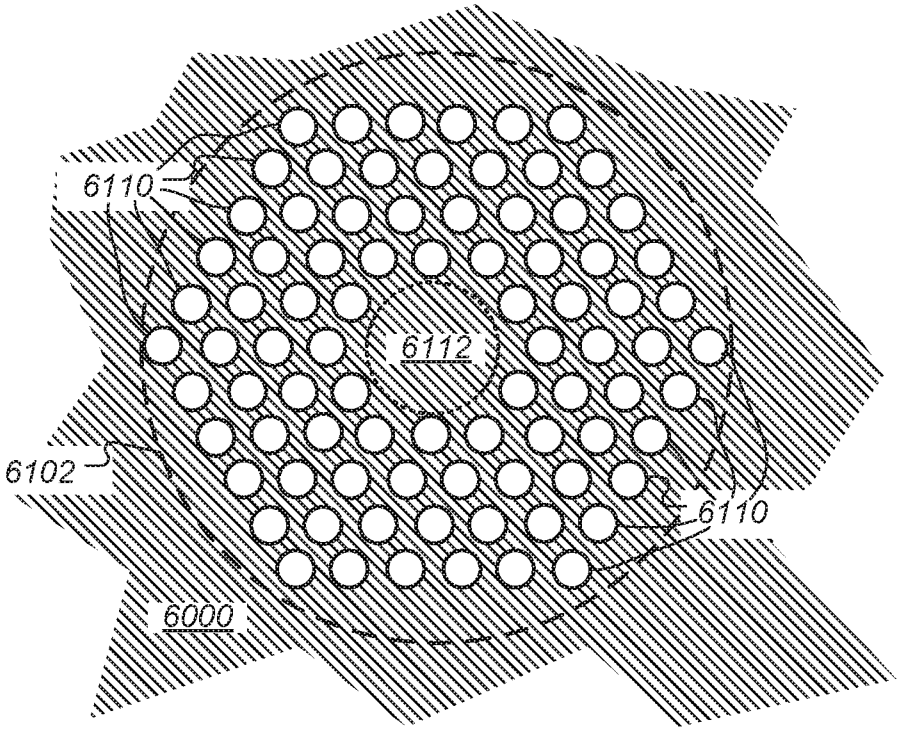


FIG. 61A

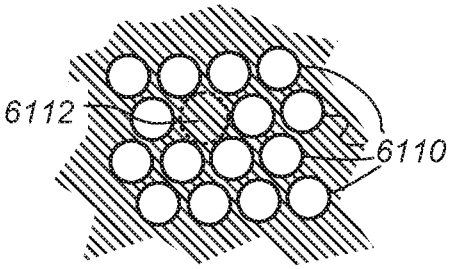


FIG. 61B

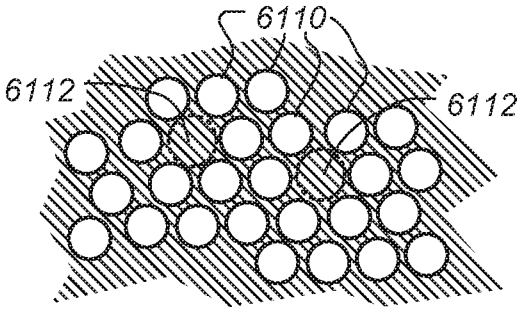


FIG. 61C

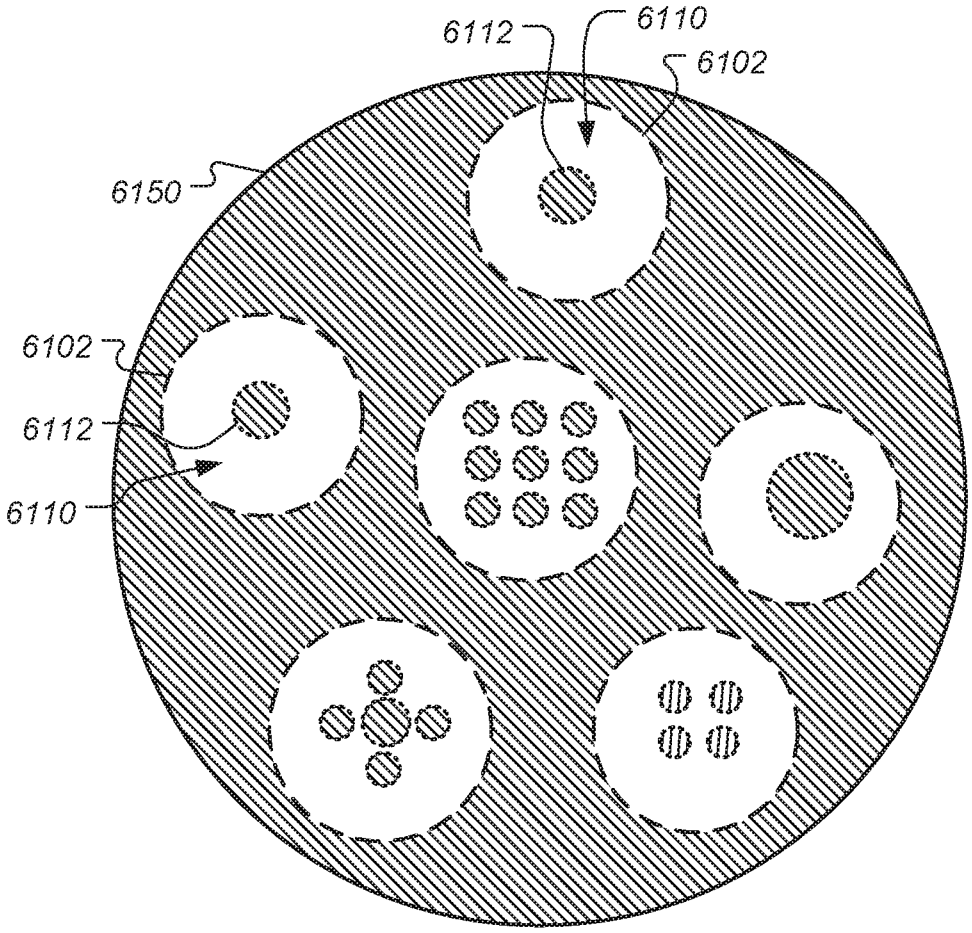


FIG. 61D

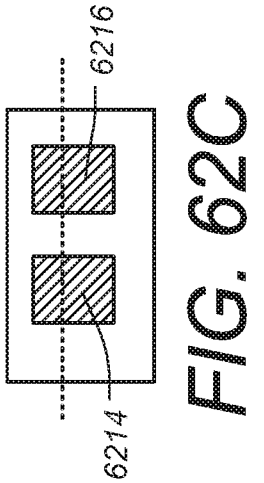


FIG. 62C

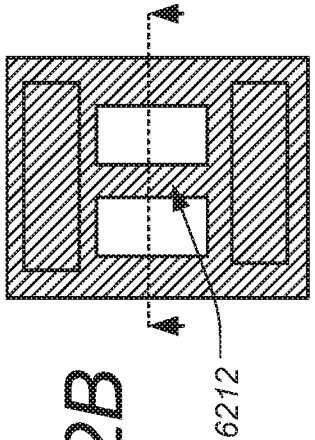


FIG. 62B

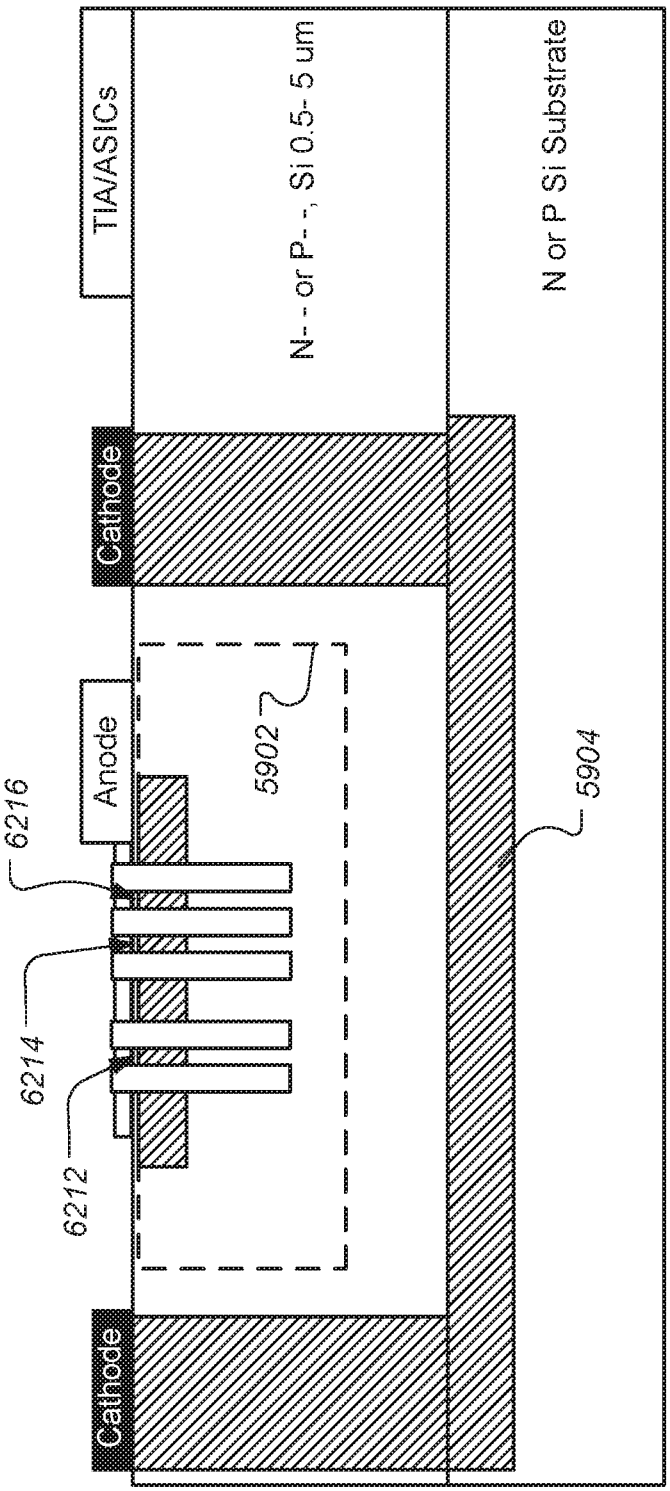


FIG. 62A

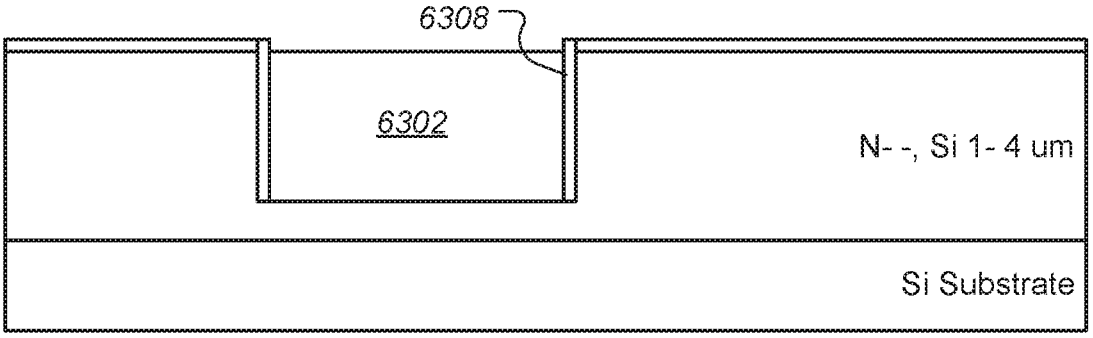


FIG. 63A

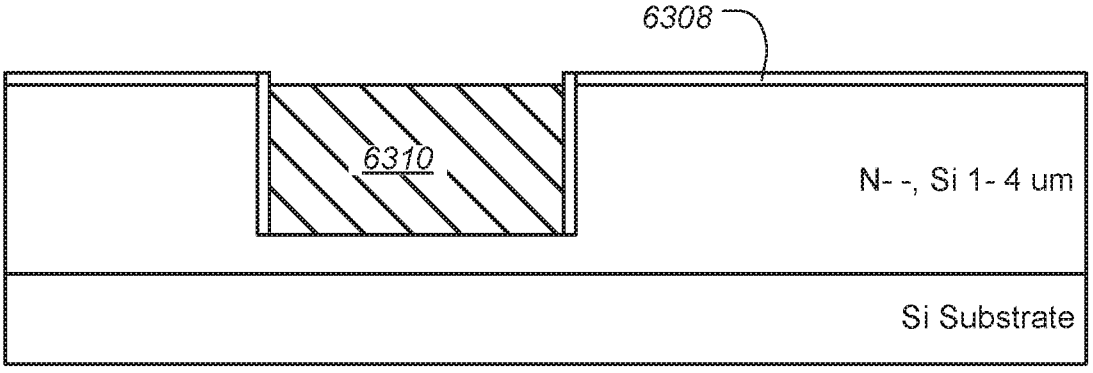


FIG. 63B

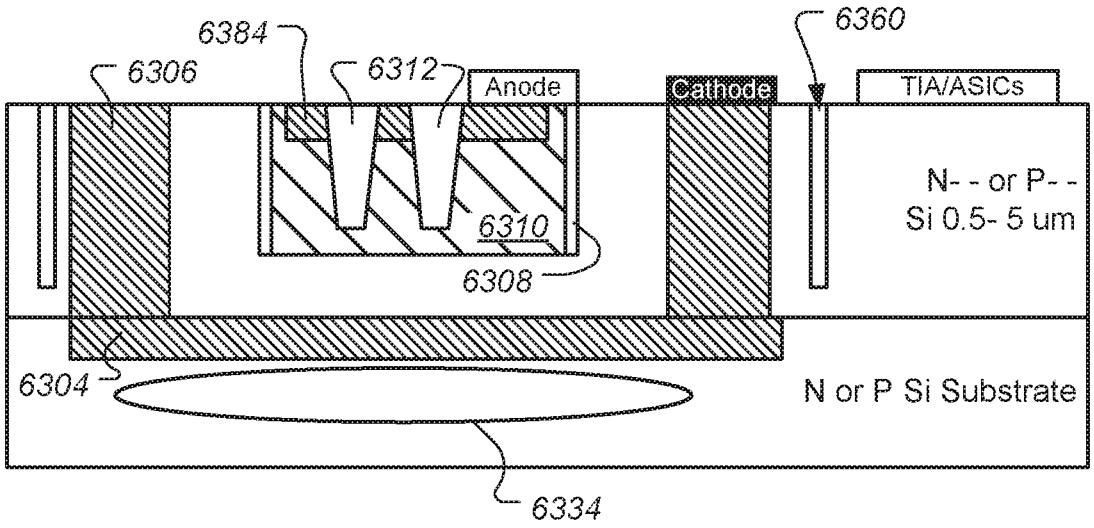

6384
6306
6312
Anode
Cathode
6360
TIA/ASICs
N- - or P- -
Si 0.5- 5 um
6310
6308
6304
N or P Si Substrate
6334

