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PTO/SB/21 (09-04)
Approved for use through 07/31/2006. OMB 0851-0031
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TRANSMITTAL FORM (to be used for all correspondence after initial filing)	Application Number	10/708,694	
	Filing Date	03/18/2004	
	First Named Inventor	Wen-Shiang Liao	
	Art Unit	2826	
	Examiner Name	ABRAHAM, FETSUM	
Total Number of Pages in This Submission	6	Attorney Docket Number	NAU0557USA

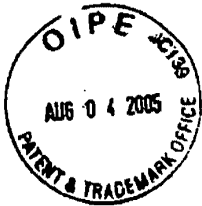
ENCLOSURES (Check all that apply)		
☐ Fee Transmittal Form	☐ Drawing(s)	☐ After Allowance Communication to TC
☐ Fee Attached	☐ Licensing-related Papers	☐ Appeal Communication to Board of Appeals and Interferences
☐ Amendment/Reply	☐ Petition	☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
☐ After Final	☐ Petition to Convert to a Provisional Application	☐ Proprietary Information
☐ Affidavits/declaration(s)	☐ Power of Attorney, Revocation	☐ Status Letter
☐ Extension of Time Request	☐ Change of Correspondence Address	☒ Other Enclosure(s) (please identify below):
☐ Express Abandonment Request	☐ Terminal Disclaimer	1. A copy of the deposit account statement
☐ Information Disclosure Statement	☒ Request for Refund	2. A copy of the application data and transaction history
☐ Certified Copy of Priority Document(s)	☐ CD, Number of CD(s) _____	
☐ Reply to Missing Parts/Incomplete Application	☐ Landscape Table on CD	
☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53		
Remarks Request for a refund of publication fee		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT	
Firm Name	North America Intellectual Property Corp.
Signature	<i>Winston Hsu</i>
Printed name	Winston Hsu
Date	AUG 03 2005
Reg. No.	41,526

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

5 Applicant: Wen-Shiang Liao

App. No.: 10/708,694

Filing Date: 03/18/2004

Examiner: ABRAHAM, FETSUM

Art Unit: 2826

Docket No.: NAUP0557USA

10 Title: TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

To: Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

15

Subject: Request for a refund of publication fee

Dear Sir,

20 The issue fee and publication fee of the above-identified application were paid on 03/28/2005. And the publication fee \$300 was deducted from the deposit account no. 50-3105 on 03/30/2005 (Attachment 1). But the above-identified application was issued as a patent on 05/03/2005 without
25 publication process (Attachment 2).

The applicant hereby requests to refund the publication fee (\$300) to the Deposit Account No. 50-3105 pursuant to 37 CFR 1.211(e) and MPEP 1126. Your quick response will be greatly
30 appreciated.

Sincerely yours,

Winston Hsu

Date: AUG 03 2005

5 Winston Hsu, Patent Agent No. 41,526
P.O. BOX 506, Merrifield, VA 22116, U.S.A.
Voice Mail: 302-729-1562
Facsimile: 806-498-6673
e-mail : winstonhsu@naipo.com

10

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time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)

15

Deposit Account Statement

第 11 頁, 共 12 頁

03/30 76	10610524	NTCP0003USA	1504	\$300.00	\$42,825.00
03/30 77	10707861	REAP0022USA	1501	\$1,400.00	\$41,425.00
03/30 78	10707861	REAP0022USA	1504	\$300.00	\$41,125.00
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03/30 80	10604855	ADTP0091USA	1504	\$300.00	\$39,425.00
03/30 81	10097066	GIGP0002USA	1501	\$1,400.00	\$38,025.00
03/30 82	10097066	GIGP0002USA	1504	\$300.00	\$37,725.00
03/30 83	10708694	NAUP0557USA	1501	\$1,400.00	\$36,325.00
✓ 03/30 84	10708694	NAUP0557USA	1504	\$300.00	\$36,025.00
03/30 85	10249750	VIAP0055USA	1501	\$1,400.00	\$34,625.00
03/30 86	10249750	VIAP0055USA	1504	\$300.00	\$34,325.00
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03/30 88	10604405	EMEP0004USA	1504	\$300.00	\$33,325.00
03/30 89	10610529	EMEP0052USA	2501	\$700.00	\$32,625.00
03/30 90	10610529	EMEP0052USA	1504	\$300.00	\$32,325.00
03/30 91	10708108	NAUP0553USA	1501	\$1,400.00	\$30,925.00
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03/31 8	10604244	LKSP0017USA	1801	\$790.00	\$27,695.00
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03/31 208	10907404	NAUP0672USA	1011	\$300.00	\$23,120.00
03/31 209	10907404	NAUP0672USA	8021	\$40.00	\$23,080.00
03/31 210	10907404	NAUP0672USA	1311	\$200.00	\$22,880.00
03/31 211	10907404	NAUP0672USA	1111	\$500.00	\$22,380.00