FIG. 63C

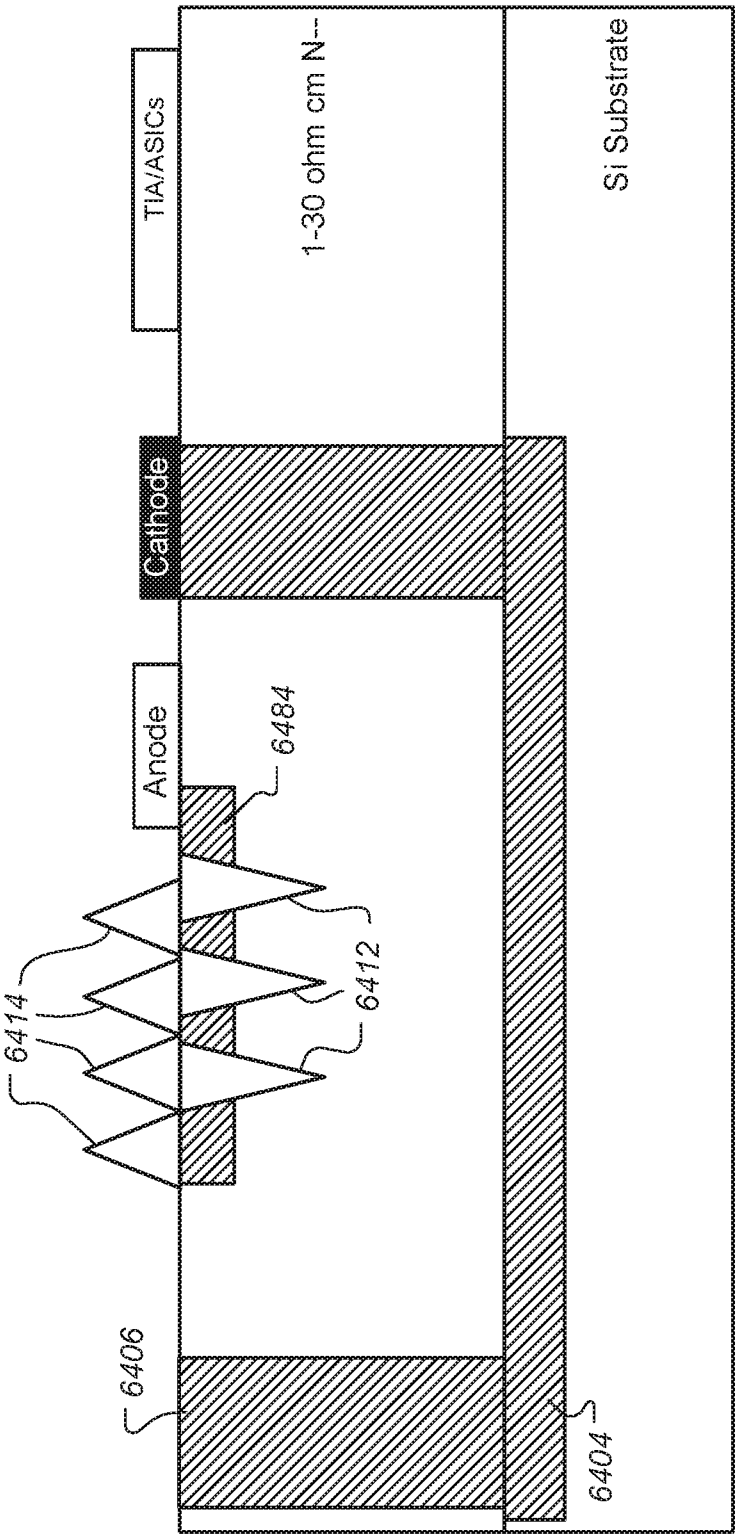

TIA/ASICs
1-30 ohm cm N--
Si Substrate
Cathode
Anode
6484
6412
6414
6406
6404

FIG. 64

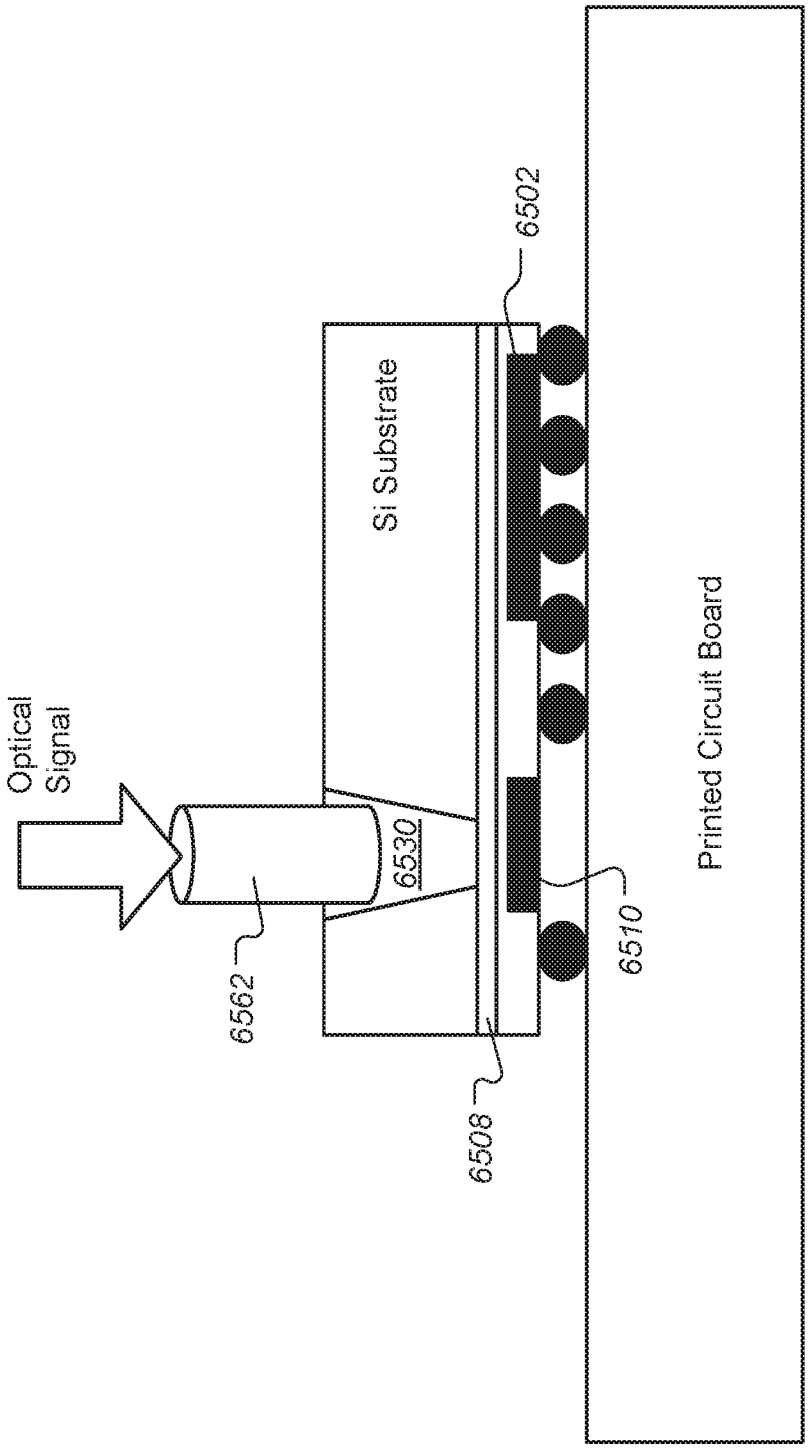

Optical Signal
6562
6530
Si Substrate
6502
6508
6510
Printed Circuit Board

FIG. 65

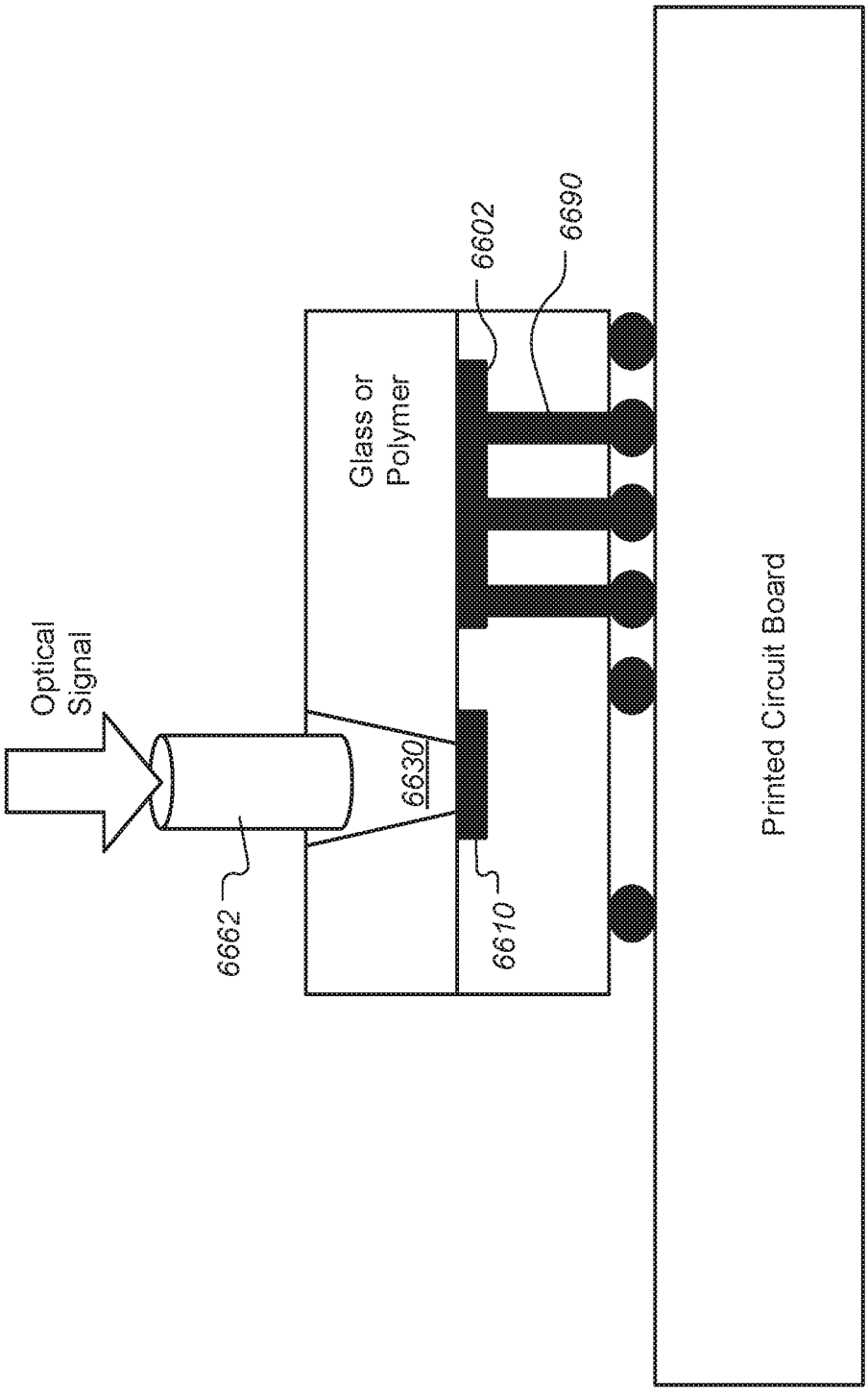

Optical Signal
6662
Glass or Polymer
6630
6602
6690
6610
Printed Circuit Board

FIG. 66

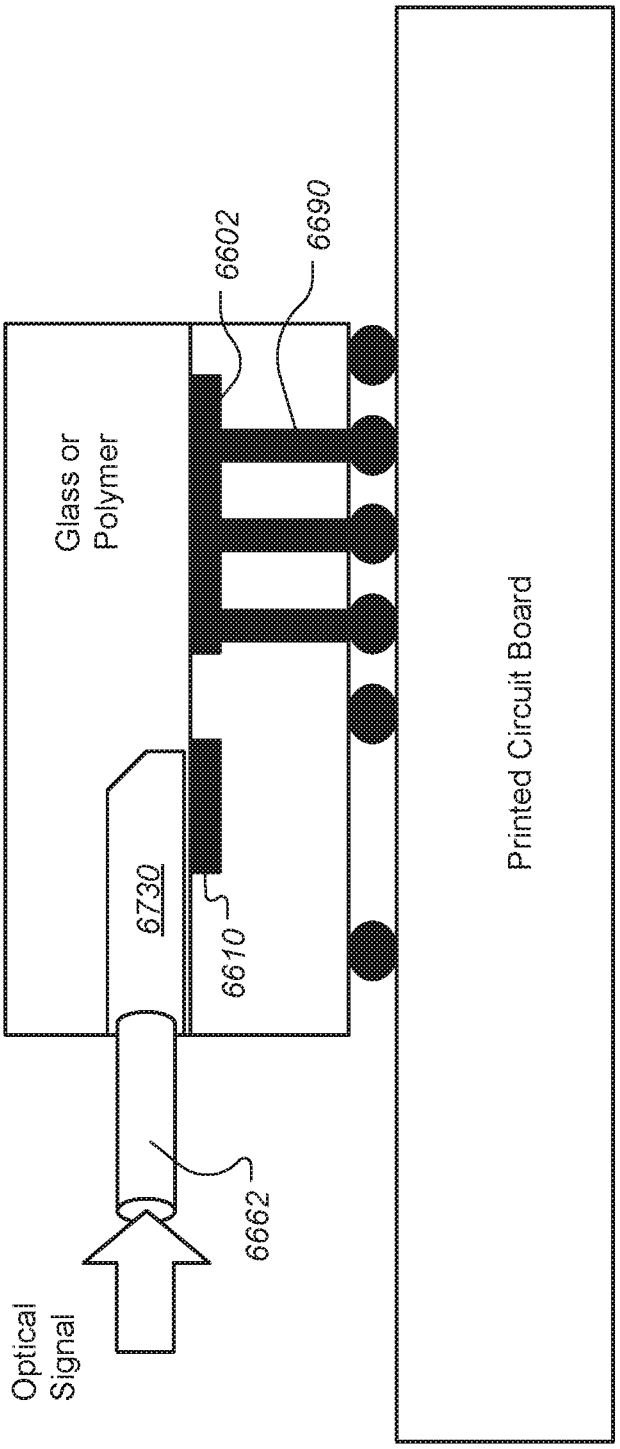

6602
6690
Glass or Polymer
6730
6610
6662
Optical Signal
Printed Circuit Board

FIG. 67

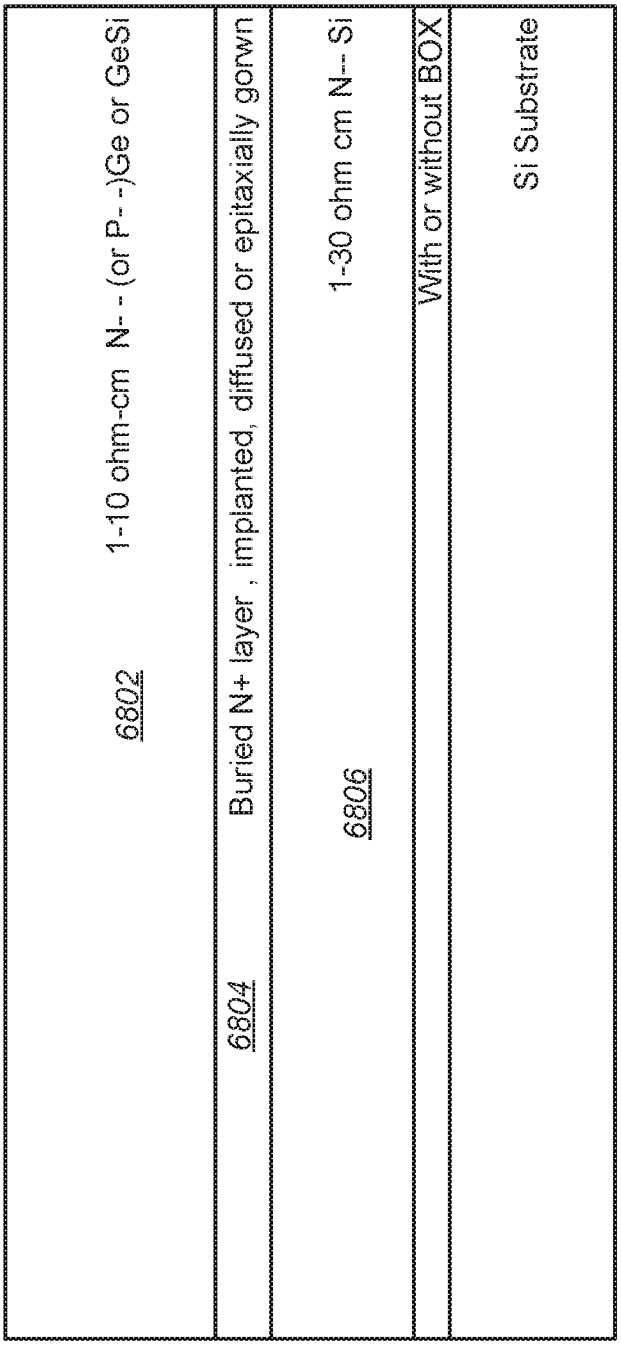

1-10 ohm-cm N- - (or P- -)Ge or GeSi
6802
Buried N+ layer , implanted, diffused or epitaxially gorwn
6804
1-30 ohm cm N-- Si
6806
With or without BOX
Si Substrate

FIG. 68A

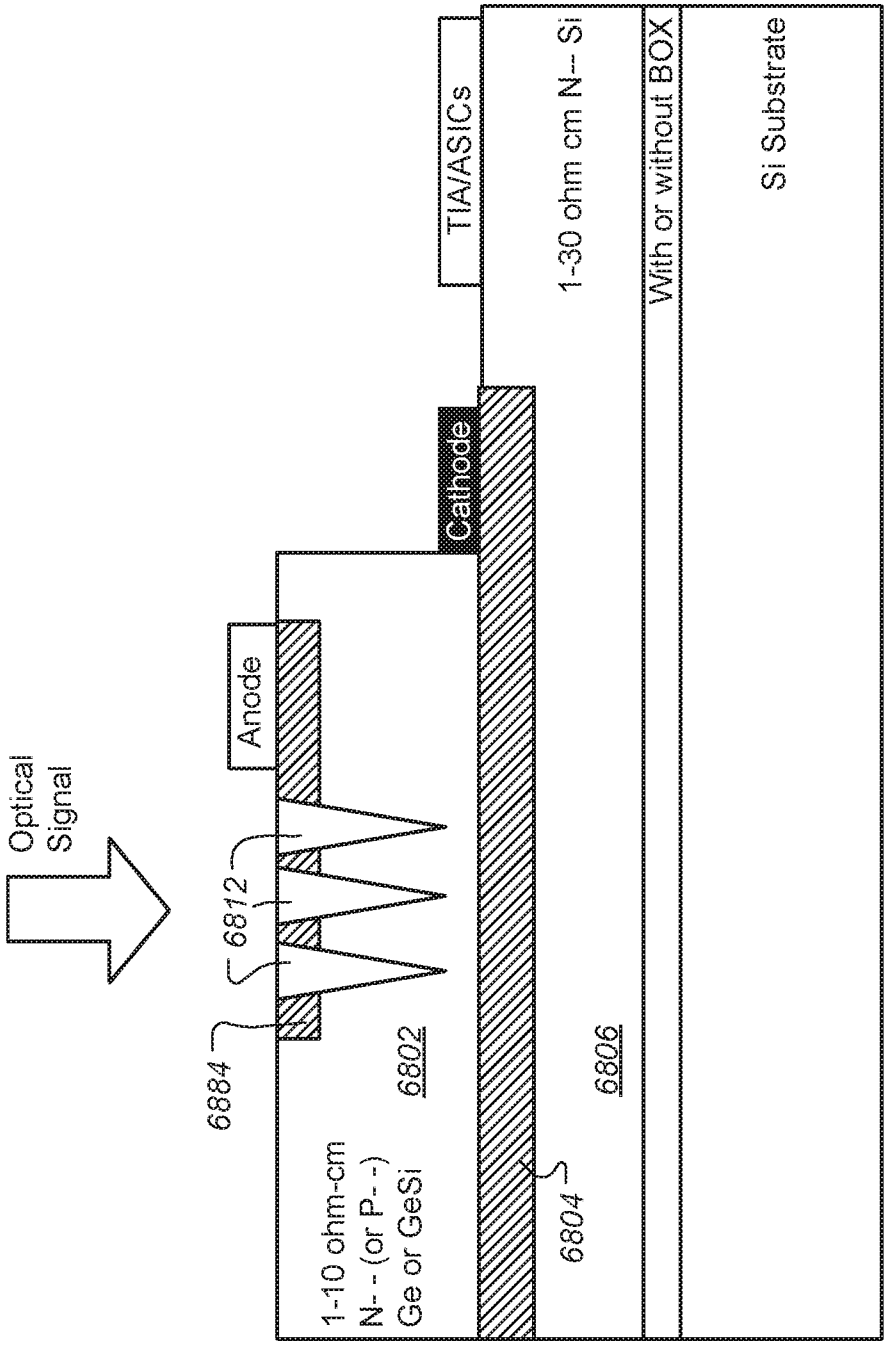

Optical Signal
Anode
Cathode
TIA/ASICs
1-30 ohm cm N-- Si
With or without BOX
Si Substrate
6812
6884
6802
6806
6804
1-10 ohm-cm
N- - (or P- -)
Ge or GeSi

FIG. 68B

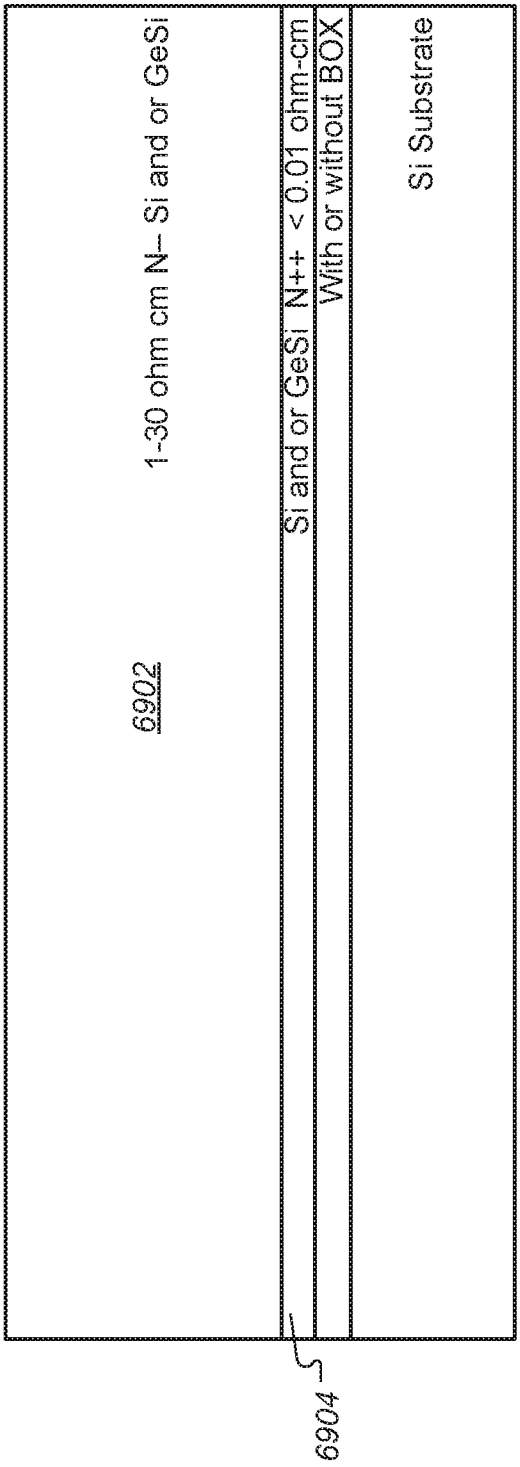

1-30 ohm cm N– Si and or GeSi
6902
Si and or GeSi N++ < 0.01 ohm-cm
With or without BOX
Si Substrate
6904

FIG. 69A

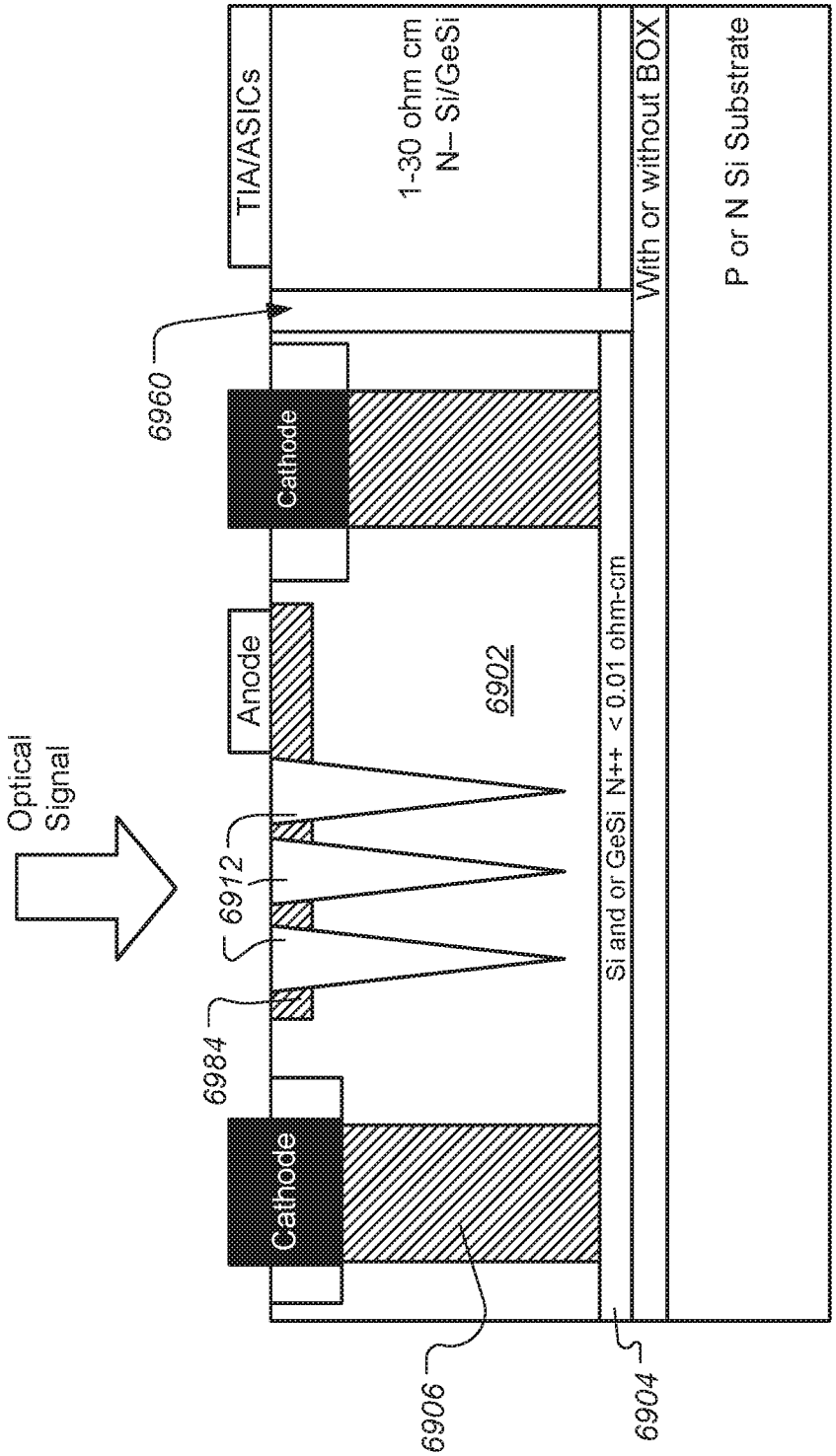

TIA/ASICs
1-30 ohm cm
N– Si/GeSi
With or without BOX
P or N Si Substrate
6960
Cathode
Anode
6902
Optical
Signal
6912
6984
Cathode
Si and or GeSi N++ < 0.01 ohm-cm
6906
6904

FIG. 69B

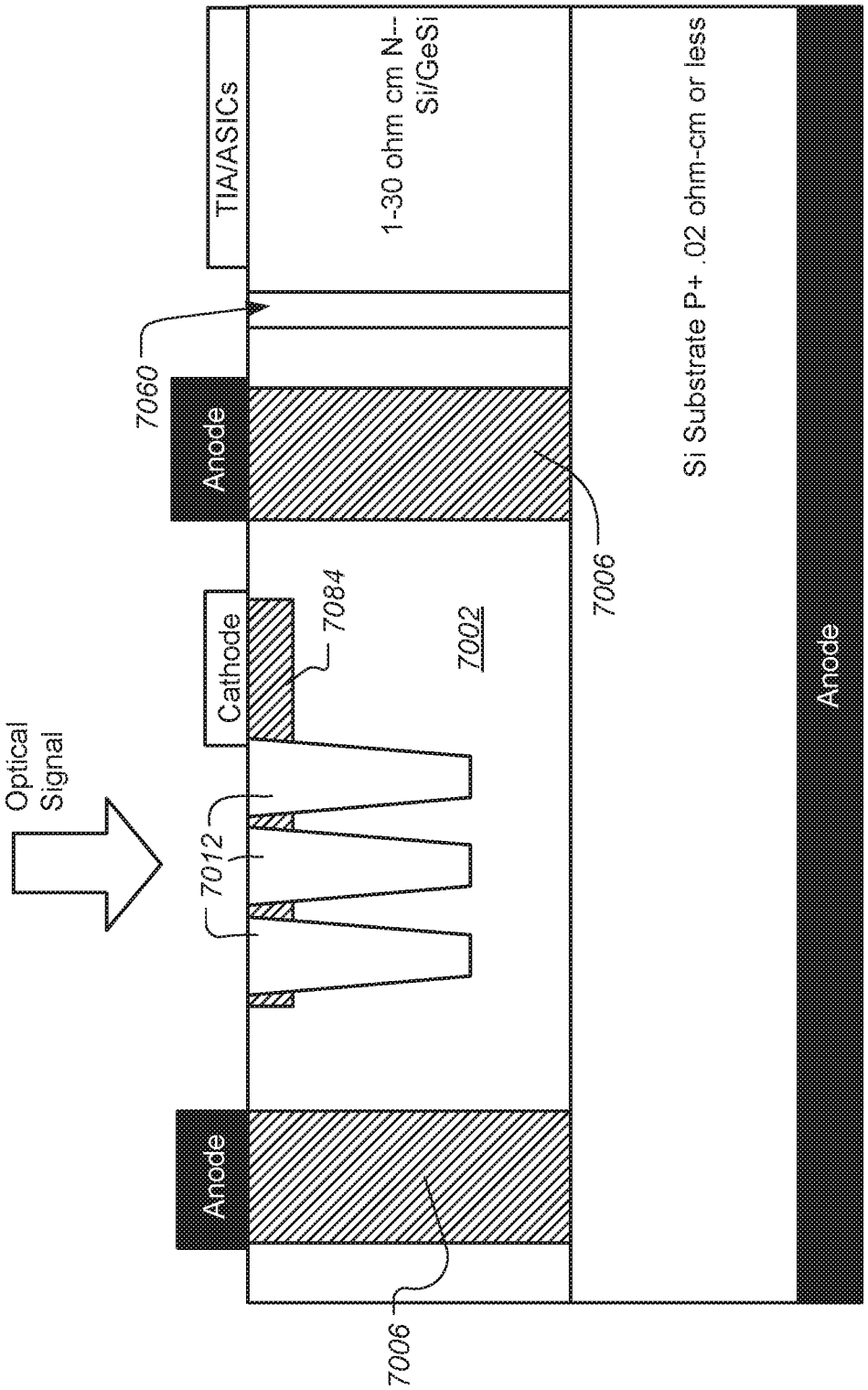

TIA/ASICs
1-30 ohm cm N--
Si/GeSi
Si Substrate P+ .02 ohm-cm or less
7060
Anode
7006
7084
Cathode
7002
Optical
Signal
7012
Anode
Anode
7006

FIG. 70A

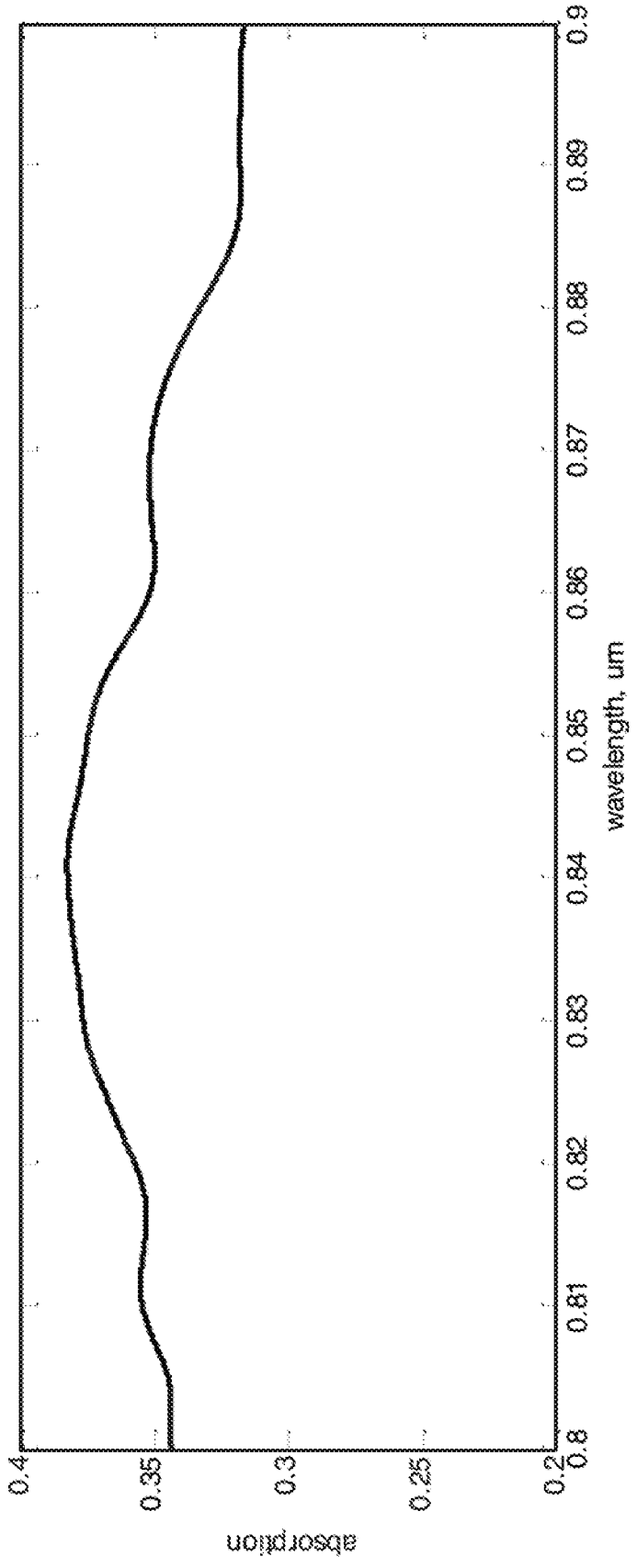

absorption
0.4
0.35
0.3
0.25
0.2
wavelength, um
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9

FIG. 70B

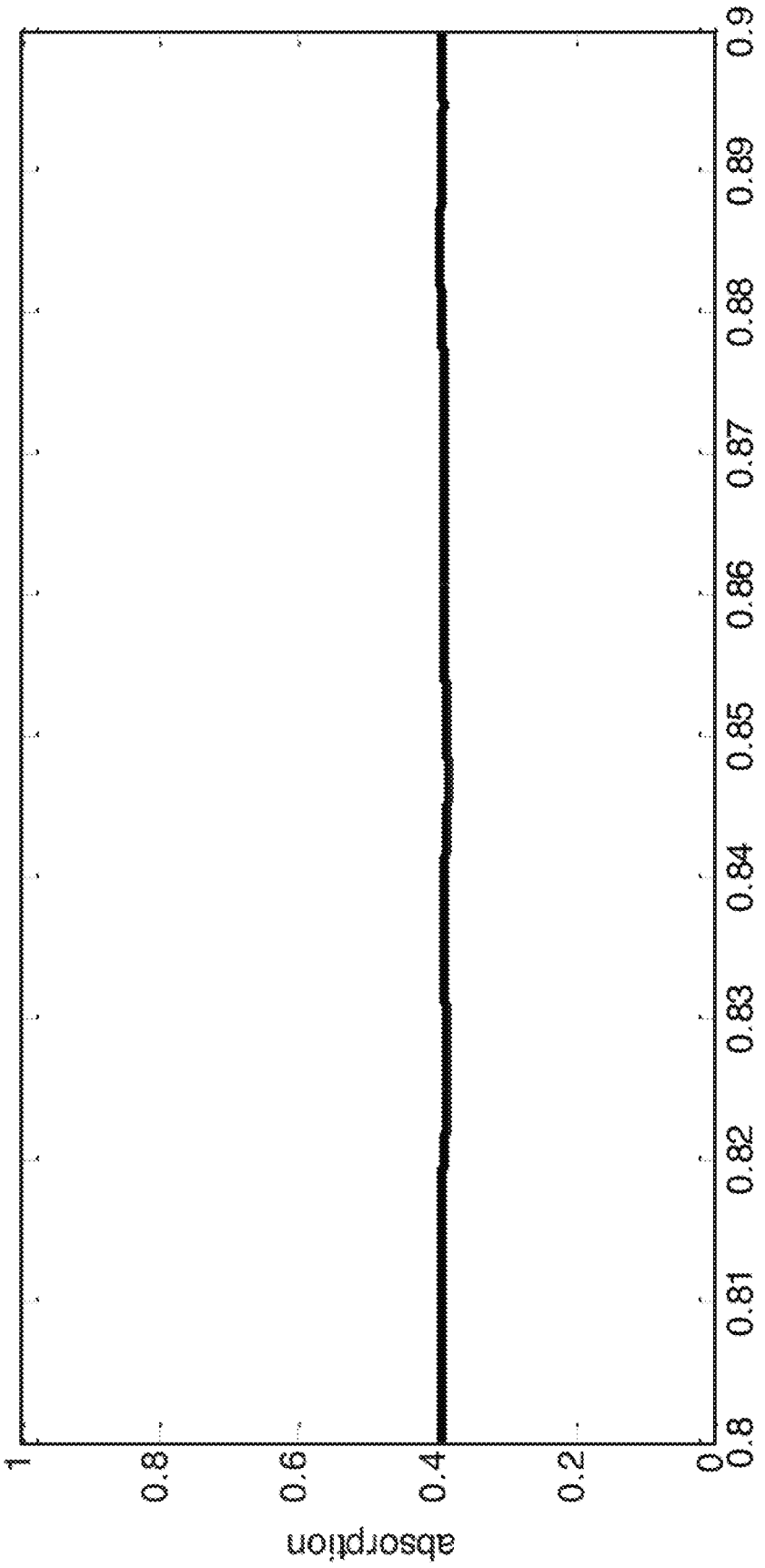

absorption
1
0.8
0.6
0.4
0.2
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9
wavelength, um

FIG. 70C

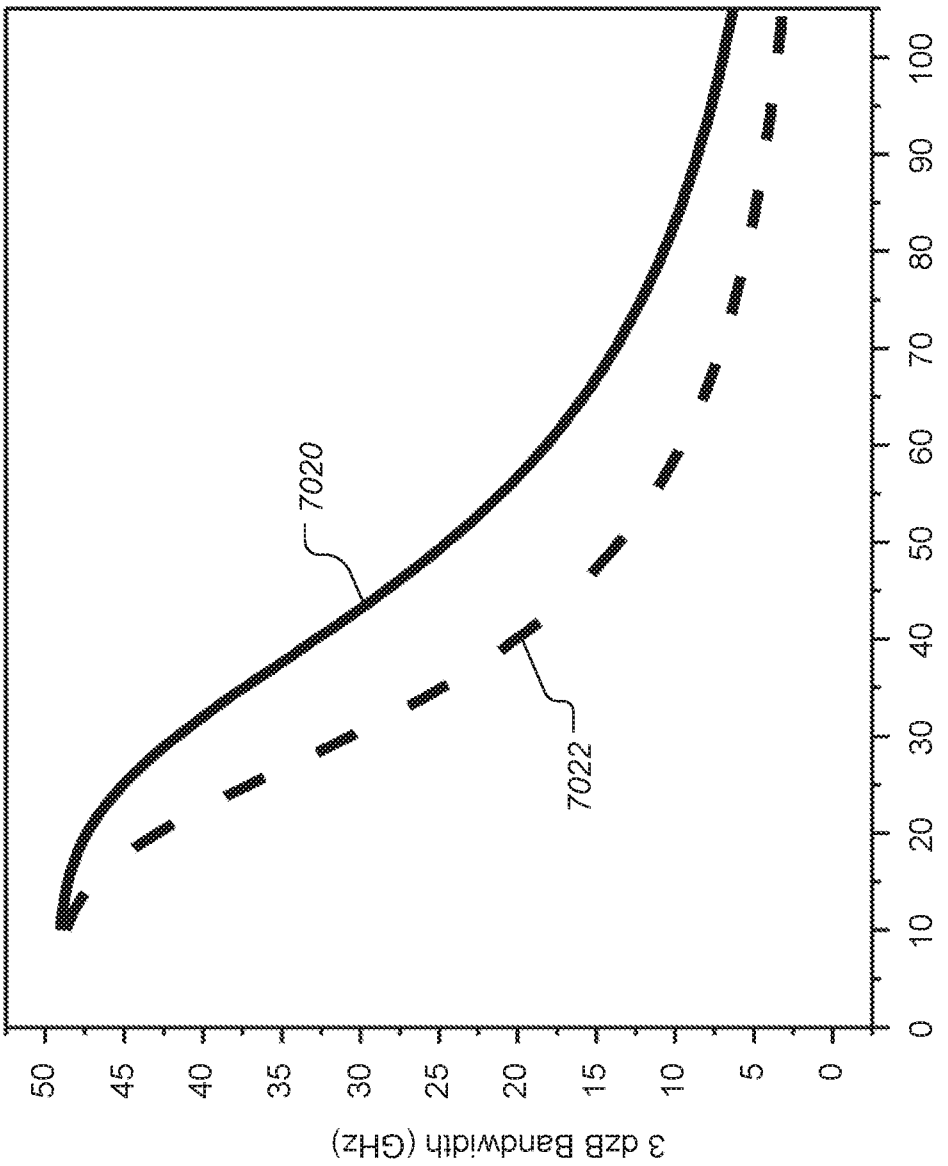

3 dzB Bandwidth (GHz)
0
5
10
15
20
25
30
35
40
45
50
PD diameter (um)
0
10
20
30
40
50
60
70
80
90
100
7020
7022

FIG. 70D

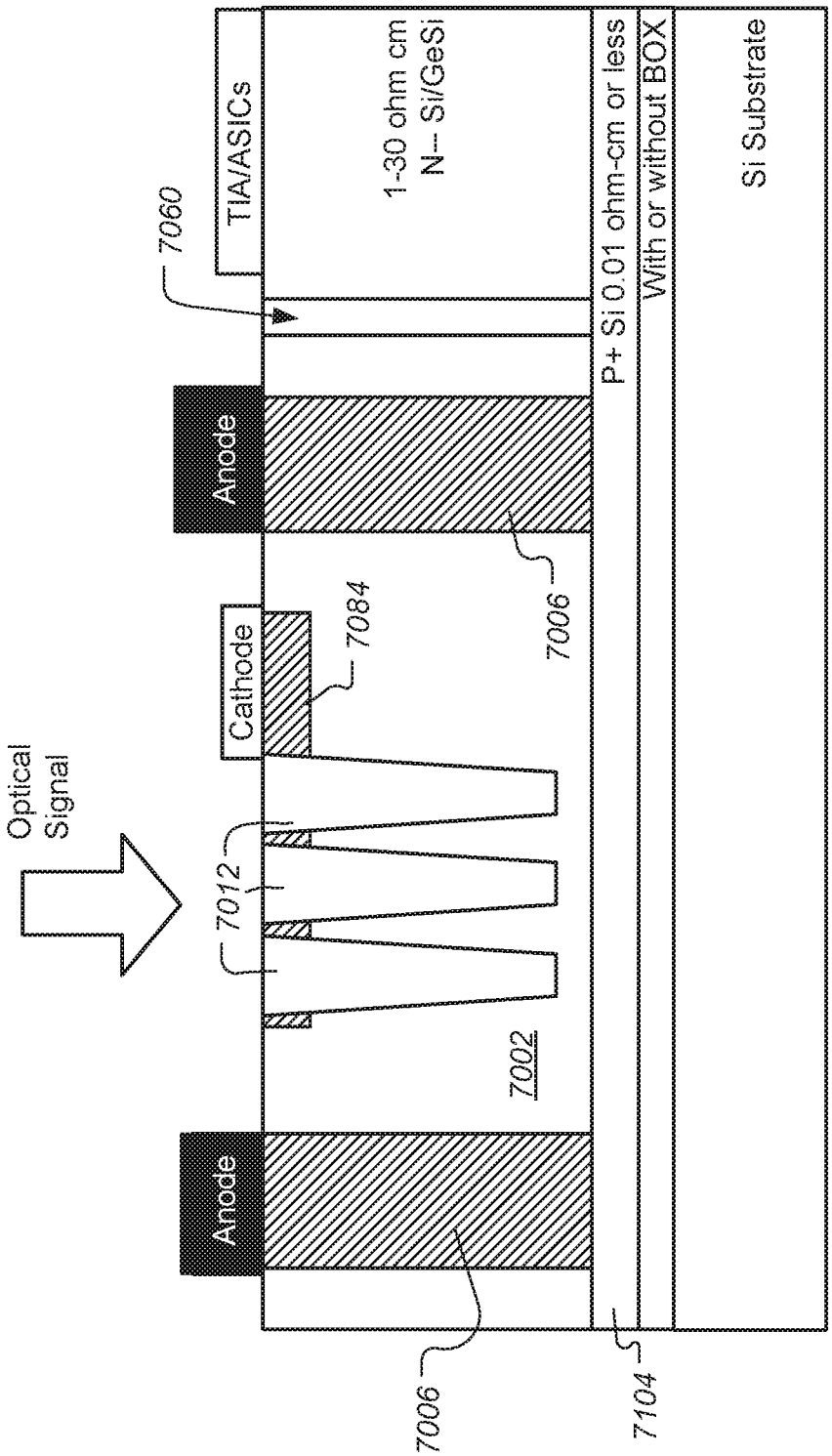

7060
TIA/ASICs
1-30 ohm cm
N– Si/GeSi
P+ Si 0.01 ohm-cm or less
With or without BOX
Si Substrate
Anode
Cathode
7084
7006
Optical
Signal
7012
7002
Anode
7006
7104

FIG. 71

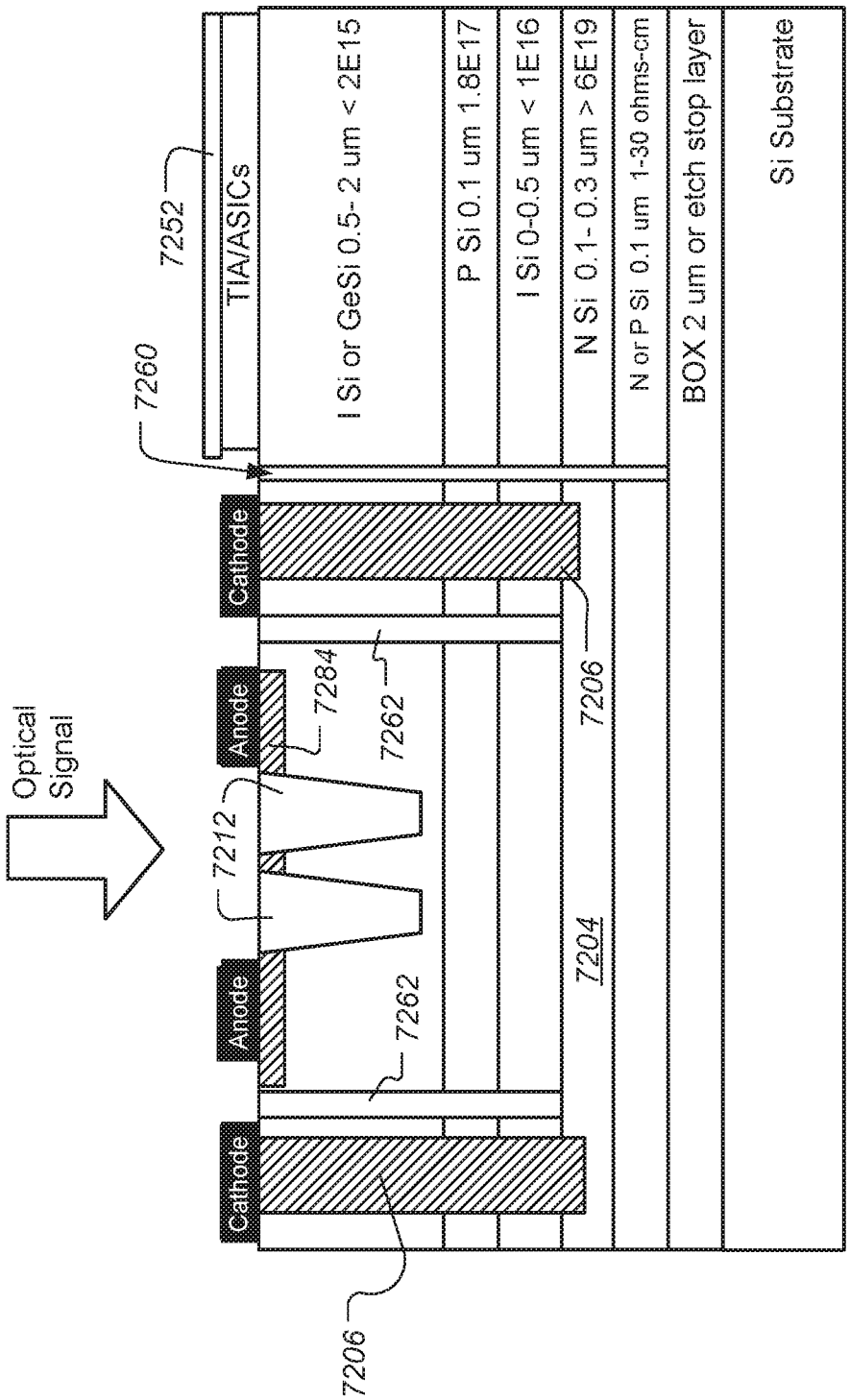

Optical Signal
7212
Anode
Anode
Cathode
Cathode
7284
7262
7262
7206
7204
7206
7260
7252
TIA/ASICs
I Si or GeSi 0.5- 2 um < 2E15
P Si 0.1 um 1.8E17
I Si 0-0.5 um < 1E16
N Si 0.1- 0.3 um > 6E19
N or P Si 0.1 um 1-30 ohms-cm
BOX 2 um or etch stop layer
Si Substrate

FIG. 72

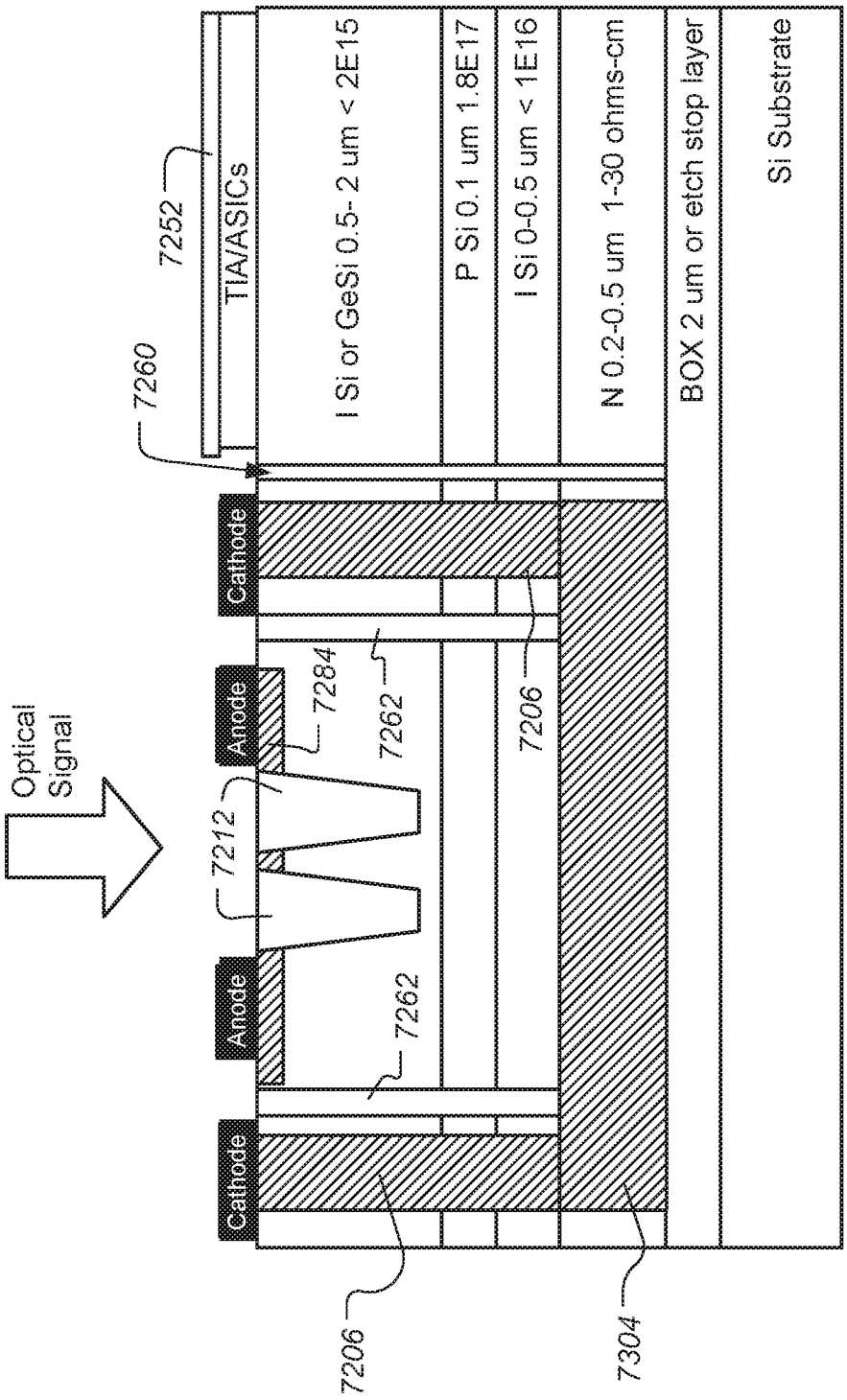

Optical Signal
7212
7284
7262
7262
7206
7206
7304
7260
7252
TIA/ASICs
I Si or GeSi 0.5- 2 um < 2E15
P Si 0.1 um 1.8E17
I Si 0-0.5 um < 1E16
N 0.2-0.5 um 1-30 ohms-cm
BOX 2 um or etch stop layer
Si Substrate
Cathode
Anode
Anode
Cathode