Attachment 1.



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PATENT APPLICATION INFORMATION RETRIEVAL



Search results as of: 7-29-2005::4:4:1 E.T.

Search results for application number: 10/708,694			
Application Number:	10/708,694	Customer Number:	27765
Filing or 371(c) Date:	03-18-2004	Status:	Patented Case
Application Type:	Utility	Status Date:	04-13-2005
Examiner Name:	ABRAHAM, FETSUM	Location:	ELECTRONIC
Group Art Unit:	2826	Location Date:	-
Confirmation Number:	2693	Earliest Publication No:	-
Attorney Docket Number:	NAUP0557USA	Earliest Publication Date:	-
Class/ Sub-Class:	257/192	Patent Number:	6,888,181
First Named Inventor:	Wen-Shiang Liao, Miao- Li Hsien, (TW)	Issue Date of Patent:	05-03-2005
Title Of Invention:	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL		

Search Options

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Display References
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Maintenance Statement - View 12 year payment window
Patent Term Adjustment History
Published Documents

Maintenance Fees Available: Mon-Fri 5:30 AM to Midnight, Sat-Sun-Hol. 7:30 AM to 8:00 PM E.T.

File History	
Date	Contents Description
05-03-2005	Recordation of Patent Grant Mailed
04-13-2005	Issue Notification Mailed
05-03-2005	Patent Issue Date Used in PTA Calculation
04-05-2005	Receipt Into Pubs
04-04-2005	Dispatch to FDC
04-04-2005	Application Is Considered Ready for Issue
03-28-2005	Issue Fee Payment Verified
03-31-2005	Receipt Into Pubs
03-28-2005	Issue Fee Payment Received
02-01-2005	Workflow - File Sent to Contractor
01-13-2005	Mail Notice of Allowance
01-10-2005	Issue Revision Completed

01-10-2005	Case Docketed to Examiner in GAU
01-10-2005	Notice of Allowability
12-10-2004	Date Forwarded to Examiner
12-02-2004	Response after Non-Final Action
09-07-2004	Mail Non-Final Rejection
09-07-2004	Non-Final Rejection
07-22-2004	Case Docketed to Examiner in GAU
06-17-2004	IFW TSS Processing by Tech Center Complete
06-17-2004	Case Docketed to Examiner in GAU
03-18-2004	Electronic Information Disclosure Statement
05-20-2004	Application Return from OIPE
05-20-2004	Application Return TO OIPE
05-20-2004	Application Dispatched from OIPE
05-20-2004	Application Is Now Complete
04-15-2004	Cleared by OIPE CSR
03-22-2004	IFW Scan & PACR Auto Security Review
03-18-2004	Initial Exam Team nn

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T-086 P03/03 U-121

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Complete and send this form, together with applicable fee(s), to: Mail

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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance order 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.

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03/30/2005 LHNDIH2 00000038 503105 10708694

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02 FC:1504 300.00 DA

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Zoe Huang

(Depositor's name)

Zoe Huang

(Signature)

2005/3/28

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,694	03/18/2004	Wen-Shiang Liao	NAUP0557USA	2693

TITLE OF INVENTION: TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	04/13/2005
EXAMINER	ART UNIT	CLASS-SUBCLASS			
ABRAHAM, FETSUM	2826	257-192000			

Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

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

1 Winston Hsu

2

3

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

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UNITED MICROELECTRONICS CORP.