FIG. 73

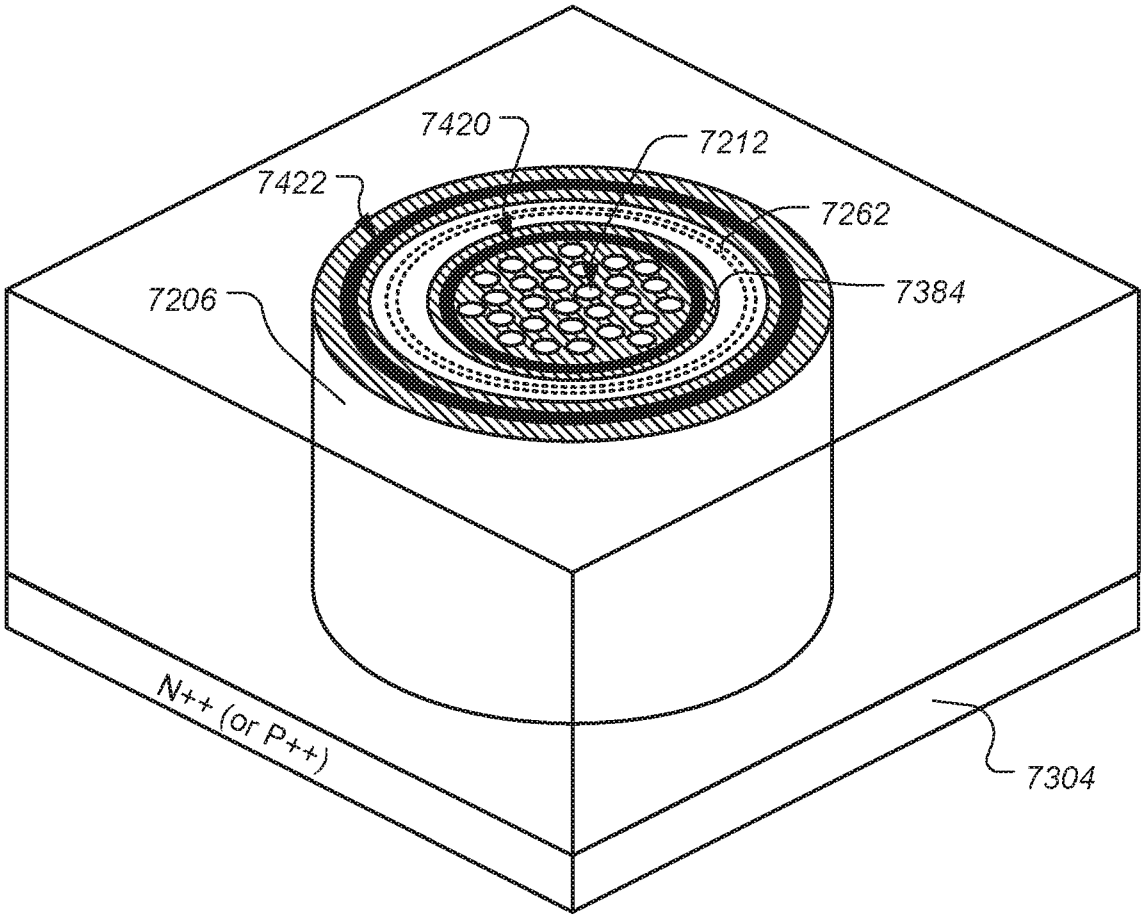


FIG. 74

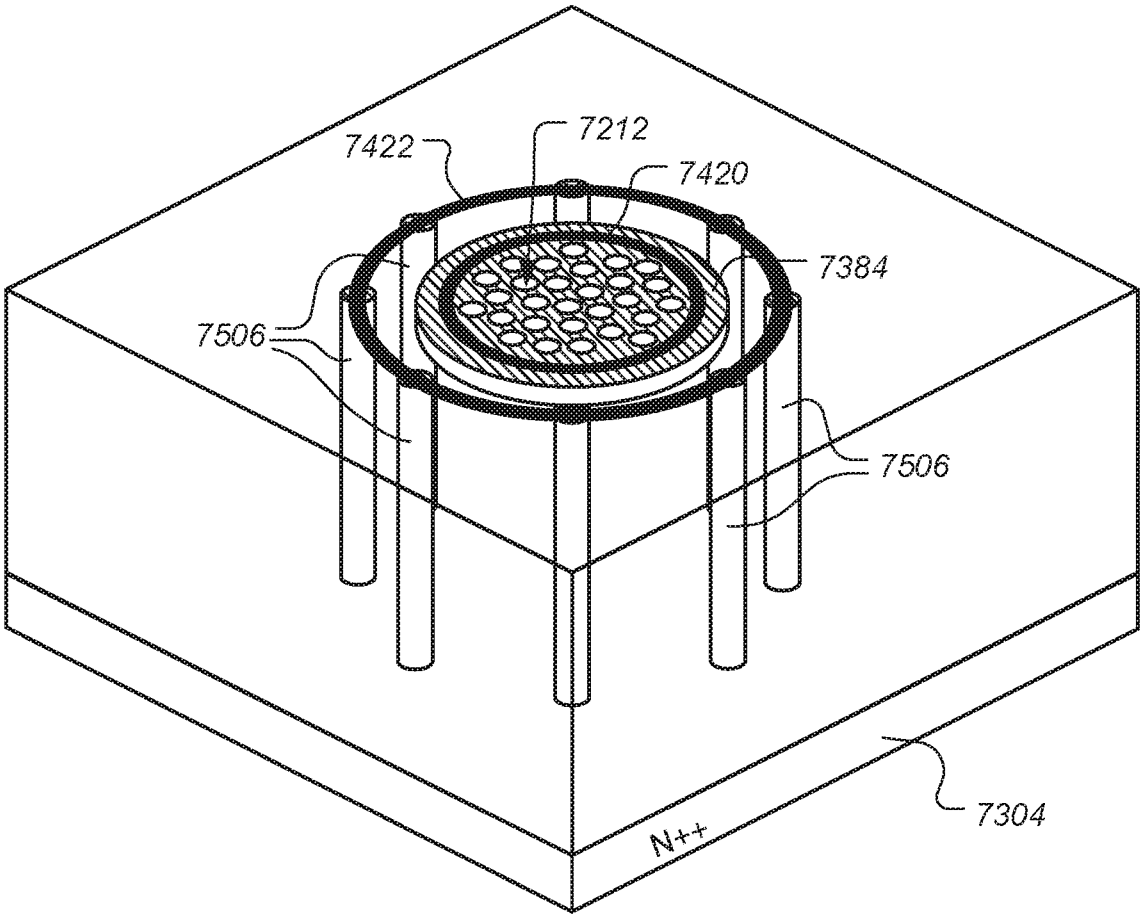


FIG. 75

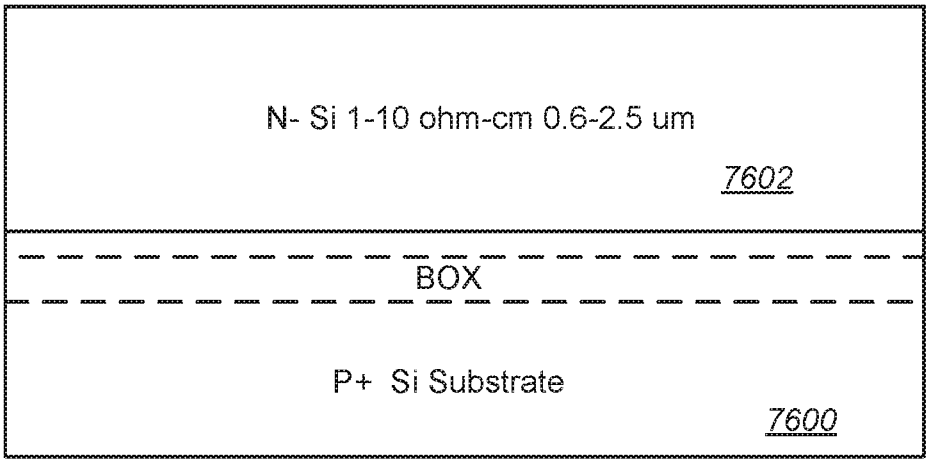


FIG. 76A

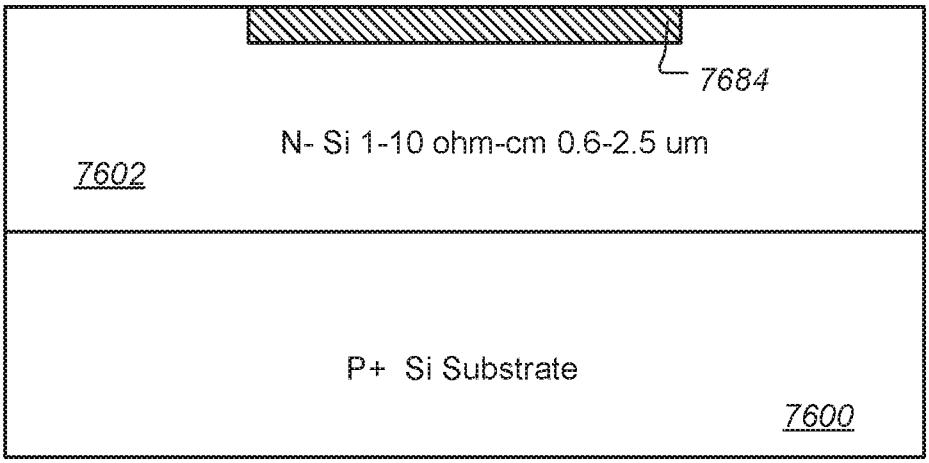


FIG. 76B

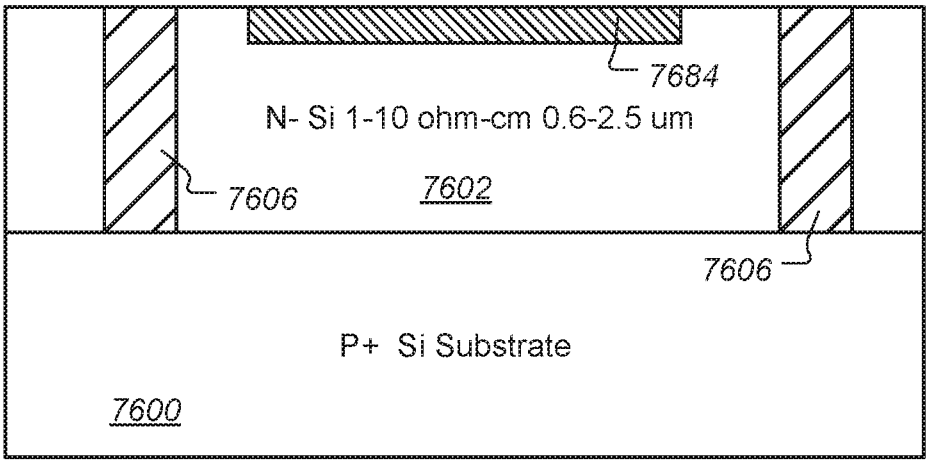


FIG. 76C

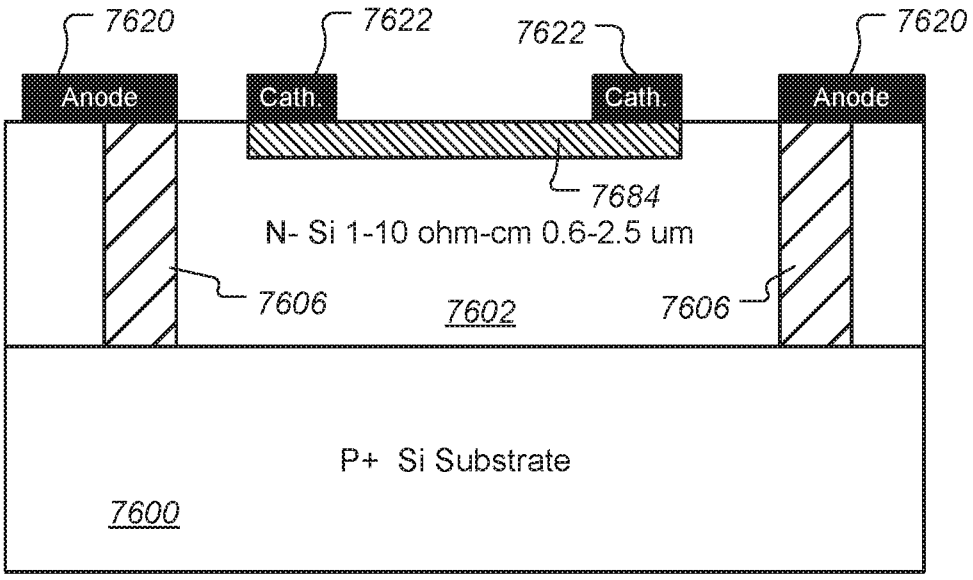


FIG. 76D

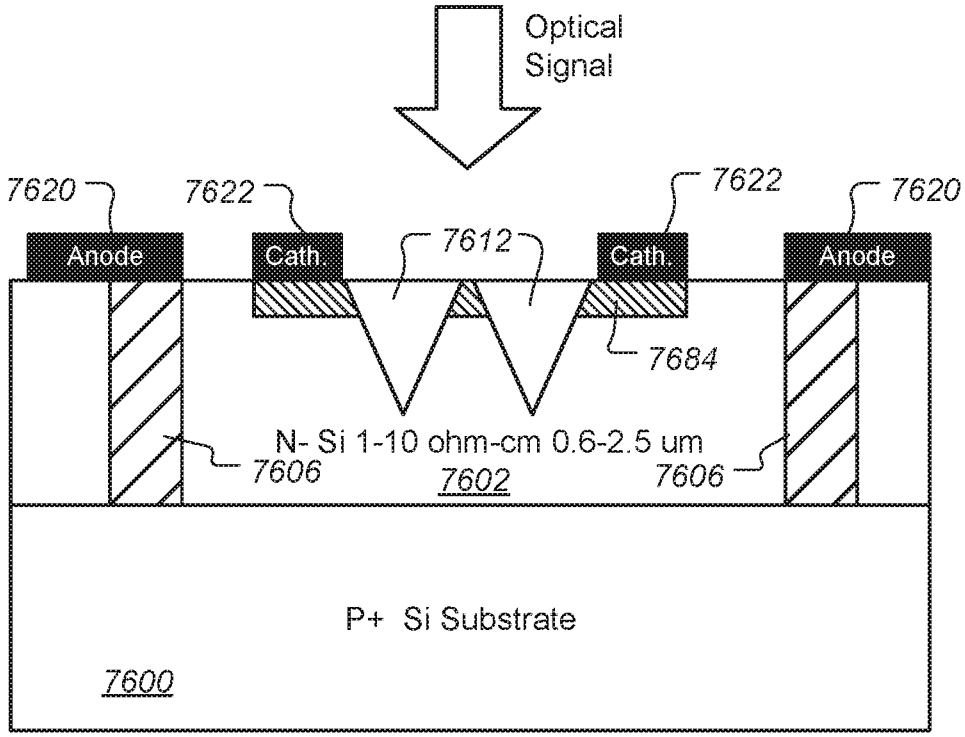


FIG. 76E

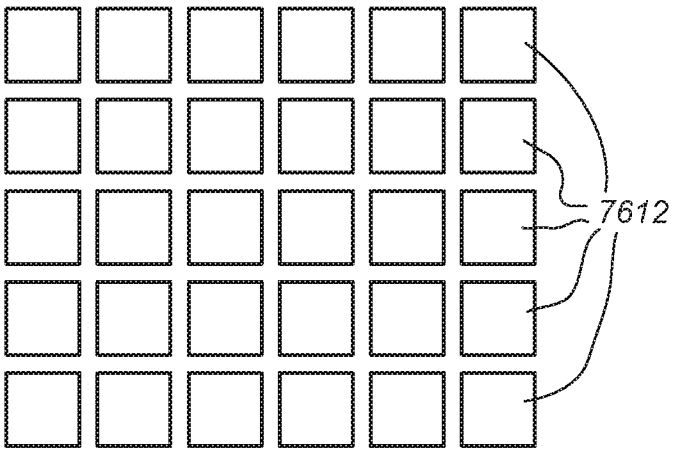


FIG. 76F

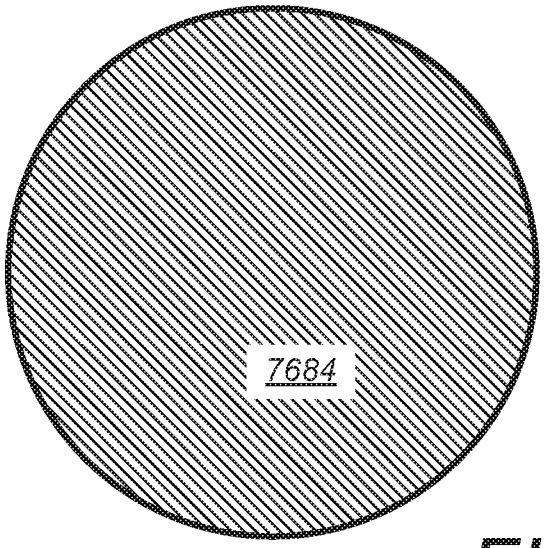


FIG. 76G

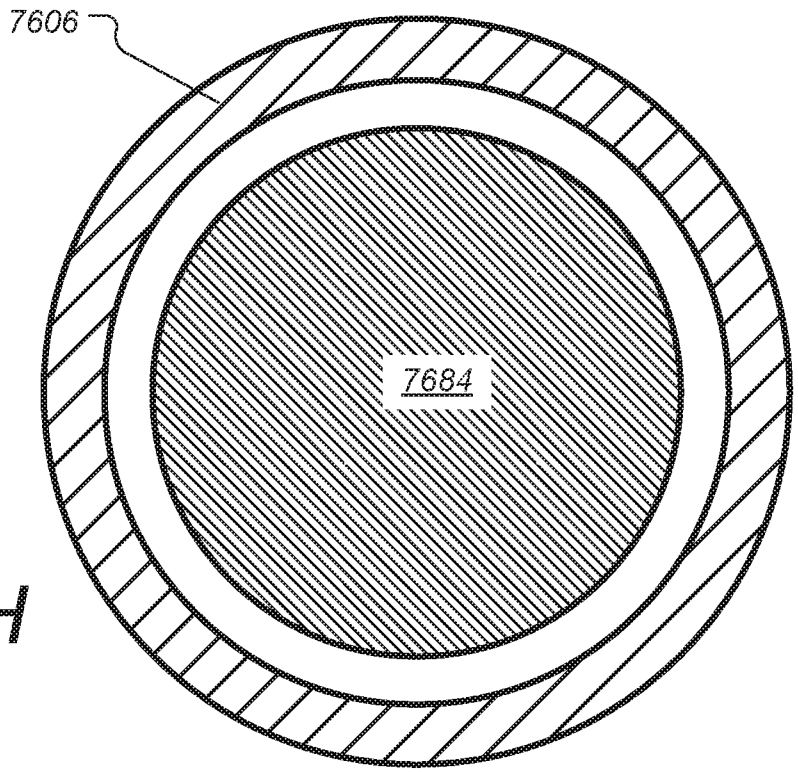


FIG. 76H

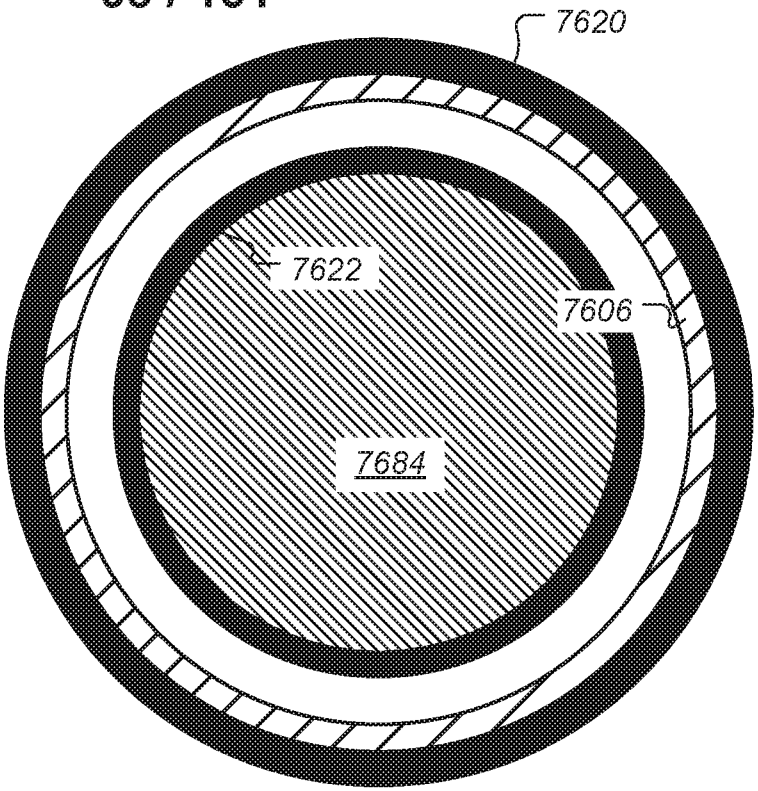


FIG. 76I

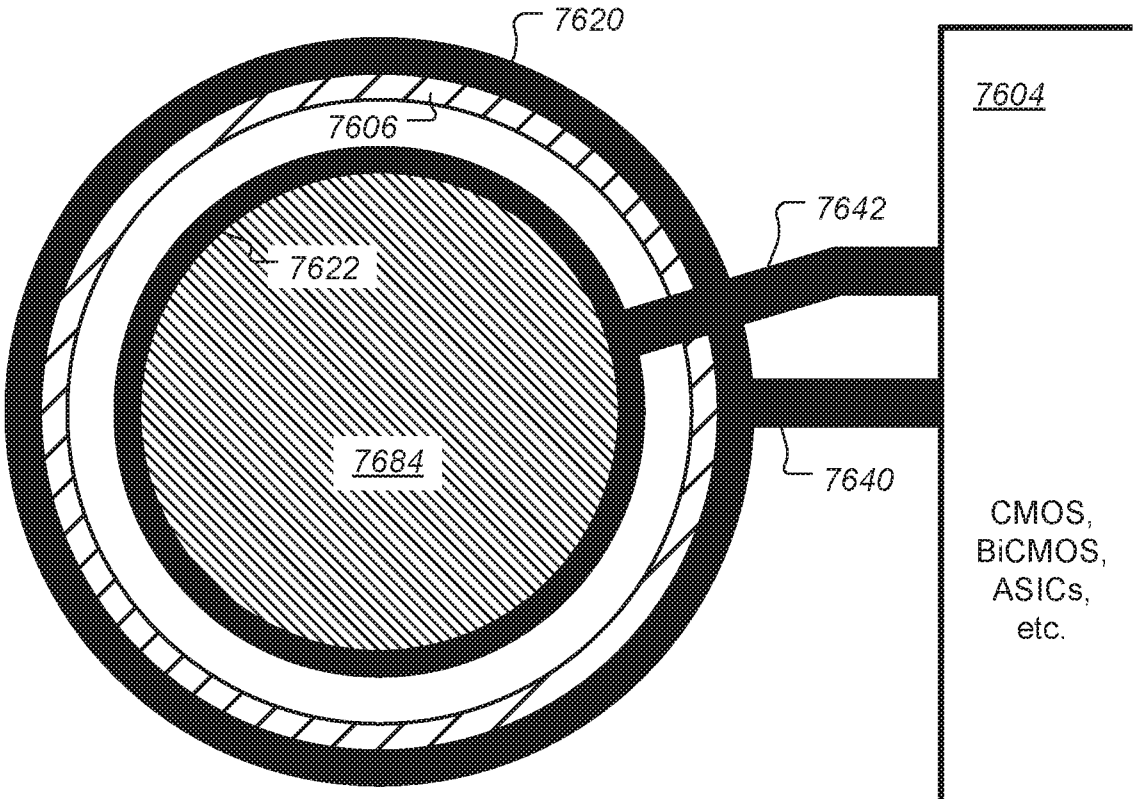


FIG. 76J

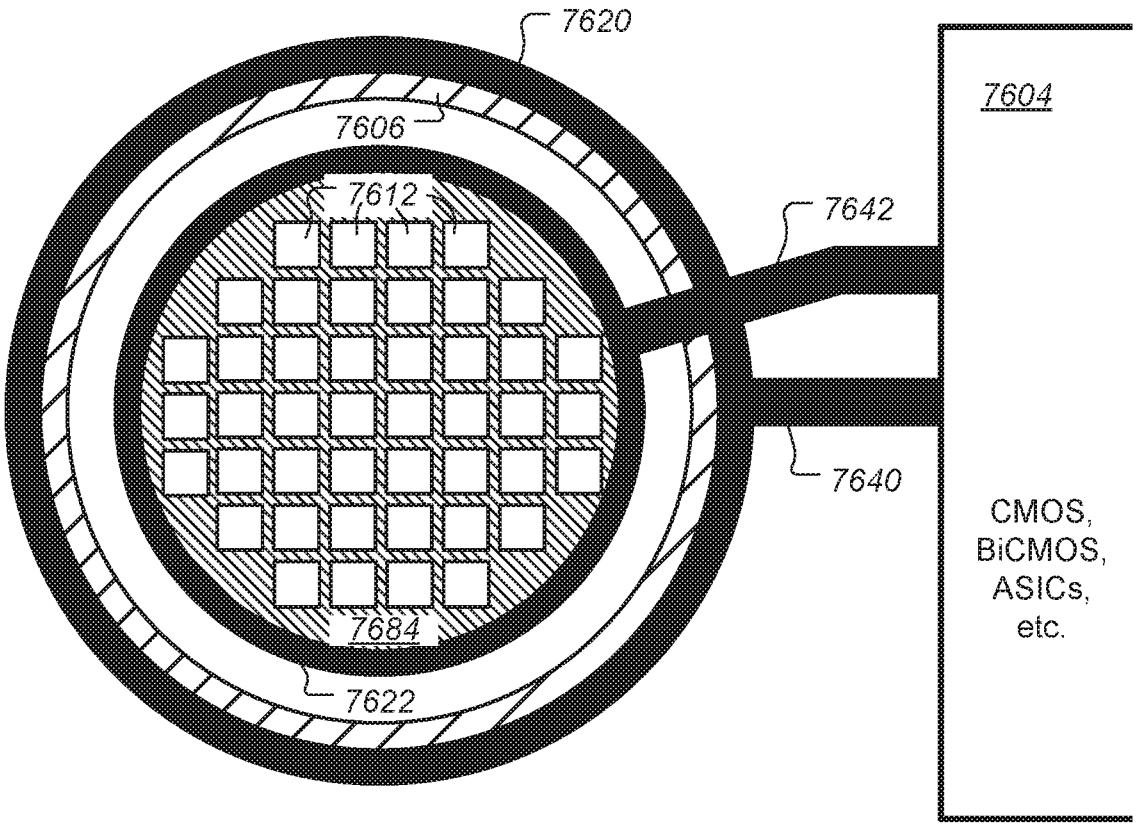

7620
7606
7612
7604
7642
7640
CMOS,
BiCMOS,
ASICs,
etc.
7684
7622

FIG. 76K

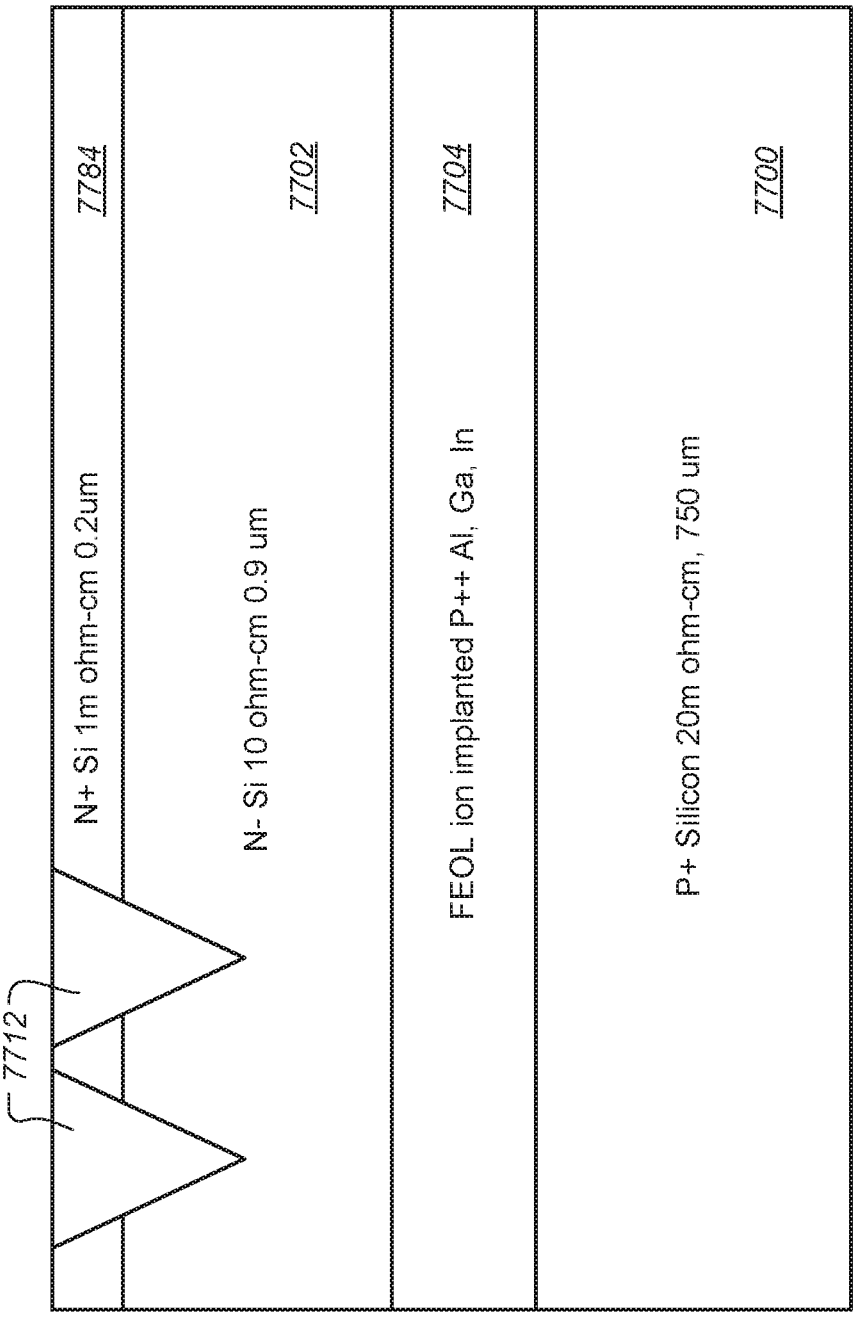

N+ Si 1m ohm-cm 0.2um
7784
N- Si 10 ohm-cm 0.9 um
7702
FEOL ion implanted P++ Al, Ga, In
7704
P+ Silicon 20m ohm-cm, 750 um
7700
7712

FIG. 77A

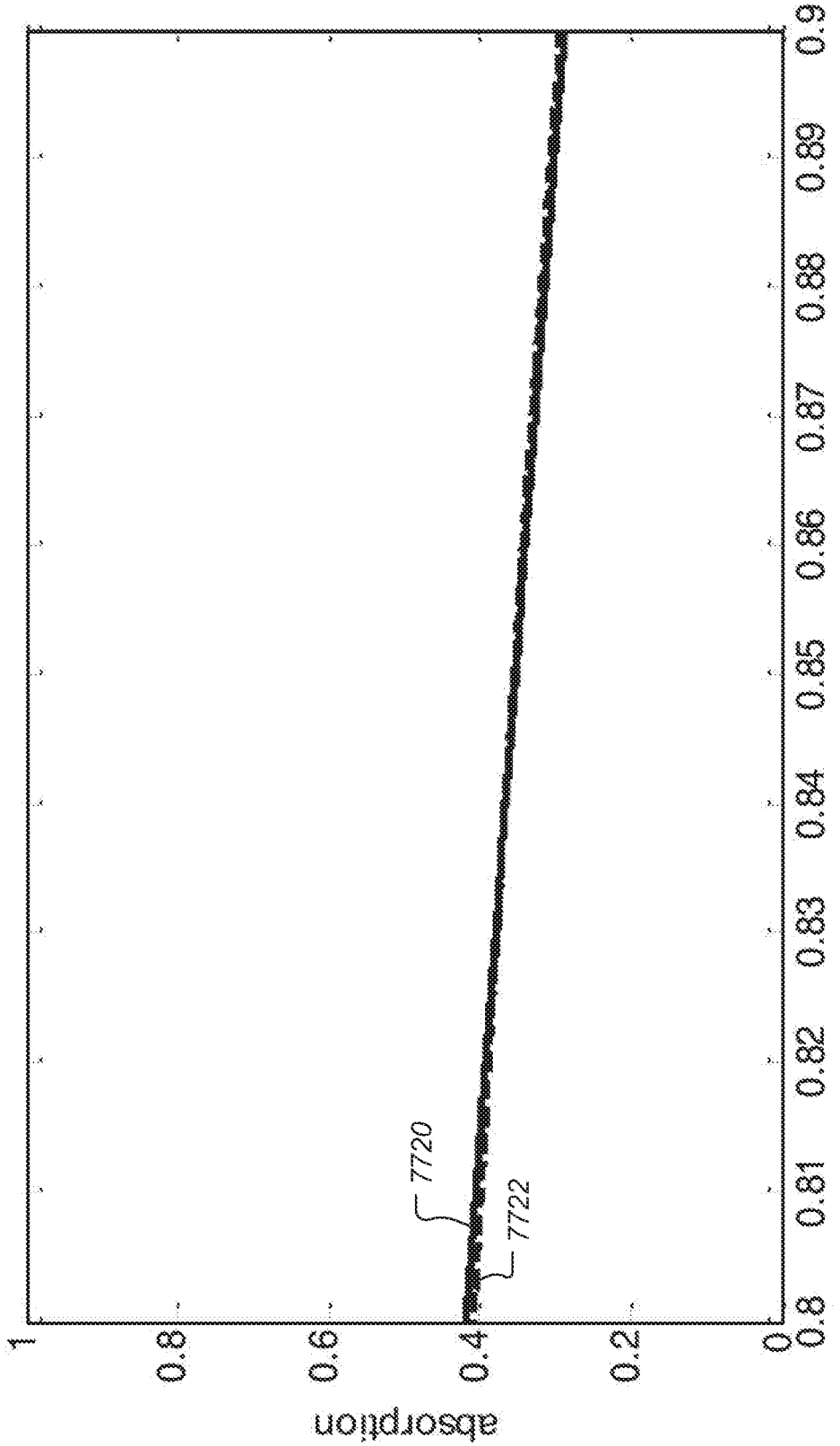

absorption
1
0.8
0.6
0.4
0.2
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9
wavelength, um
7720
7722

FIG. 77B

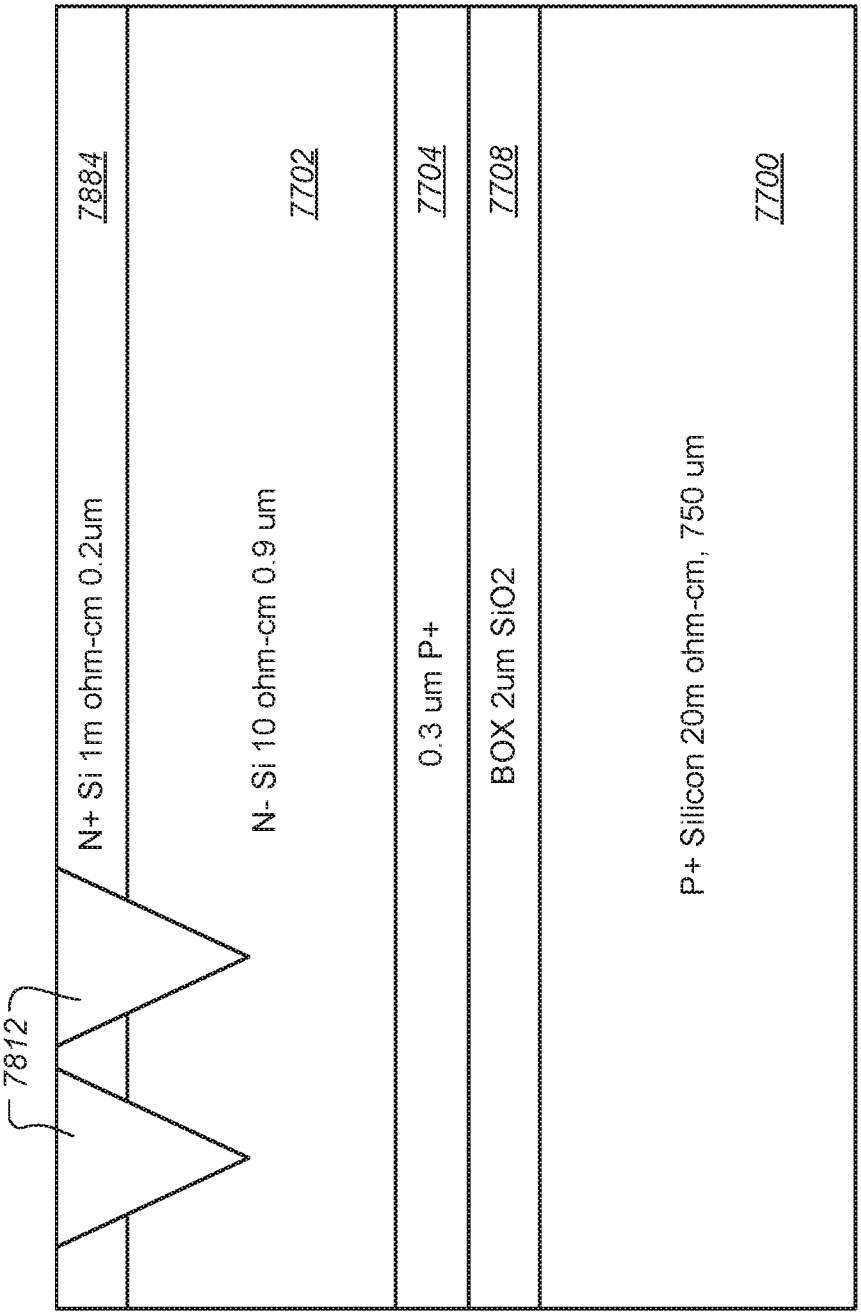

7884
7702
7704
7708
7700
N+ Si 1m ohm-cm 0.2um
N- Si 10 ohm-cm 0.9 um
0.3 um P+
BOX 2um SiO2
P+ Silicon 20m ohm-cm, 750 um
7812

FIG. 78

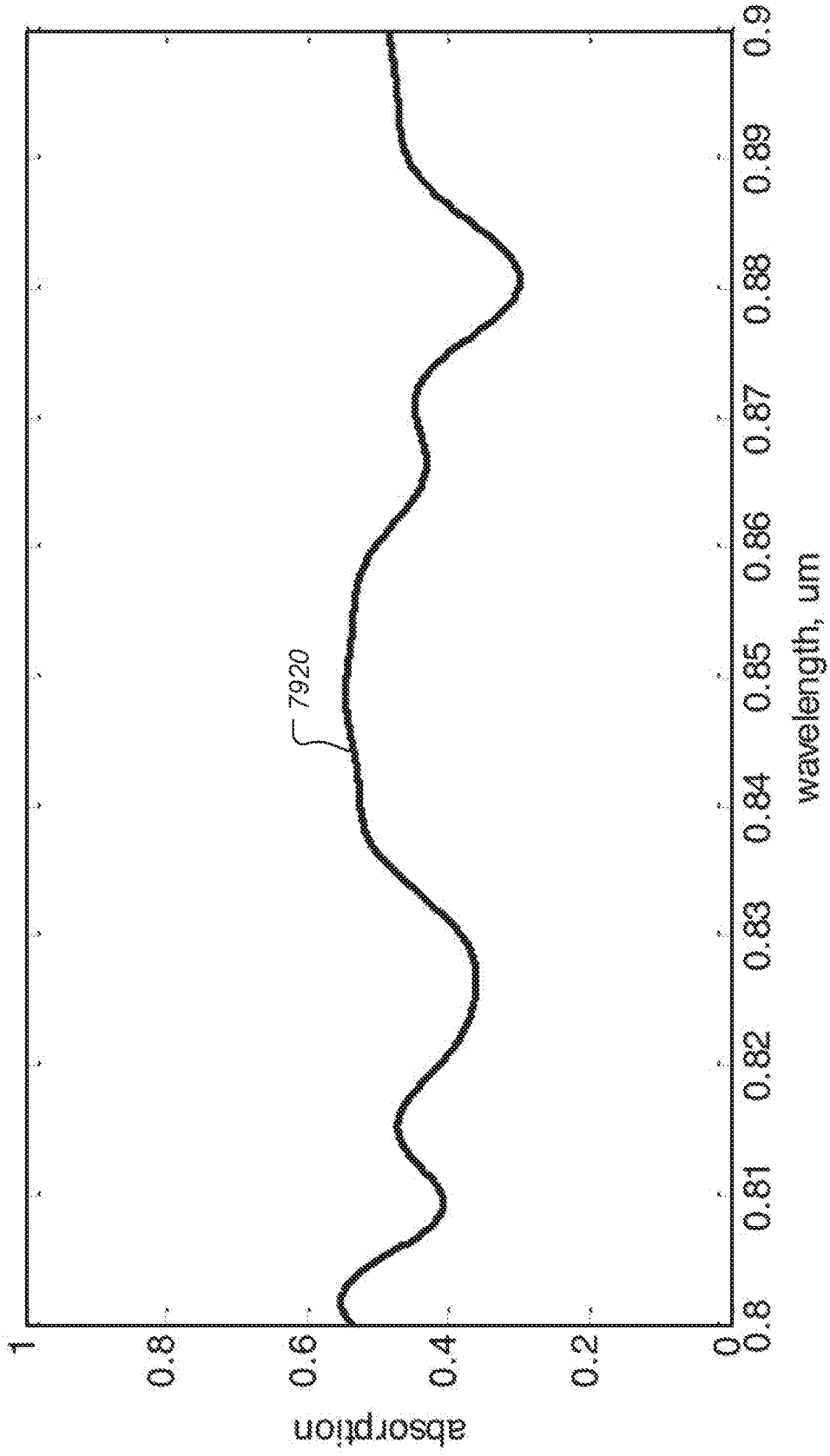

absorption
1
0.8
0.6
0.4
0.2
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9
wavelength, um
7920

FIG. 79

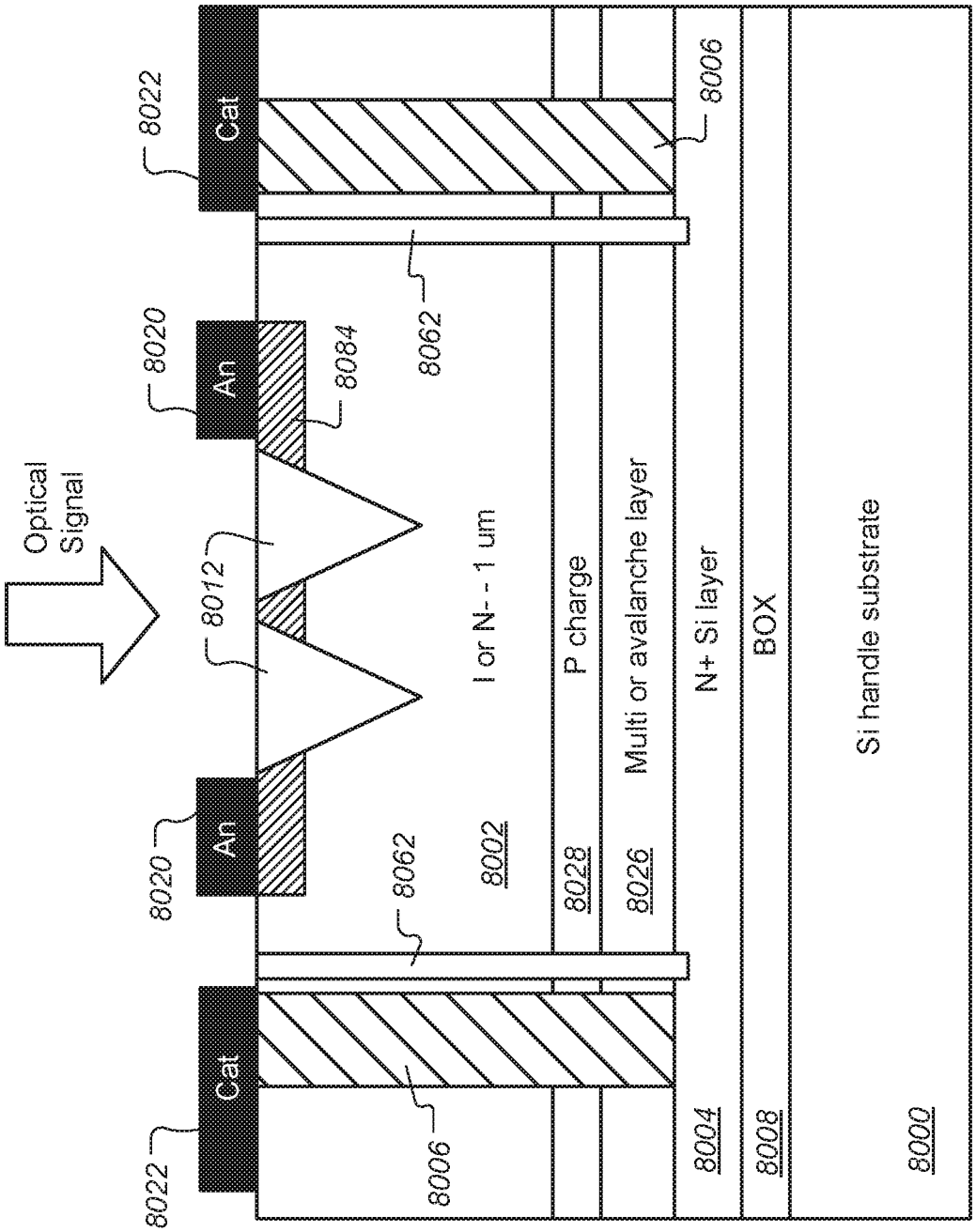

Optical Signal
8012
8022
Cat
8020
An
8084
8062
8006
I or N- - 1 um
8002
P charge
8028
Multi or avalanche layer
8026
N+ Si layer
8004
BOX
8008
Si handle substrate
8000

FIG. 80

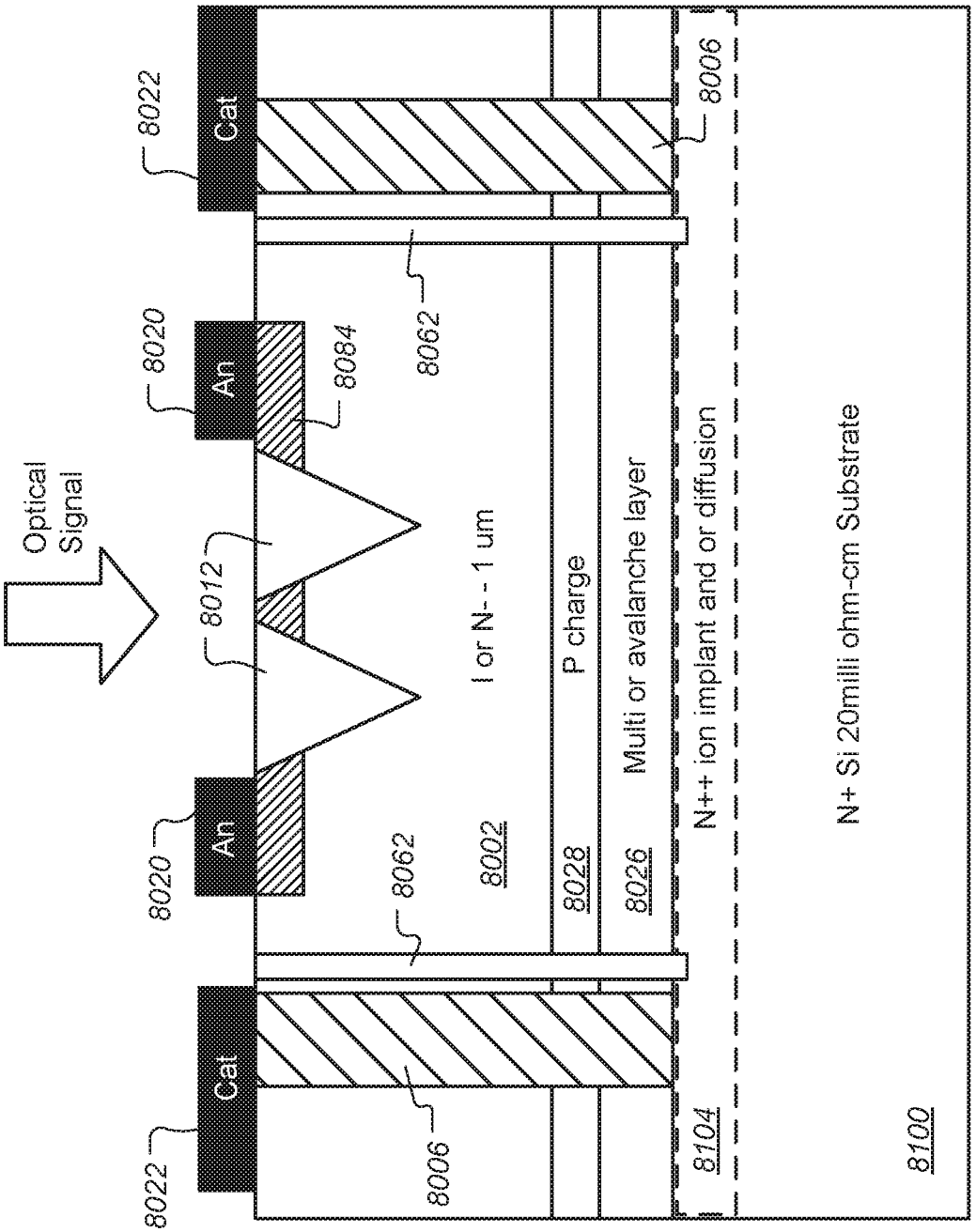

Optical Signal
8012
8022
Cat
8020
An
8084
8062
8006
I or N- - 1 um
8002
P charge
8028
Multi or avalanche layer
8026
N++ ion implant and or diffusion
8104
N+ Si 20milli ohm-cm Substrate
8100

FIG. 81

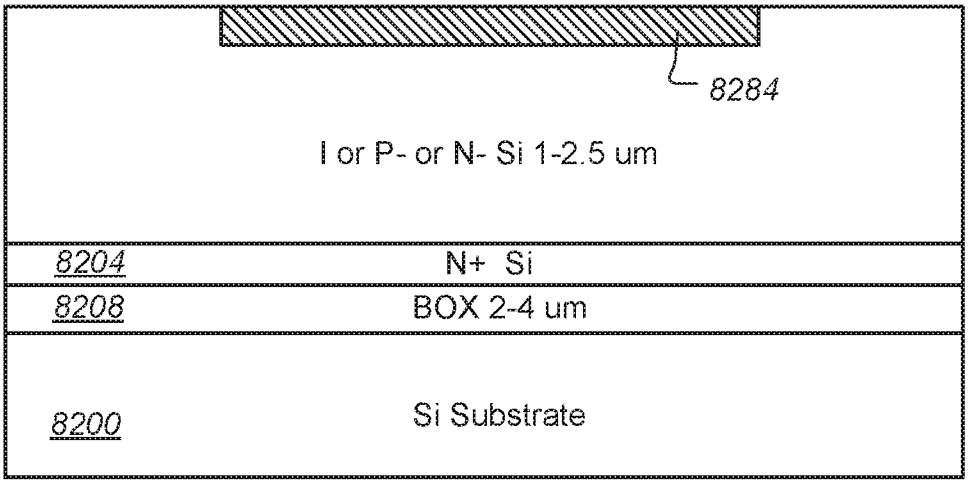


FIG. 82A

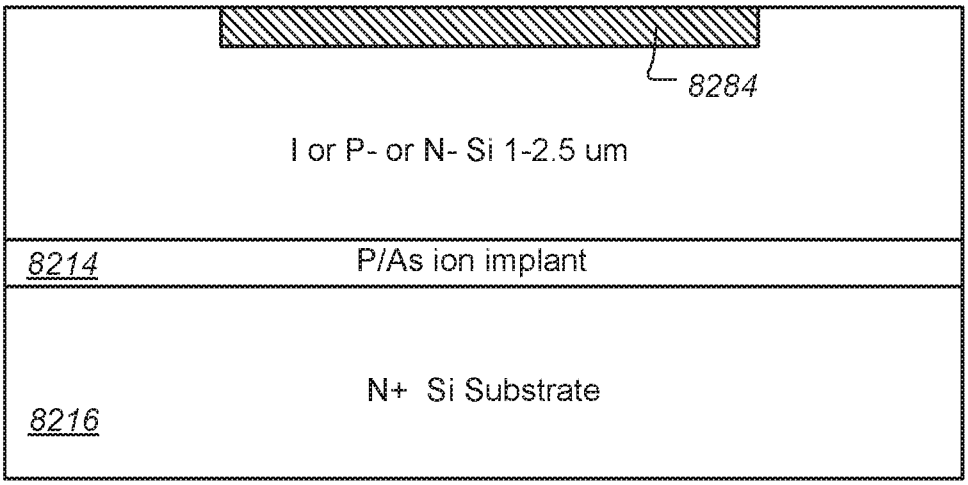


FIG. 82B

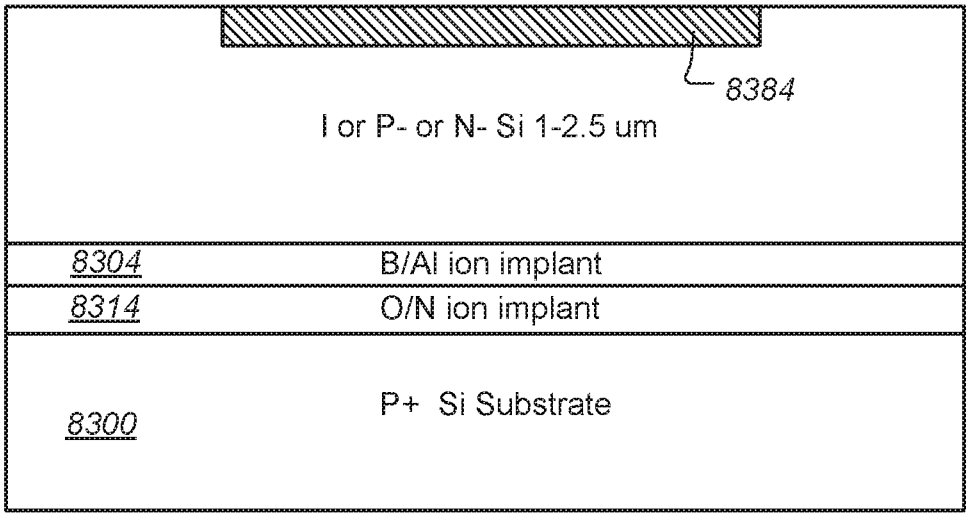

8384
I or P- or N- Si 1-2.5 um
8304
B/Al ion implant
8314
O/N ion implant
8300
P+ Si Substrate

FIG. 83

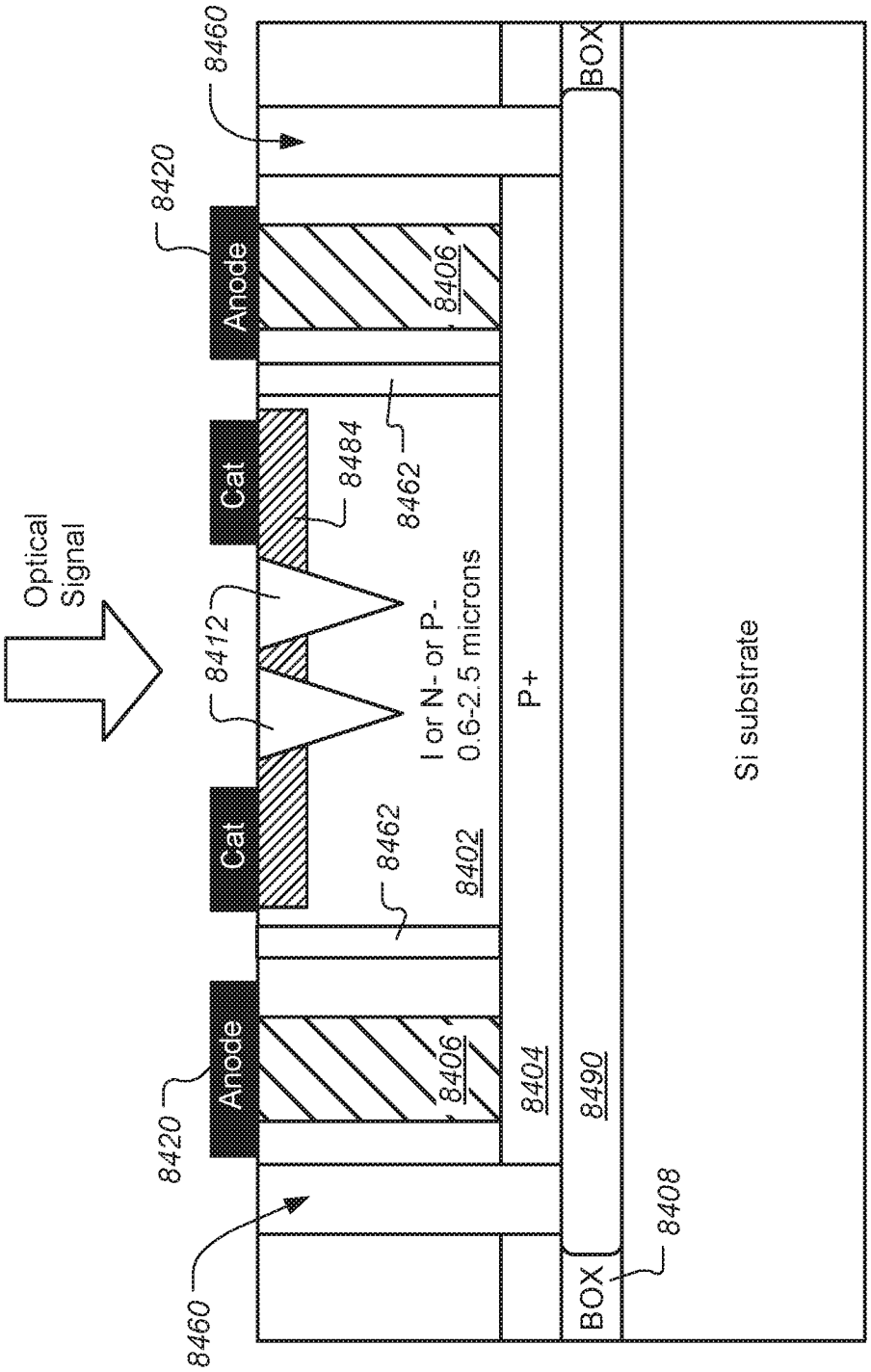

Optical Signal
8460
8420
Anode
Cat
Cat
Anode
8420
8460
8412
8484
8462
8462
8406
8406
I or N- or P-
0.6-2.5 microns
8402
P+
8404
8490
BOX
BOX
8408
Si substrate

FIG. 84A

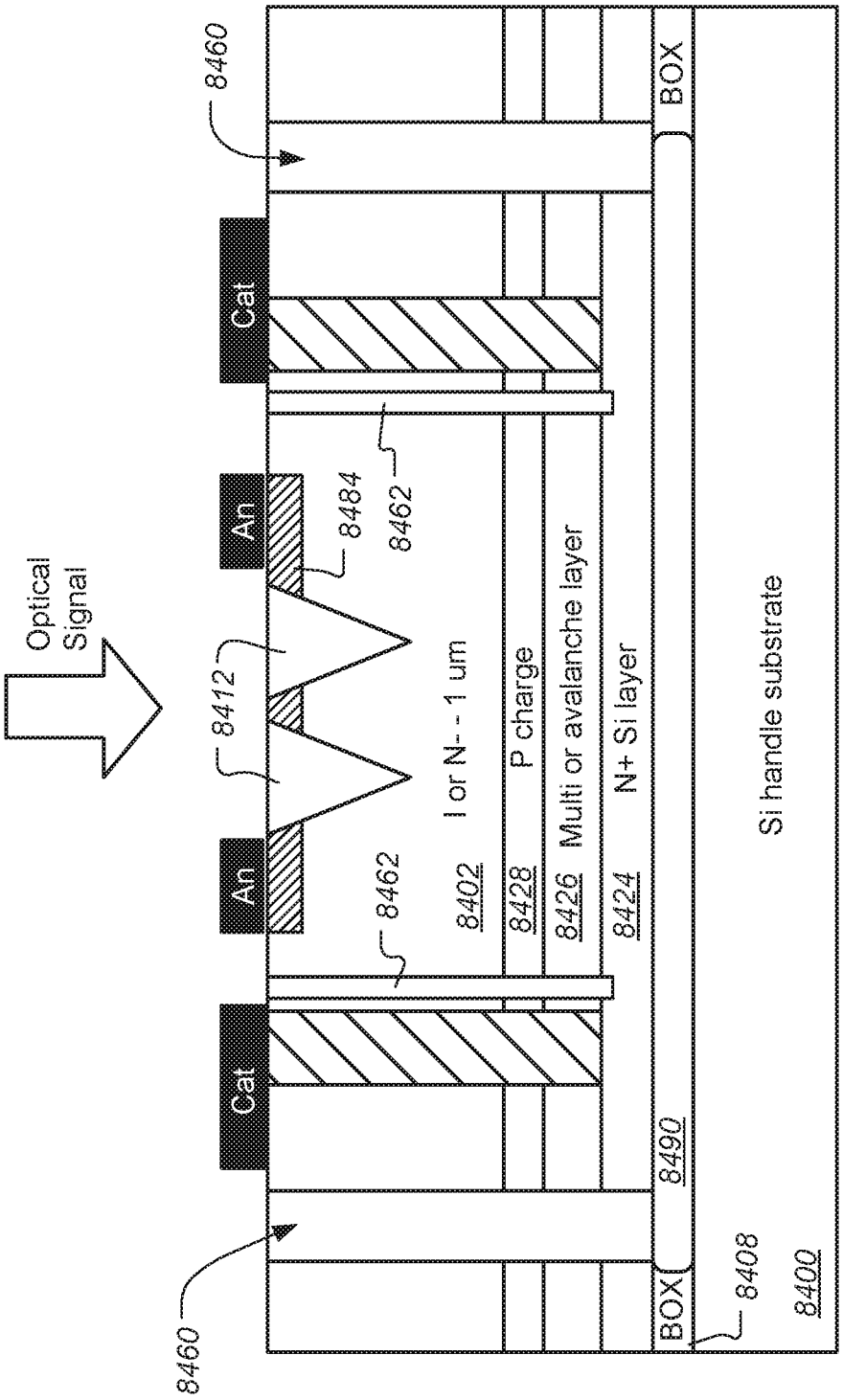

8460
BOX
Cat
An
8484
8462
Optical Signal
8412
I or N- - 1 um
8402
P charge
8428
Multi or avalanche layer
8426
N+ Si layer
8424
Si handle substrate
8462
Cat
8490
8460
BOX
8408
8400

FIG. 84B

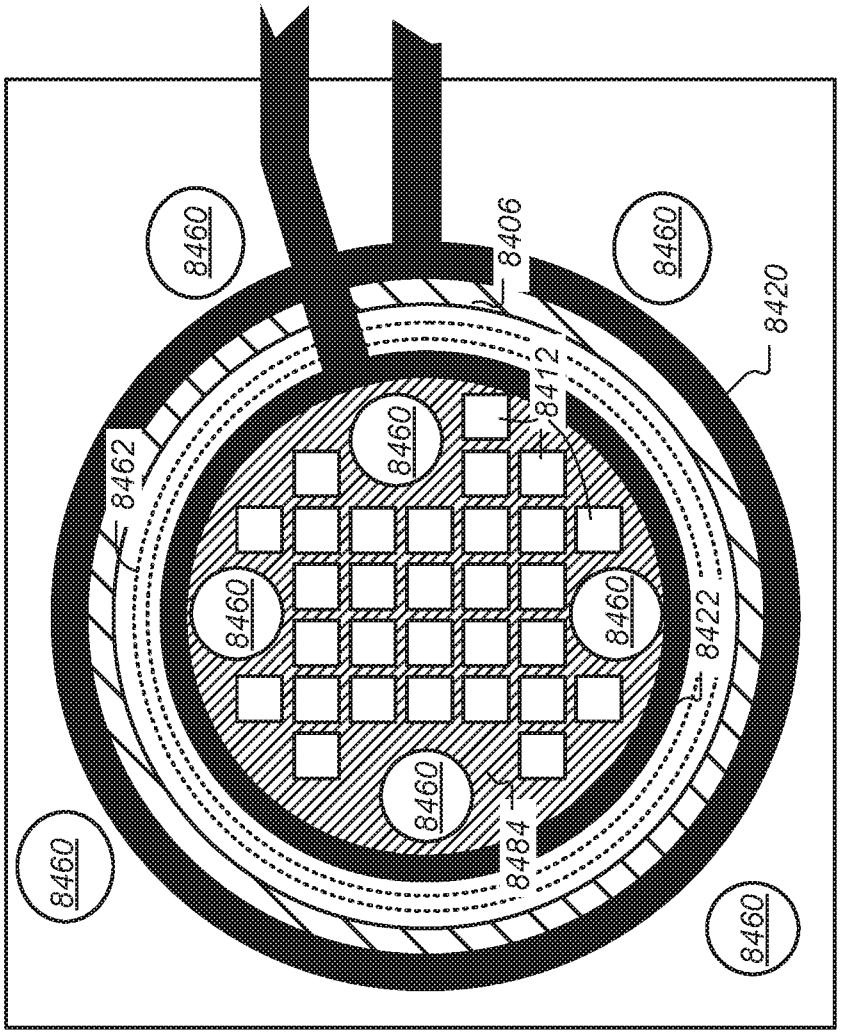

8460
8406
8460
8420
8412
8462
8460
8460
8460
8422
8460
8484
8460

FIG. 85

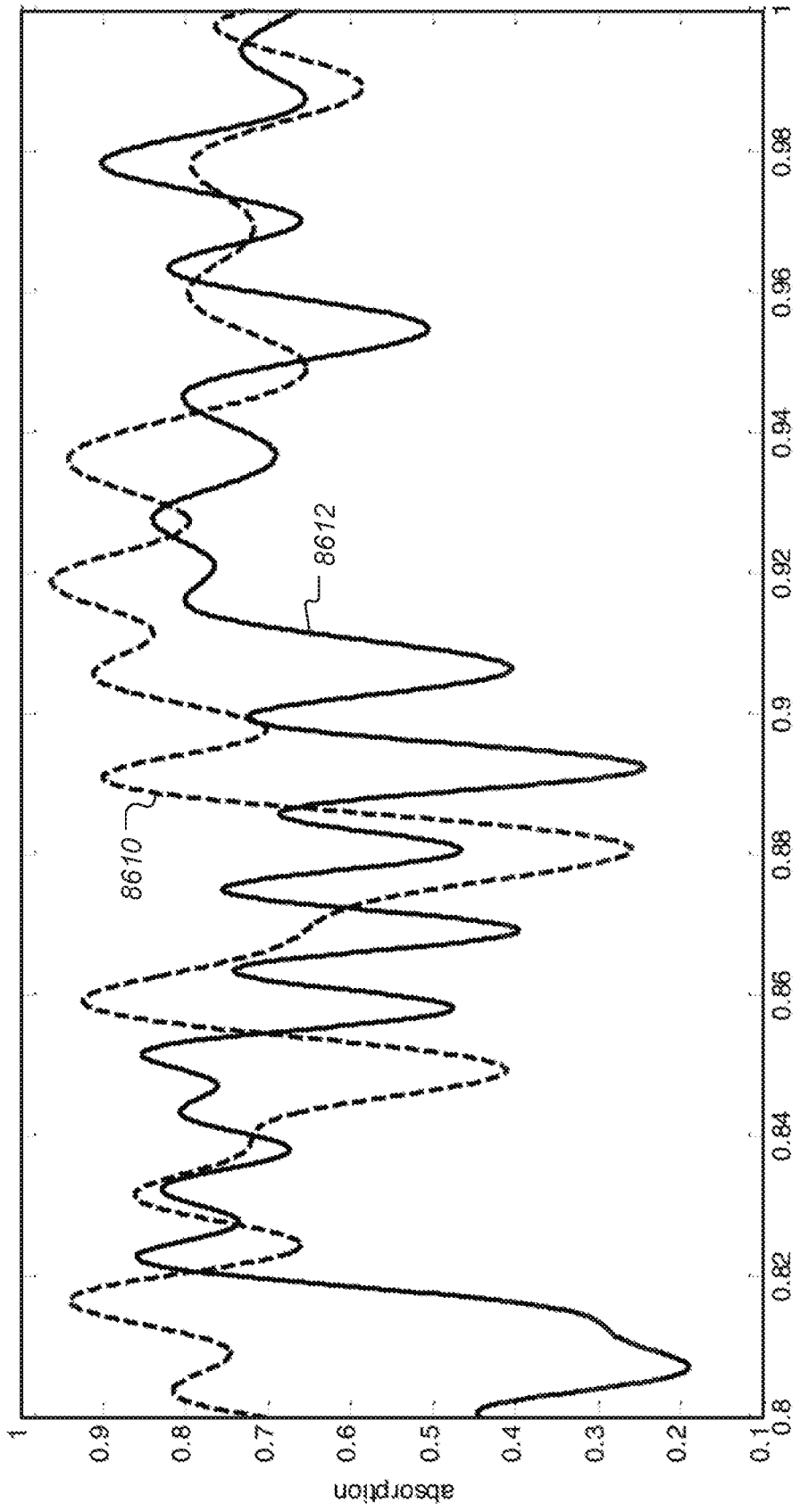

absorption
wavelength, um
8610
8612
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98
1