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

No.3, Li-Hsin Road 2, Science-Based Industrial Park, Hsin-Chu City,
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☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

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Change in Entity Status (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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Authorized Signature

Winston Hsu

Date 03/28/2005

Typed or printed name Winston Hsu

Registration No. 41.526

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Intellectual Property corporation**

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e-mail: winstonhsu@naipo.com

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Fax: (703) 746-4000

FROM: Winston Hsu, PATENT AGENT, REG. NO.: 41,526

SERIAL NO.: 10/708,694

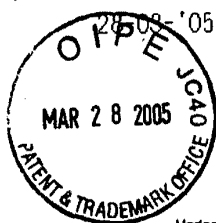
ATTORNEY DOCKET NO.: NAUP0557USA

SUBJECT: ISSUE FEE PAYMENT

TOTAL PAGES: 3 PAGES (INCLUDING COVER PAGE)

Winston Hsu 2005/03/28

NAUP0557USA0_E2



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T-086 P02/03 U-121

PTO/SB/21 (09-04)

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TRANSMITTAL FORM (to be used for all correspondence after initial filing)	Application Number	10/708,694	
	Filing Date	03/18/2004	
	First Named Inventor	Wen-Shiang Liao	
	Art Unit	2826	
	Examiner Name	ABRAHAM, FETSUM	
Total Number of Pages in This Submission	2	Attorney Docket Number	NAUP0557USA

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☐ Amendment/Reply ☐ After Final	☐ Licensing-related Papers	☐ Appeal Communication to Board of Appeals and Interferences
☐ Affidavits/declaration(s)	☐ Petition	☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
☐ Extension of Time Request	☐ Petition to Convert to a Provisional Application	☐ Proprietary Information
☐ Express Abandonment Request	☐ Power of Attorney, Revocation	☐ Status Letter
☐ Information Disclosure Statement	☐ Change of Correspondence Address	☐ Other Enclosure(s) (please identify below):
☐ Certified Copy of Priority Document(s)	☐ Terminal Disclaimer	
☐ Reply to Missing Parts/Incomplete Application	☐ Request for Refund	
☐ Reply to Missing Parts under 37 CFR 1.52 or 1.63	☐ CD, Number of CD(s) _____	
	☐ Landscape Table on CD	
Remarks		
SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT		
Firm Name	North America Intellectual Property Corporation	
Signature	<i>Winston Hsu</i>	
Printed name	Winston Hsu	
Date	03/28/2005	Reg. No. 41,526

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NOTICE OF ALLOWANCE AND FEE(S) DUE

027765 7590 01/13/2005
(NAIPC) NORTH AMERICA INTERNATIONAL PATENT
OFFICE
P.O. BOX 506
MERRIFIELD, VA 22116

EXAMINER

ABRAHAM, FETSUM

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 01/13/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,694	03/18/2004	Wen-Shiang Liao	NAUP0557USA	2693

TITLE OF INVENTION: TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	04/13/2005

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

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If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

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If the SMALL ENTITY is shown as NO:

- A. Pay TOTAL FEE(S) DUE shown above, or
- B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. 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.

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

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

**Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
(703) 746-4000**

or Fax

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)

027765 7590 01/13/2005

**(NAIPC) NORTH AMERICA INTERNATIONAL PATENT
OFFICE
P.O. BOX 506
MERRIFIELD, VA 22116**

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

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,694	03/18/2004	Wen-Shiang Liao	NAUP0557USA	2693

TITLE OF INVENTION: TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	04/13/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
ABRAHAM, FETSUM	2826	257-192000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a **Customer Number** is required.

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

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

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

(A) NAME OF ASSIGNEE

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

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

4a. The following fee(s) are enclosed:

- ☐ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

- ☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
 NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,694	03/18/2004	Wen-Shiang Liao	NAUP0557USA	2693
027765	7590	01/13/2005	EXAMINER	
(NAIPC) NORTH AMERICA INTERNATIONAL PATENT OFFICE P.O. BOX 506 MERRIFIELD, VA 22116			ABRAHAM, FETSUM	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 01/13/2005

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

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

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

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

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

Notice of Allowability	Application No.	Applicant(s)	
	10/708,694	LIAO ET AL.	
	Examiner	Art Unit	
	Fetsum Abraham	2826	