FIG. 86

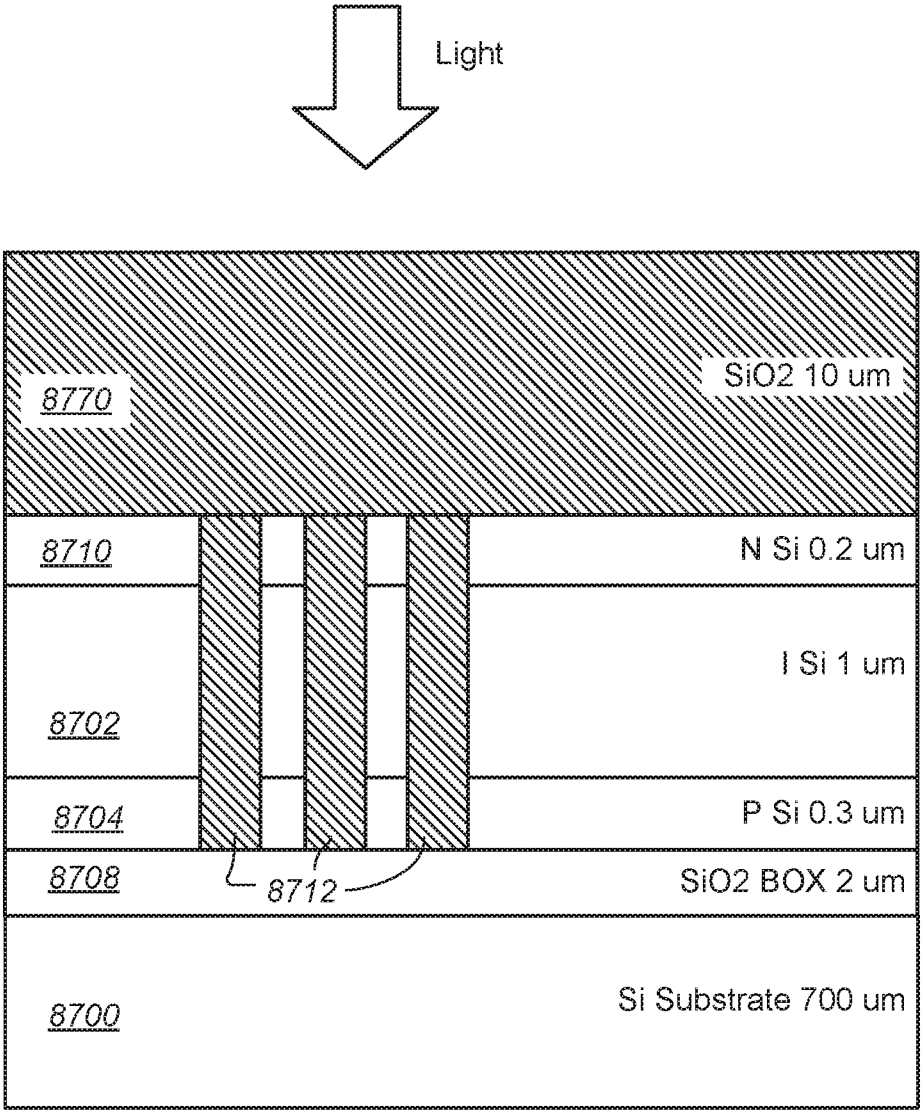

Light
8770
SiO2 10 um
8710
N Si 0.2 um
8702
I Si 1 um
8704
P Si 0.3 um
8708
8712
SiO2 BOX 2 um
8700
Si Substrate 700 um

FIG. 87

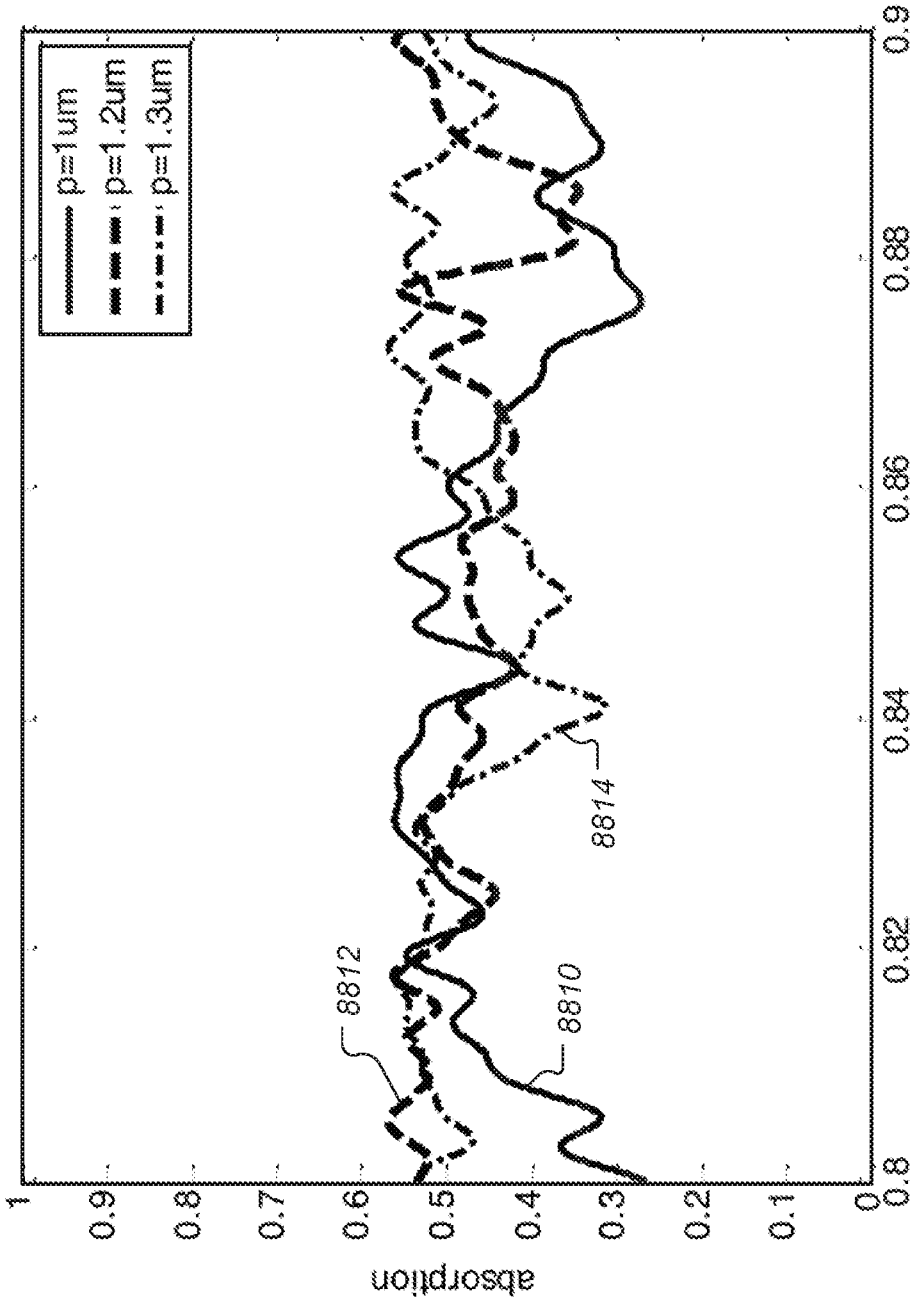

p=1um
p=1.2um
p=1.3um
8812
8810
8814
absorption
wavelength, um
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9

FIG. 88

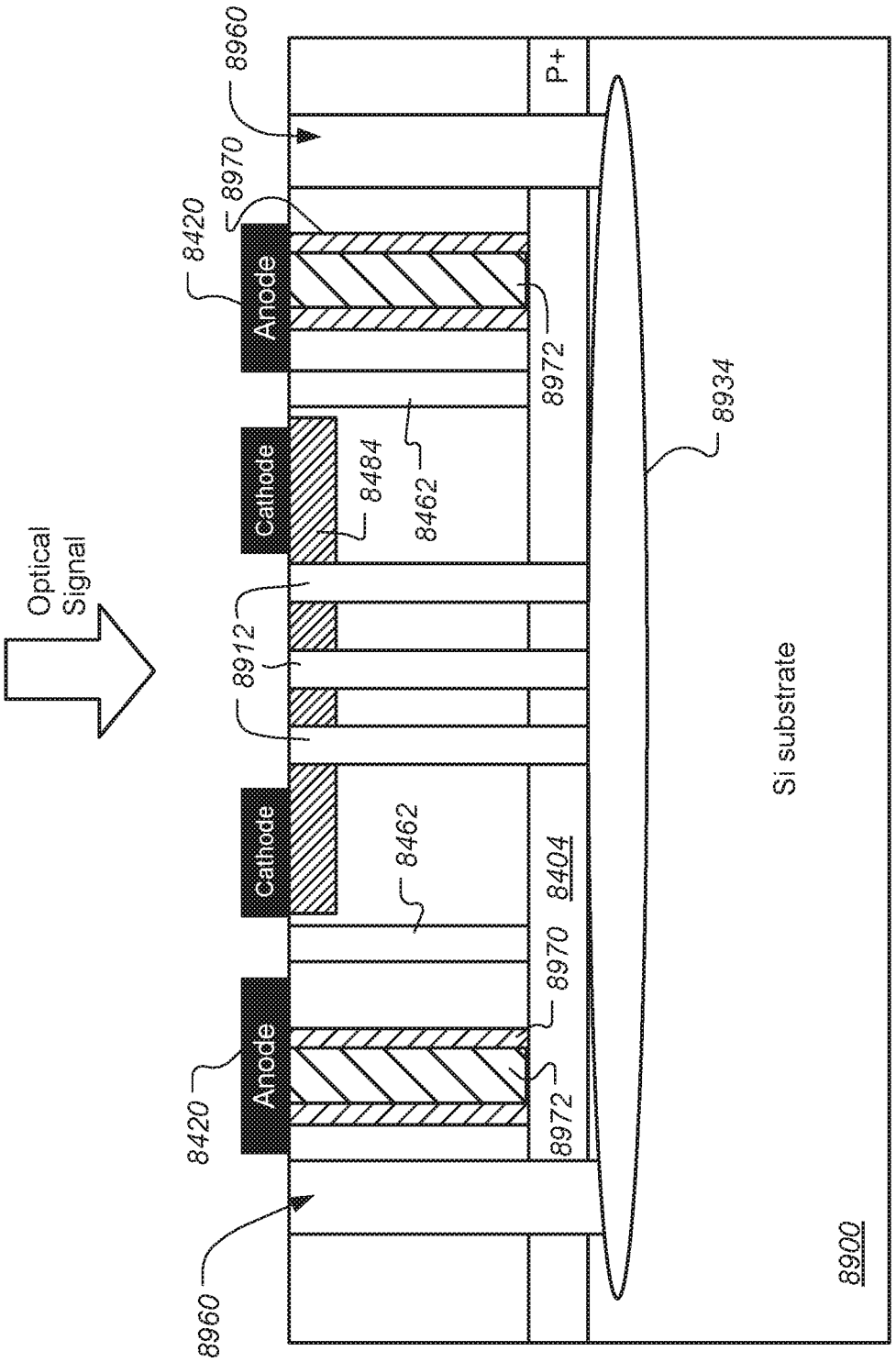

Optical Signal
8960
8970
8420
Anode
Cathode
Cathode
Anode
8420
8960
8912
8484
8462
8462
8404
8970
8972
8972
8934
P+
Si substrate
8900

FIG. 89

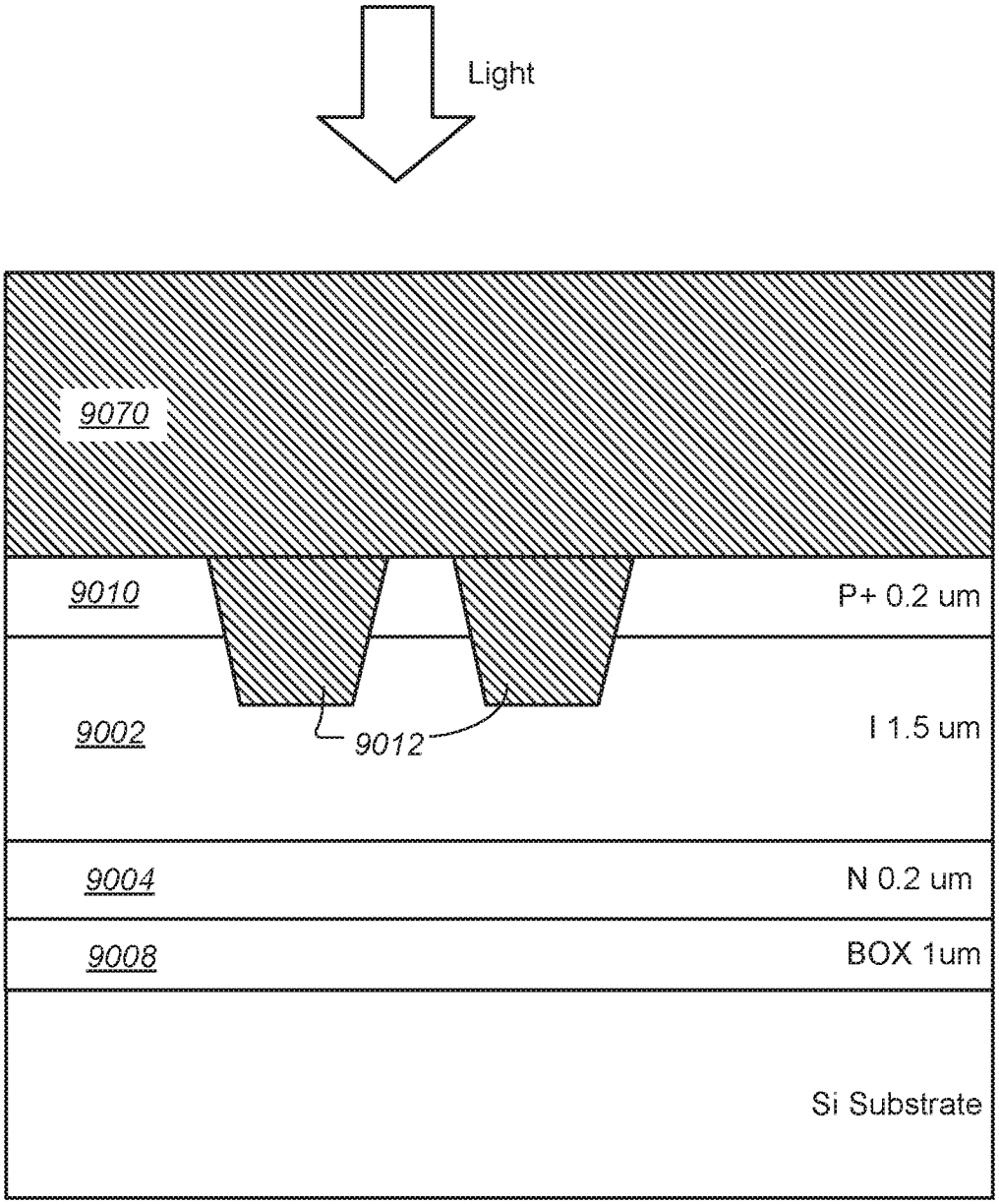

Light
9070
9010
P+ 0.2 um
9002
I 1.5 um
9012
9004
N 0.2 um
9008
BOX 1um
Si Substrate

FIG. 90

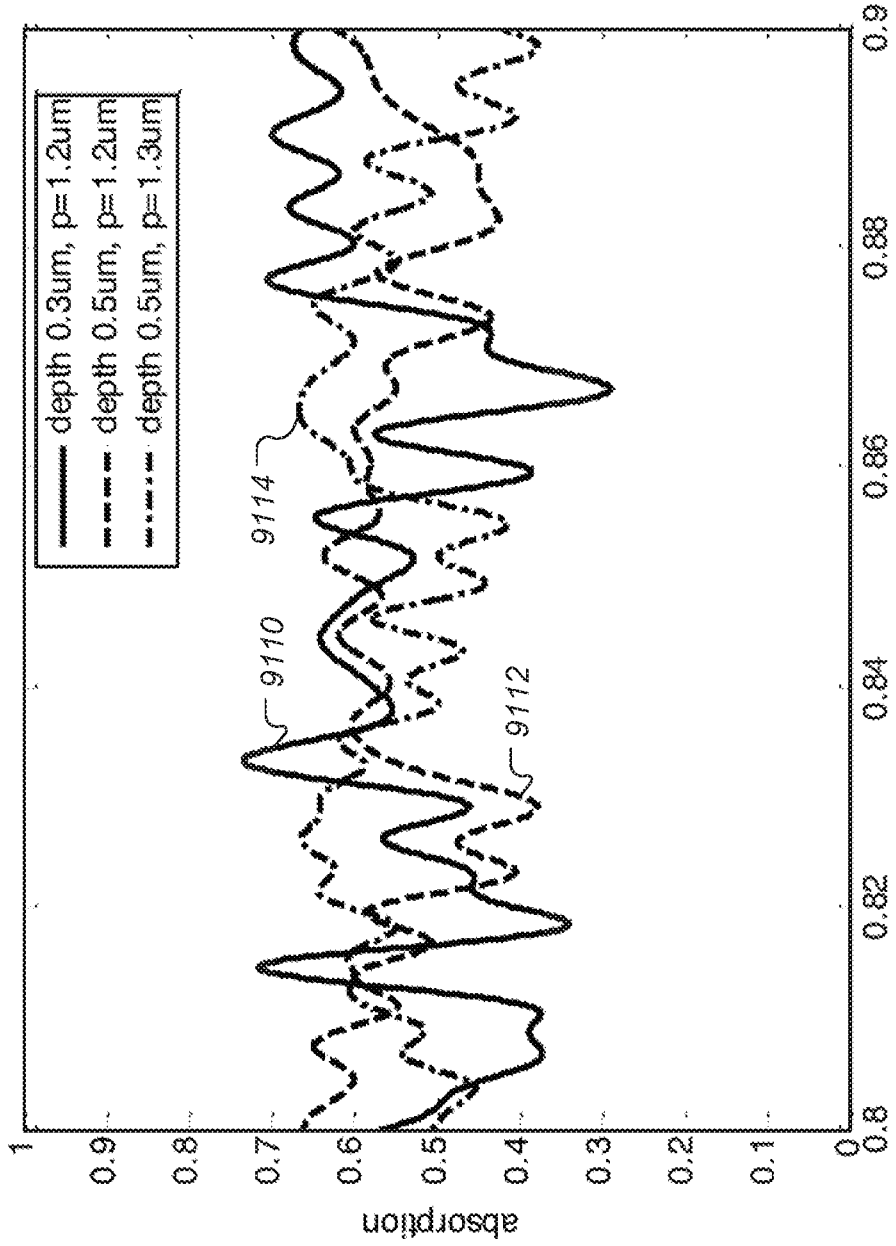

depth 0.3um, p=1.2um
depth 0.5um, p=1.2um
depth 0.5um, p=1.3um
9110
9112
9114
absorption
wavelength, um
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.8
0.82
0.84
0.86
0.88
0.9

FIG. 91

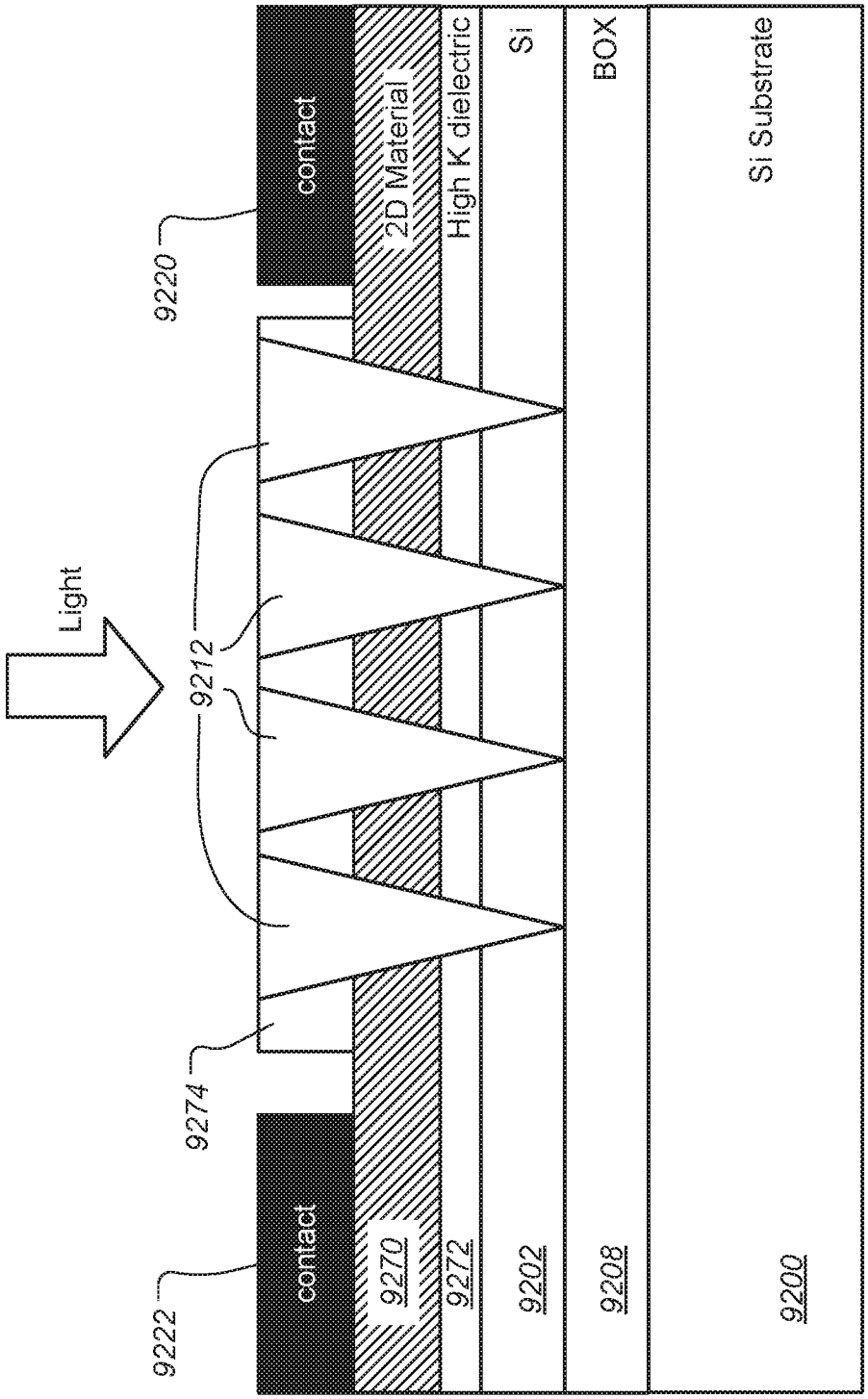

Light
9212
9220
9222
9274
contact
contact
2D Material
High K dielectric
Si
BOX
Si Substrate
9270
9272
9202
9208
9200