-- 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 the amendment received on 12/02/04.
2. ☒ The allowed claim(s) is/are 1-6 and 8-11.
3. ☒ The drawings filed on 18 March 2004 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ 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).
7. ☐ 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) | 5. ☐ Notice of Informal Patent Application (PTO-152) |
| 2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08),
Paper No./Mail Date _____. | 7. ☐ Examiner's Amendment/Comment |
| 4. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. ☐ Examiner's Statement of Reasons for Allowance |
| | 9. ☐ Other _____. |

Notice of References Cited	Application/Control No. 10/708,694	Applicant(s)/Patent Under Reexamination LIAO ET AL.	
	Examiner Fetsum Abraham	Art Unit 2826	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,838,322	01-2005	Pham et al	438
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

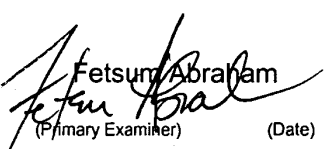
*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

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

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

Issue Classification 	Application No.	Applicant(s)	
	10/708,694	LIAO ET AL.	
	Examiner	Art Unit	
	Fetsum Abraham	2826	

ISSUE CLASSIFICATION									
ORIGINAL					CROSS REFERENCE(S)				
CLASS		SUBCLASS			CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
257		192							
INTERNATIONAL CLASSIFICATION									
H	O	I	L	31/0328					
				/					
				/					
				/					
				/					
(Assistant Examiner) (Date)					 Fetsum Abraham (P Primary Examiner) (Date)				
 (Legal Instruments Examiner) (Date)									
					Total Claims Allowed: 10 O.G. Print Claim(s) O.G. Print Fig. 1. 1				

☐ Claims renumbered in the same order as presented by applicant										☐ CPA										☐ T.D.										☐ R.1.47									
Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original		Final	Original											
1	1			31			61			91			121			151			181																				
2	2			32			62			92			122			152			182																				
3	3			33			63			93			123			153			183																				
4	4			34			64			94			124			154			184																				
5	5			35			65			95			125			155			185																				
6	6			36			66			96			126			156			186																				
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7	8			38			68			98			128			158			188																				
8	9			39			69			99			129			159			189																				
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	26			56			86			116			146			176			206																				
	27			57			87			117			147			177			207																				
	28			58			88			118			148			178			208																				
	29			59			89			119			149			179			209																				
	30			60			90			120			150			180			210																				



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BIBDATASHEET**CONFIRMATION NO. 2693**

Bib Data Sheet

SERIAL NUMBER 10/708,694	FILING DATE 03/18/2004 RULE	CLASS 257	GROUP ART UNIT 2826	ATTORNEY DOCKET NO. NAUP0557USA
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APPLICANTS

Wen-Shiang Liao, Miao- Li Hsien, TAIWAN;
 Wei-Tsun Shiau, Kao-Hsiung Hsien, TAIWAN;

**** CONTINUING DATA *******

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

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
**** 05/20/2004**

Foreign Priority claimed ☐ yes ☒ no	STATE OR COUNTRY TAIWAN	SHEETS DRAWING 6	TOTAL CLAIMS 11	INDEPENDENT CLAIMS 2
35 USC 119 (a-d) conditions met ☐ yes ☒ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature	Initials		

ADDRESS
 027765
 (NAIPC) NORTH AMERICA INTERNATIONAL PATENT OFFICE
 P.O. BOX 506
 MERRIFIELD , VA
 22116

TITLE
 TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

FILING FEE RECEIVED 770	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit
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Search Notes 	Application No. 10/708,694 Examiner Fetsum Abraham	Applicant(s) LIAO ET AL. Art Unit 2826
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SEARCHED			
Class	Subclass	Date	Examiner
257	192	1/5/2004	FA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
WEST	1/5/2005	FA

Refine Search

Search Results -

Terms	Documents
4996574 and epitax\$5	37

Database:

US Pre-Grant Publication Full-Text Database
 US Patents Full-Text Database
 US OCR Full-Text Database
 EPO Abstracts Database
 JPO Abstracts Database
 Derwent World Patents Index
 IBM Technical Disclosure Bulletins

Search:

L15

Search History

DATE: Wednesday, January 05, 2005 [Printable Copy](#) [Create Case](#)