FIG. 92

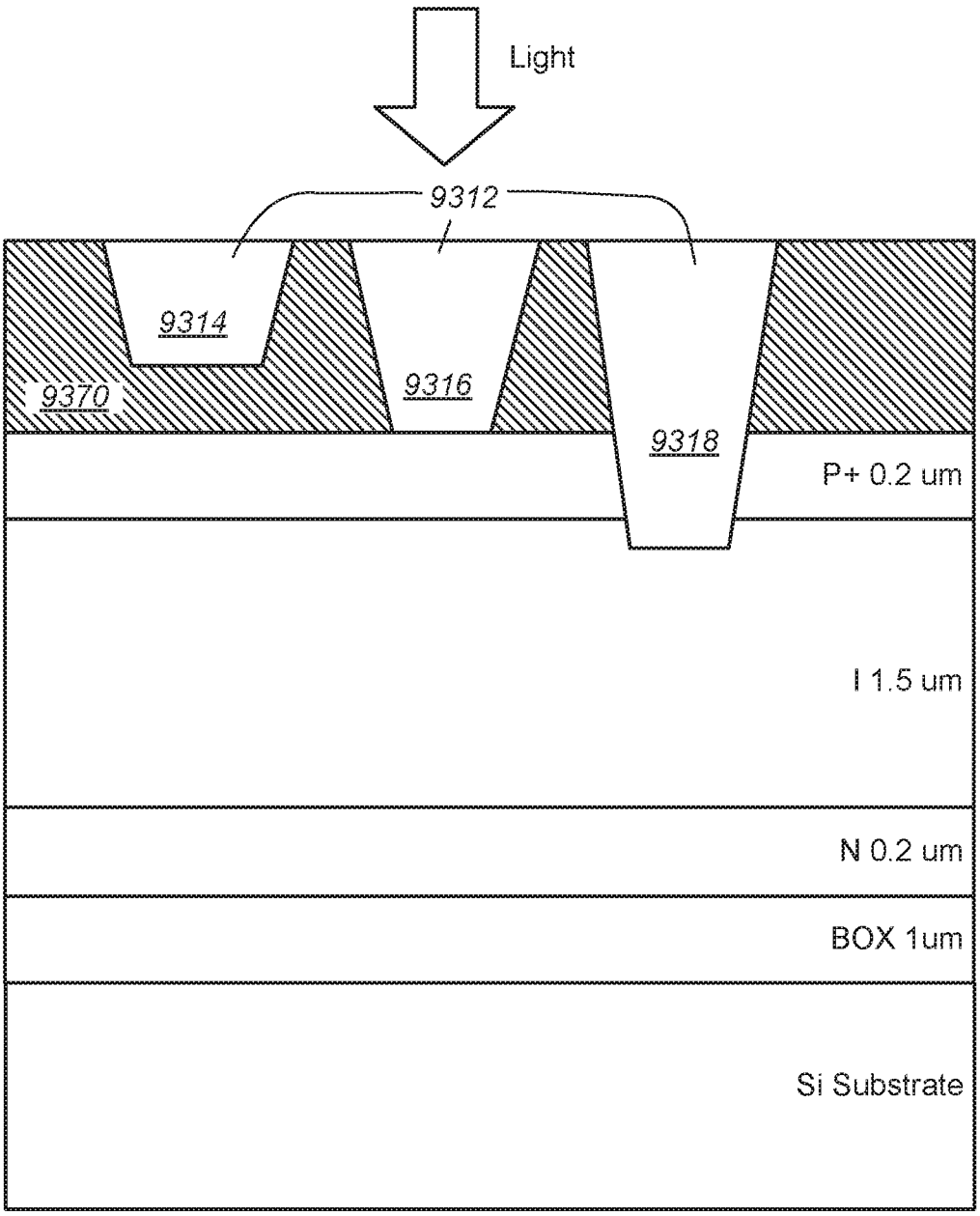

Light
9312
9314
9316
9318
9370
P+ 0.2 um
I 1.5 um
N 0.2 um
BOX 1um
Si Substrate

FIG. 93

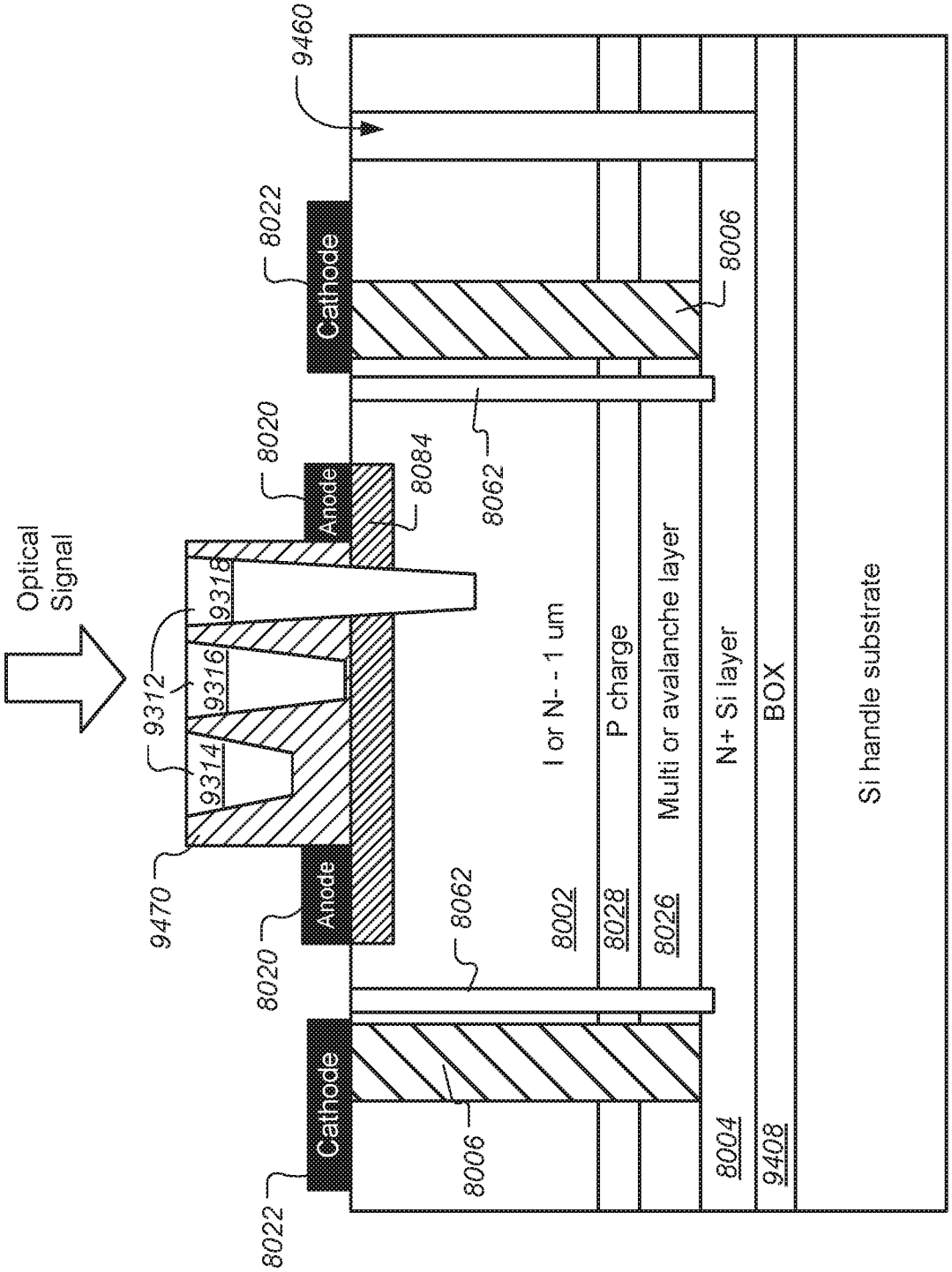

9460
8022
Cathode
8006
8020
Anode
8084
8062
Optical Signal
9318
9312
9316
9314
9470
I or N- - 1 um
P charge
Multi or avalanche layer
N+ Si layer
BOX
Si handle substrate
8002
8028
8026
8004
9408
8062
8020
Anode
8006
Cathode
8022

FIG. 94

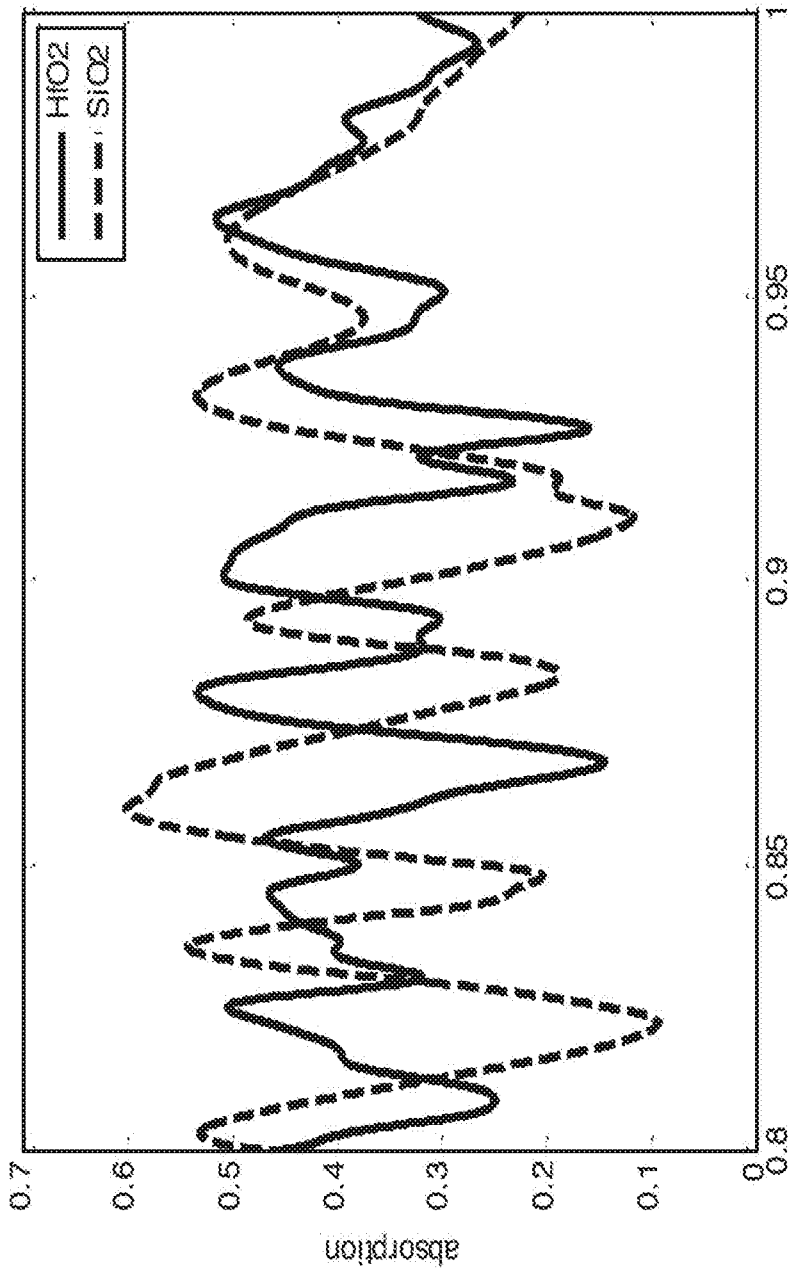

HfO2
SiO2
absorption
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.85
0.9
0.95
1
wavelength, um

FIG. 95A

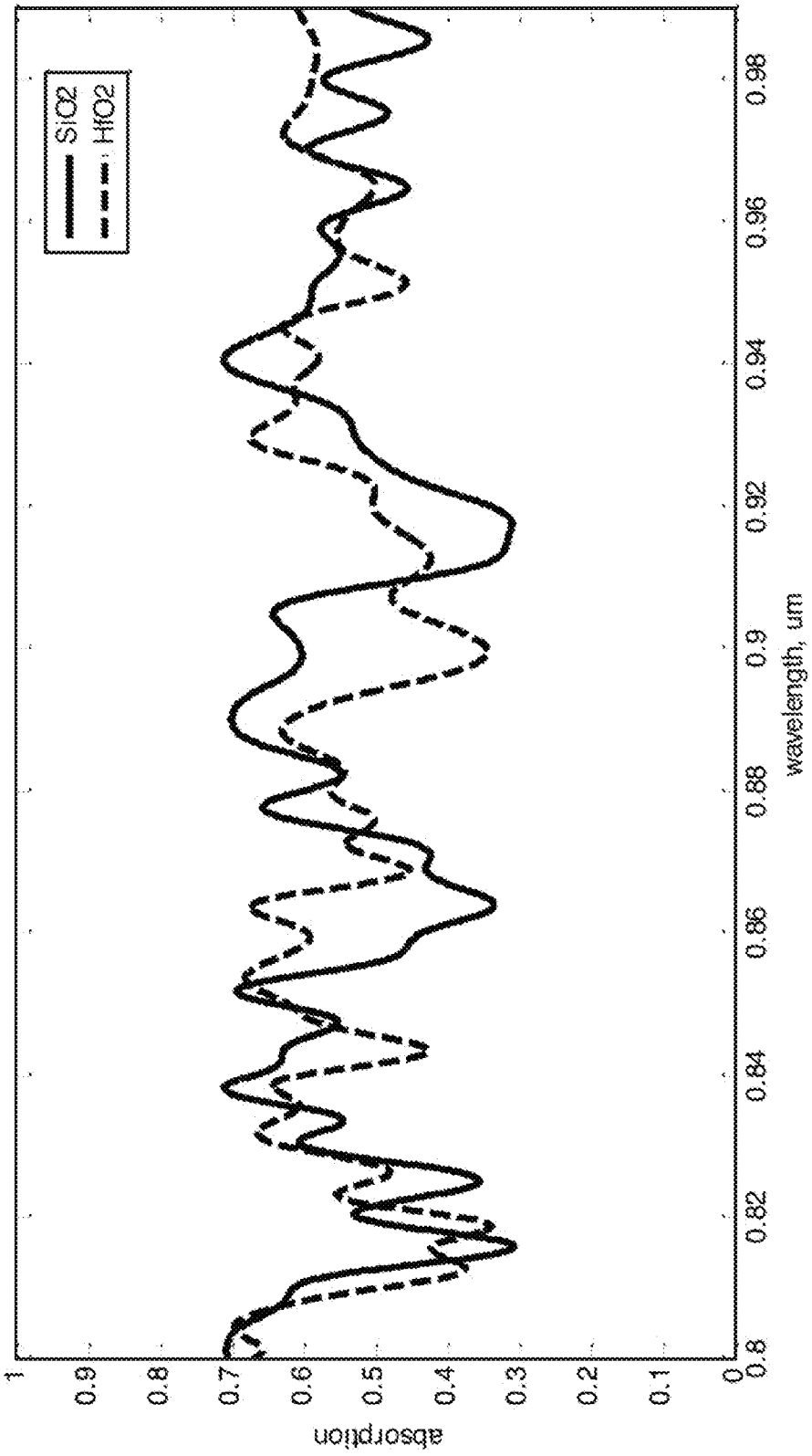

SiO2
HfO2
absorption
wavelength, um
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98

FIG. 95B

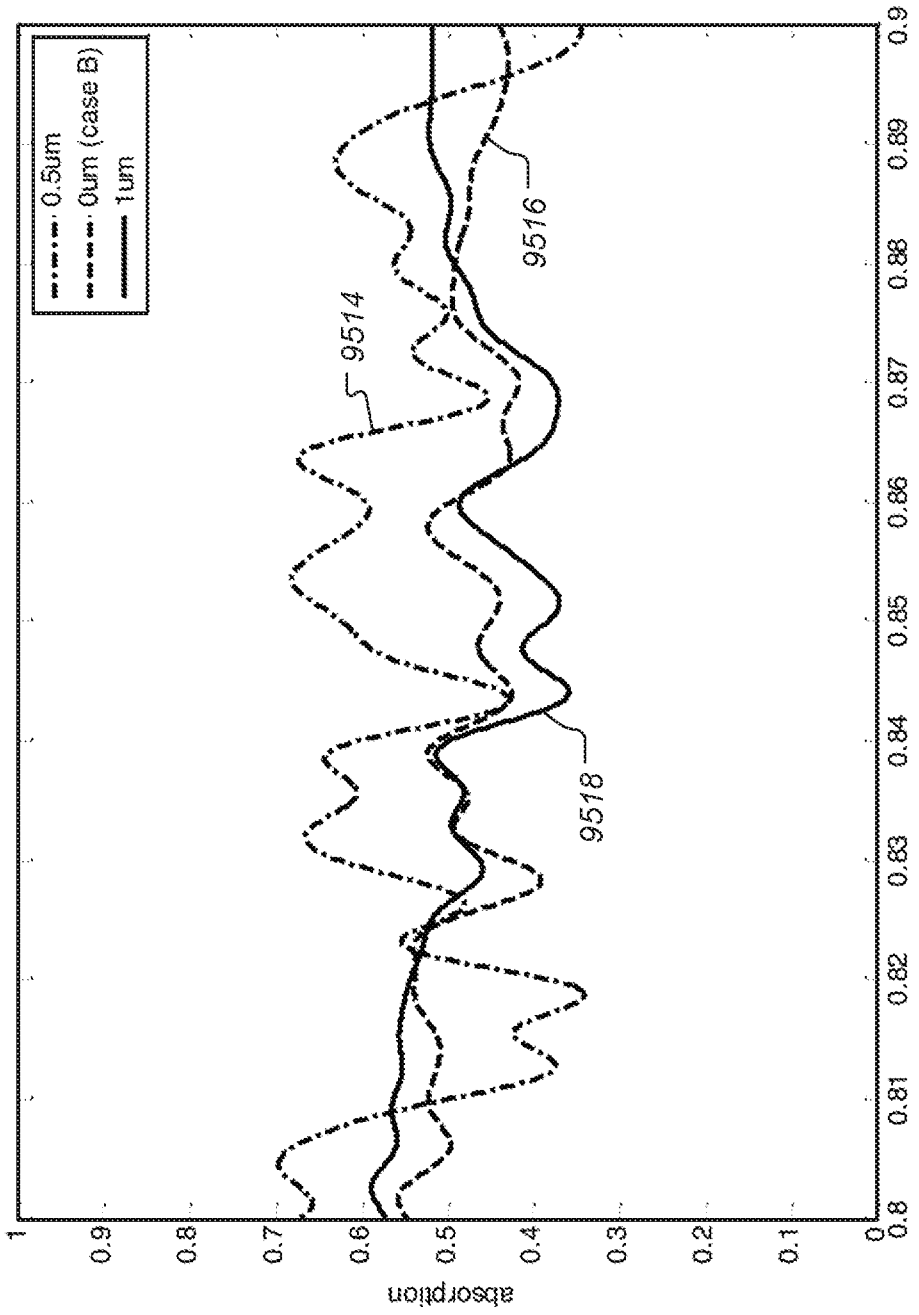

0.5um
0um (case B)
1um
9514
9516
9518
absorption
wavelength, um
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.81
0.82
0.83
0.84
0.85
0.86
0.87
0.88
0.89
0.9

FIG. 95C

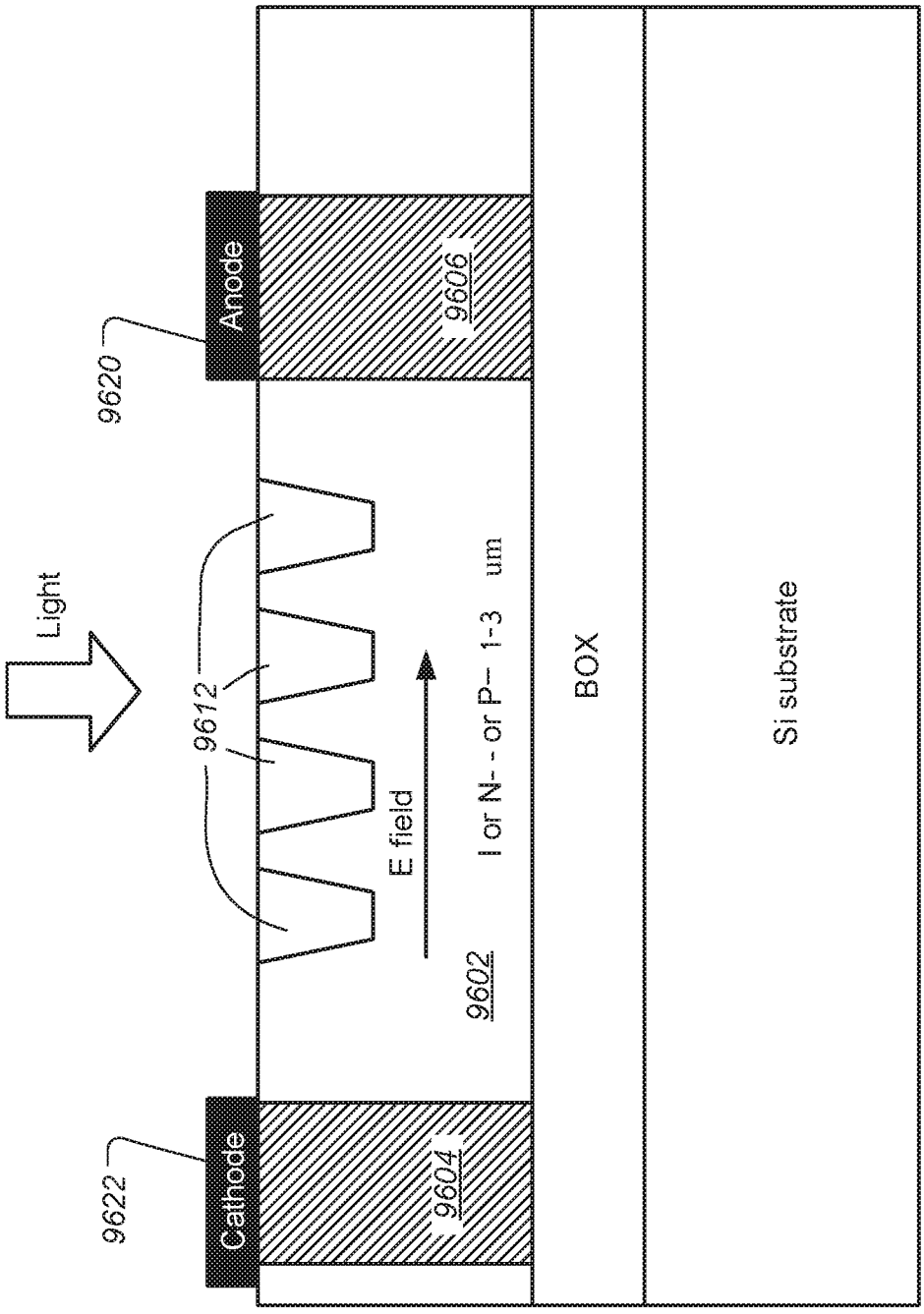

Light
9620
Anode
9606
9612
E field
9602
I or N- - or P- 1-3 um
BOX
Si substrate
9622
Cathode
9604

FIG. 96

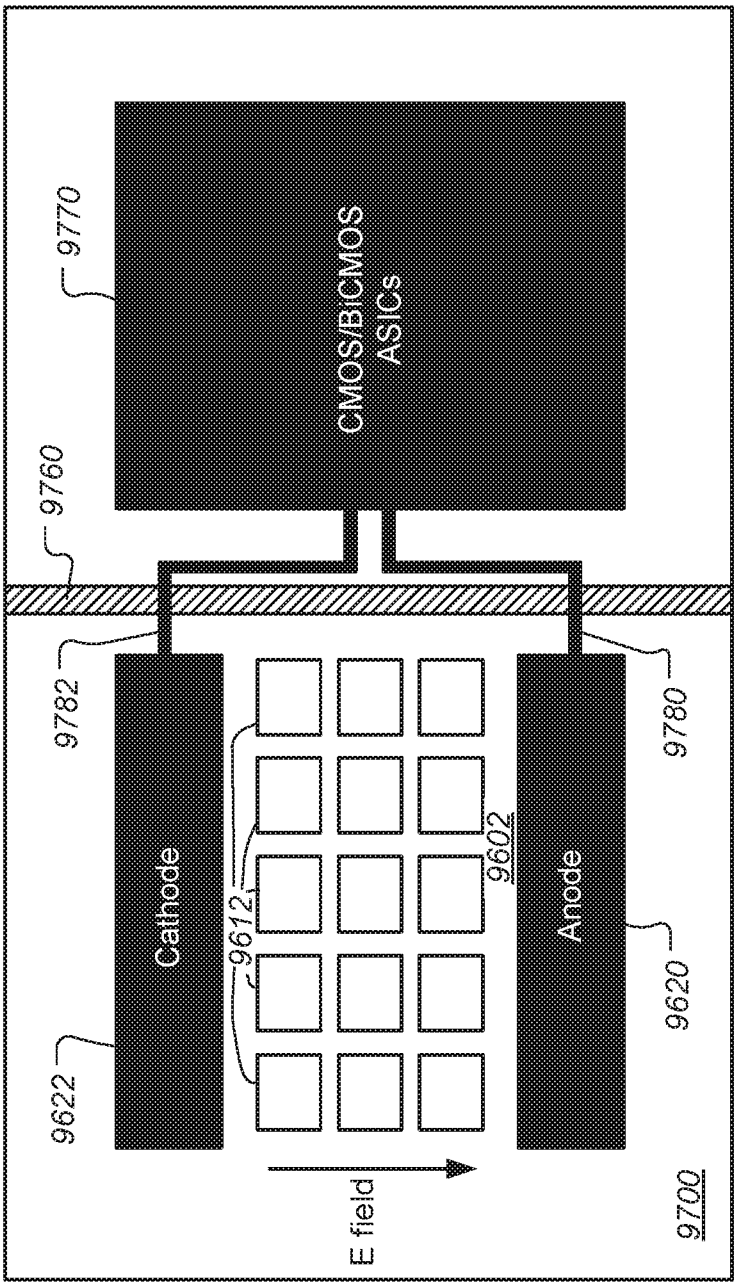

9770
CMOS/BiCMOS
ASICs
9760
9782
9780
Cathode
9602
9612
Anode
9620
9622
E field
9700

FIG. 97

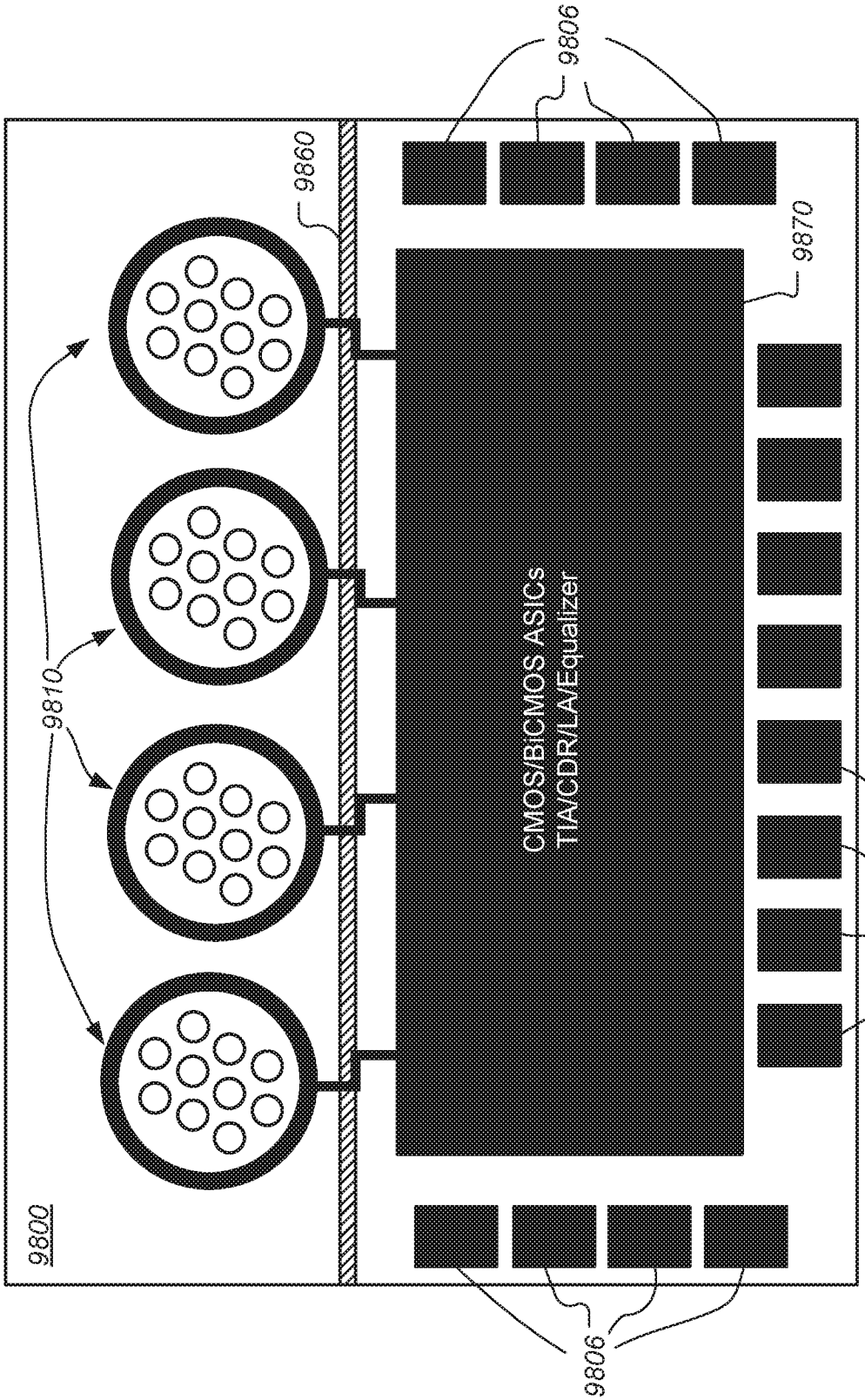

9806
9860
9870
9810
CMOS/BiCMOS ASICs
TIA/CDR/LA/Equalizer
9800
9806
9806

FIG. 98

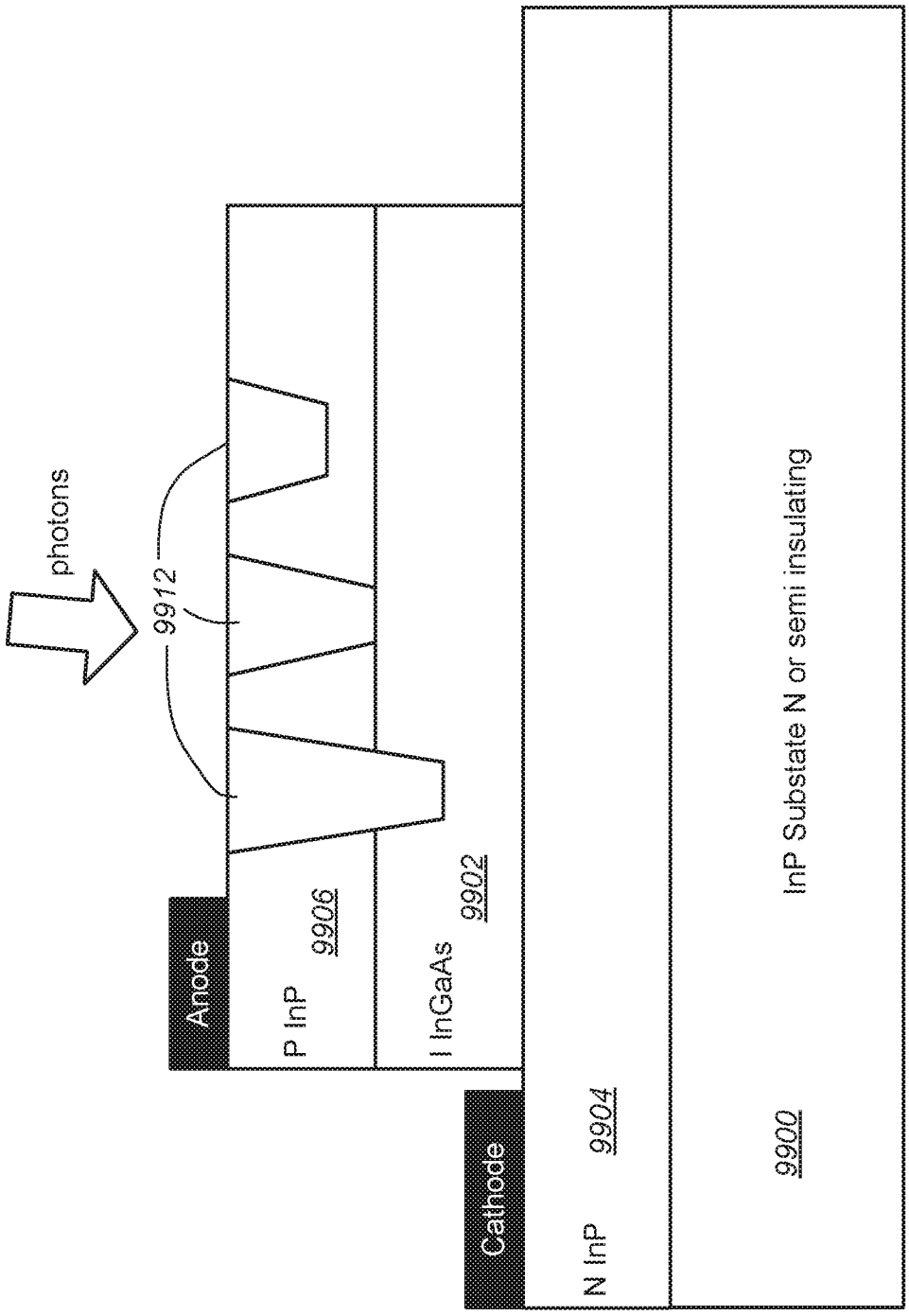

photons
9912
Anode
P InP
9906
I InGaAs
9902
Cathode
N InP
9904
InP Substate N or semi insulating
9900

FIG. 99A

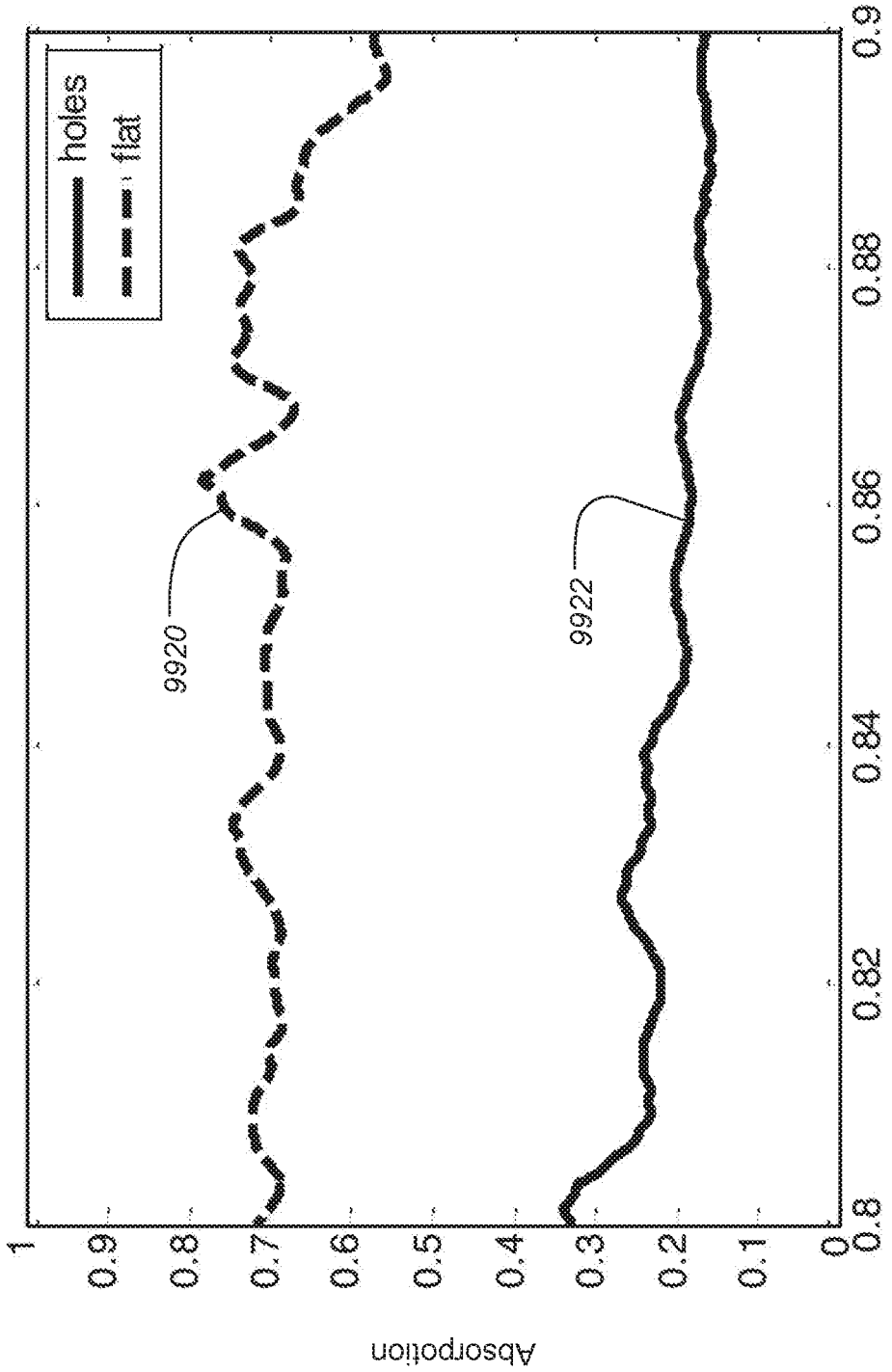

holes
flat
9920
9922
Absorption
wavelength, um
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0.8
0.82
0.84
0.86
0.88
0.9

FIG. 99B

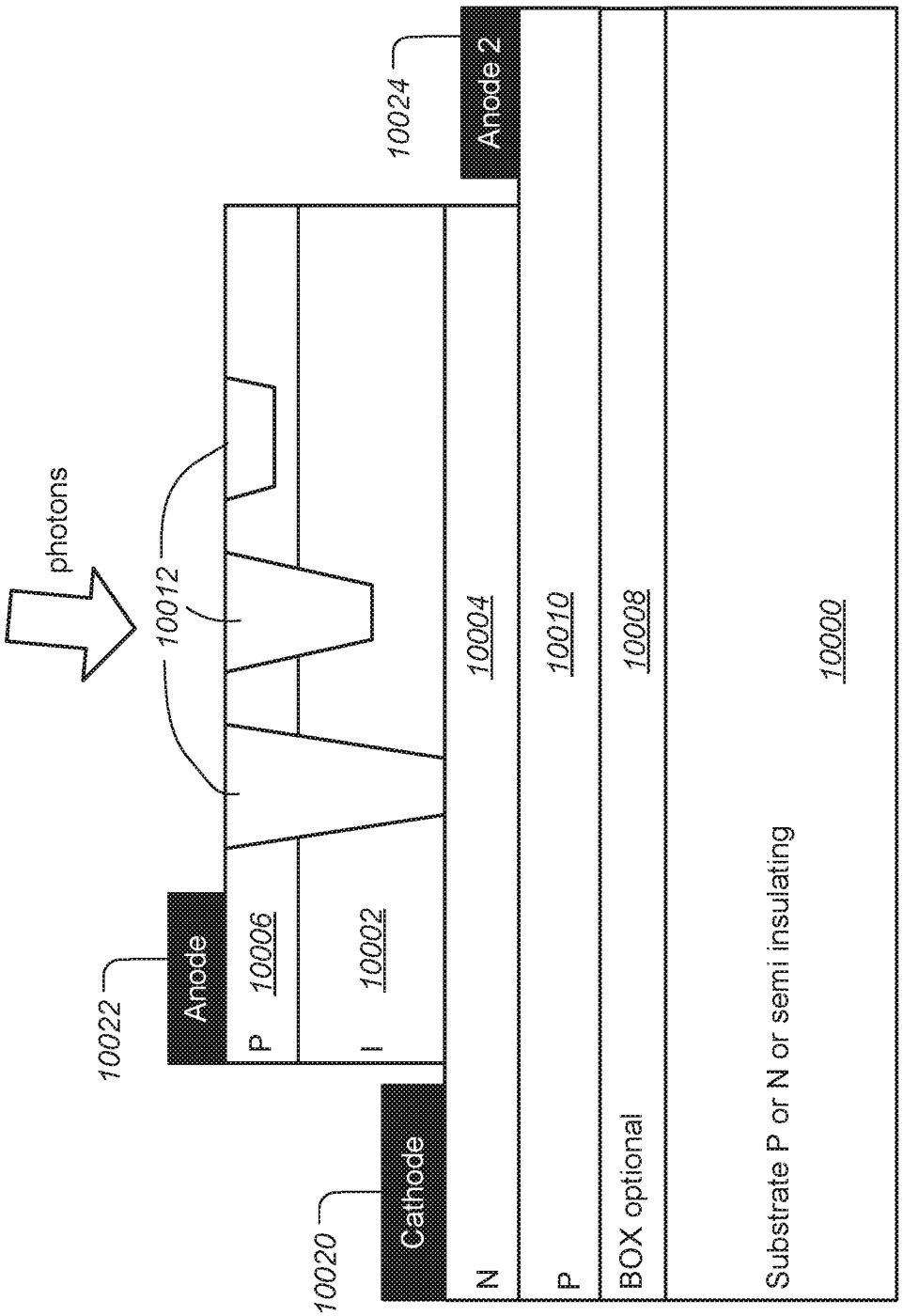

photons
10012
10022
Anode
P 10006
I 10002
10020
Cathode
N 10004
P 10010
BOX optional 10008
Substrate P or N or semi insulating 10000
10024
Anode 2

FIG. 100

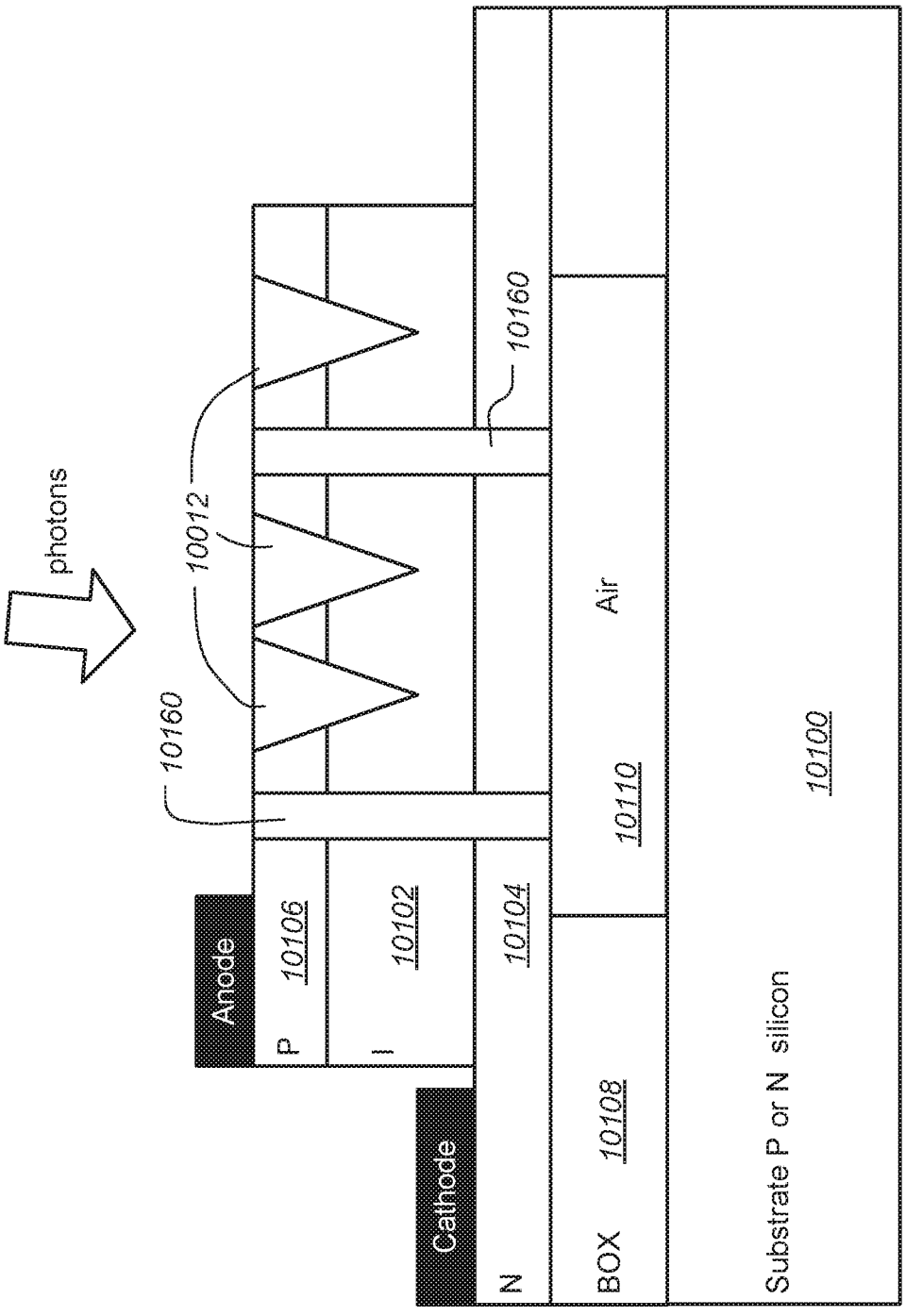

photons
10012
10160
10160
Anode
P
10106
I
10102
N
10104
Cathode
BOX
10108
10110
Air
10100
Substrate P or N silicon

FIG. 101

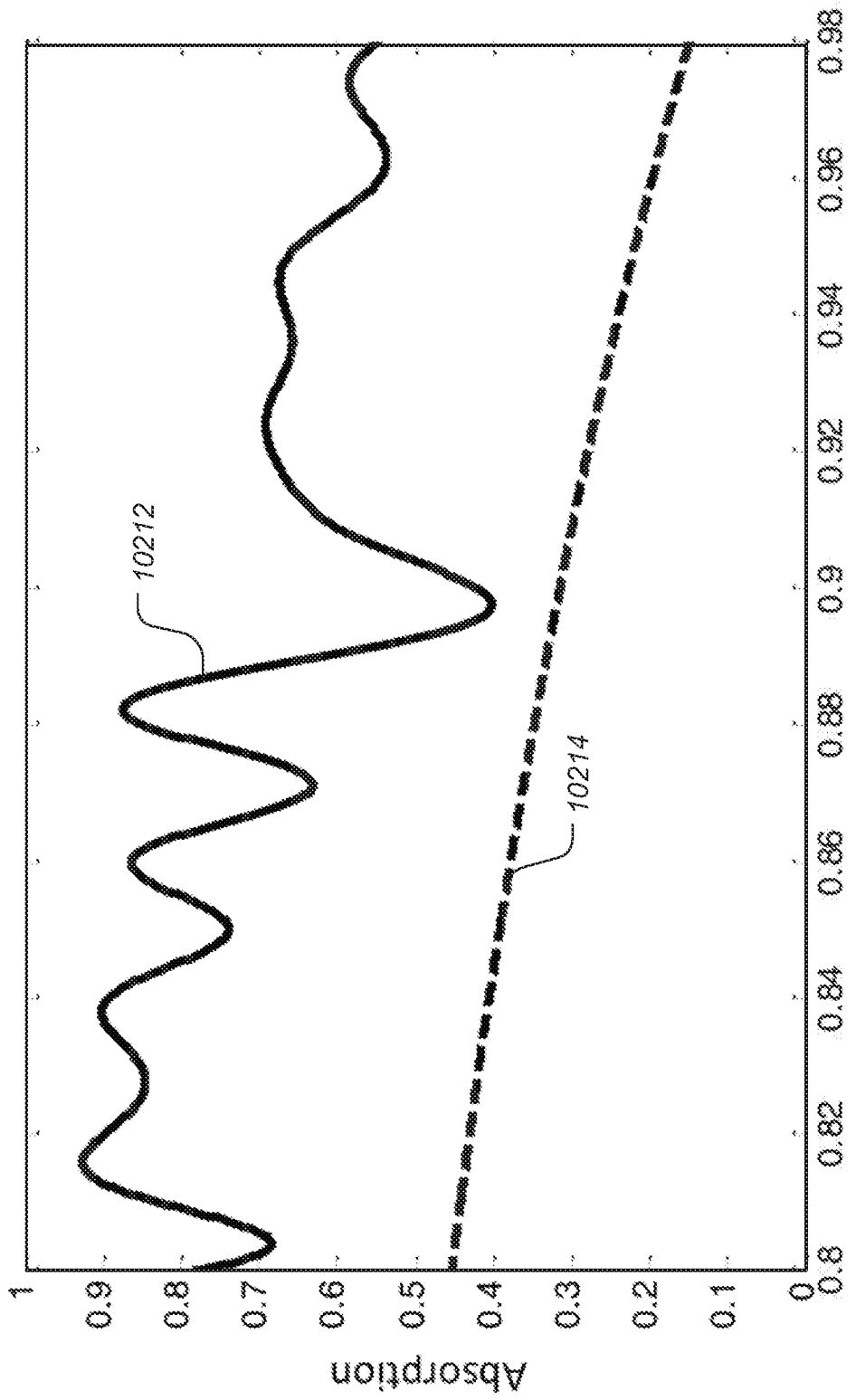

Absorption
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.8
0.82
0.84
0.86
0.88
0.9
0.92
0.94
0.96
0.98
wavelength, um
10212
10214

FIG. 102

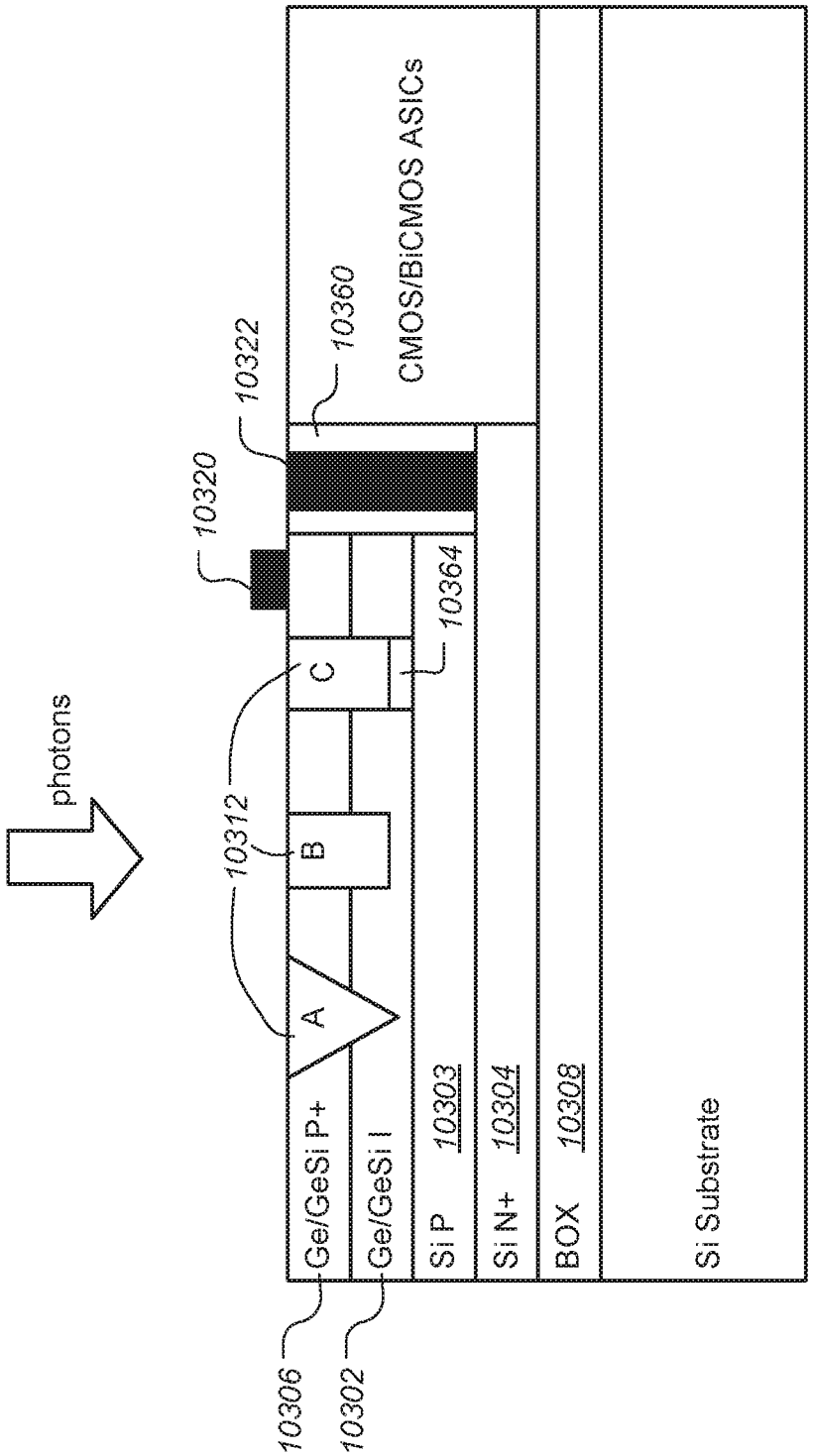

photons
10312
10320
10322
10360
CMOS/BiCMOS ASICs
10364
A
B
C
Ge/GeSi P+
Ge/GeSi I
Si P 10303
Si N+ 10304
BOX 10308
Si Substrate
10306
10302

FIG. 103

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TERMINAL DISCLAIMER TO OBVIATE A PROVISIONAL DOUBLE PATENTING REJECTION OVER A PENDING "REFERENCE" APPLICATION	Docket Number (Optional) 5176/88184-CIP-A

In re Application of: Shih-Yuan WANG et al.

Application No.: Not yet known

Filed: Concurrently herewith

For: MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

The applicant, W&WSens, Devices Inc., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of any patent granted on pending **reference** Application Number 16/042,535, filed, July 23, 2018, as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and any patent granted on the **reference** application are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of any patent granted on the instant application that would extend to the expiration date of the full statutory term of any patent granted on said **reference** application, "as the term of any patent granted on said **reference** application may be shortened by any terminal disclaimer filed prior to the grant of any patent on the pending **reference** application," in the event that: any such patent granted on the pending **reference** application expires for failure to pay a maintenance fee, is held unenforceable, is found invalid by a court of competent jurisdiction, is statutorily disclaimed in whole or terminally disclaimed under 37 CFR 1.321, has all claims canceled by a reexamination certificate, is reissued, or is in any manner terminated prior to the expiration of its full statutory term as shortened by any terminal disclaimer filed prior to its grant.

Check either box 1 or 2 below, if appropriate.

1. ☐ The undersigned is the applicant. If the applicant is an assignee, the undersigned is authorized to act on behalf of the assignee.

I hereby acknowledge that any willful false statements made are punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

2. ☑ The undersigned is an attorney or agent of record. Reg. No. 25,161

/Ivan Kavrukov/	March 8, 2019
Signature	Date
Ivan Kavrukov	
Typed or printed name	
attorney of record	(212) 278-0400
Title	Telephone Number

☑ Terminal disclaimer fee under 37 CFR 1.20(d) is included.

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.

This collection of information is required by 37 CFR 1.321. 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.**

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

As the below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application, or

☒ United States application or PCT international application number 15/797821

filed on October 30, 2017.

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

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

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

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

LEGAL NAME OF INVENTOR

Inventor: M. Saif Islam Date (Optional): _____

Signature: _____

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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.

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76)

Title of Invention	MICROSTRUCTURE ENHANCED ABSORPTION PHOTOSENSITIVE DEVICES

As the below named inventor, I hereby declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☒ United States application or PCT international application number 15/797821 filed on October 30, 2017

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

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

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

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LEGAL NAME OF INVENTOR

Inventor: Shih-Ping WANG Date (Optional) :

Signature:

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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- ☒ United States application or PCT international application number 15/797821 filed on October 30, 2017

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

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LEGAL NAME OF INVENTOR

Inventor: Shih-Yuan WANG Date (Optional) :

Signature: Shih-Yuan Wang

Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form or must have been previously filed. Use an additional PTO/AIA/01 form for each additional inventor.

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