Set Name Query

side by side

Hit Count Set Name

result set

DB=USPT; PLUR=YES; OP=OR

<u>L15</u>	4996574 and epitax\$5	37	<u>L15</u>
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<u>L14</u>	4996574 and fin	7	<u>L14</u>
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<u>L13</u>	4996574 and finL12	0	<u>L13</u>
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<u>L12</u>	L11 and fin	3	<u>L12</u>
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<u>L11</u>	5338959	26	<u>L11</u>
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<u>L10</u>	4996574	63	<u>L10</u>
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DB=DWPI; PLUR=YES; OP=OR

<u>L8</u>	L7	0	<u>L8</u>
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<u>L7</u>	L6	0	<u>L7</u>
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L5 L4

0 L5

DB=PGPB; PLUR=YES; OP=OR

L4 L3

0 L4

DB=USPT; PLUR=YES; OP=OR

L3 11 and epitax\$5

0 L3

L2 "fin" same ("tripple gate" or "tri-gate")

0 L2

L1 6764884

1 L1

END OF SEARCH HISTORY

Refine Search

Search Results -

Terms	Documents
6838322	1

Database:

US Pre-Grant Publication Full-Text Database
 US Patents Full-Text Database
 US OCR Full-Text Database
 EPO Abstracts Database
 JPO Abstracts Database
 Derwent World Patents Index
 IBM Technical Disclosure Bulletins

Search:

L17

Search History

DATE: Wednesday, January 05, 2005 [Printable Copy](#) [Create Case](#)

Set Name Query

side by side

Hit Count Set Name

result set

DB=USPT; PLUR=YES; OP=OR

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<u>L16</u>	finfet	88	<u>L16</u>
<u>L15</u>	4996574 and epitax\$5	37	<u>L15</u>
<u>L14</u>	4996574 and fin	7	<u>L14</u>
<u>L13</u>	4996574 and finL12	0	<u>L13</u>
<u>L12</u>	L11 and fin	3	<u>L12</u>
<u>L11</u>	5338959	26	<u>L11</u>
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DB=JPAB; PLUR=YES; OP=OR

<u>L7</u>	L6	0	<u>L7</u>
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<i>DB=EPAB; PLUR=YES; OP=OR</i>		
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<i>DB=USOC; PLUR=YES; OP=OR</i>		
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<u>L4</u>	L3	0 <u>L4</u>
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<u>L2</u>	"fin" same ("tripple gate" or "tri-gate")	0 <u>L2</u>
<u>L1</u>	6764884	1 <u>L1</u>

END OF SEARCH HISTORY

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number

10708694

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
FOR	NUMBER FILED	NUMBER EXTRA
BASIC FEE (37 CFR 1.16(a))		
TOTAL CLAIMS (37 CFR 1.16(c))	minus 20 =	*
INDEPENDENT CLAIMS (37 CFR 1.16(b))	minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(d))		

SMALL ENTITY

OR

OTHER THAN SMALL ENTITY

RATE	FEE
	\$ _____
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL	

OR

OR

OR

OR

OR

RATE	FEE
	\$ _____
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL	

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

CLAIMS AS AMENDED - PART II

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(c))	10	Minus 20	=
Independent (37 CFR 1.16(b))	2	Minus 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))			

SMALL ENTITY

OR

OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

OR

OR

OR

OR

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(c))		Minus	=
Independent (37 CFR 1.16(b))		Minus	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))			

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

OR

OR

OR

OR

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

	(Column 1)	(Column 2)	(Column 3)
AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA
Total (37 CFR 1.16(c))		Minus	=
Independent (37 CFR 1.16(b))		Minus	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(d))			

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

OR

OR

OR

OR

RATE	ADDITIONAL FEE
X \$ _____ =	
X \$ _____ =	
+ \$ _____ =	
TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

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P.O. BOX 506, Merrifield, VA 22116, U.S.A.

Voice Mail: 302-729-1562

FAX: 806-498-6673

e-mail: winstonhsu@naipo.com

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DEC 02 2004

**FAX TO: ABRAHAM, FETSUM Tel.: (571) 272-1911
ART UNIT: 2826 Fax: (703) 872-9306**

FROM: Winston Hsu, PATENT AGENT, REG. NO.: 41,526

SERIAL NO.: 10/708,694

ATTORNEY DOCKET NO.: NAUP0557USA

SUBJECT: Response to the Office Action dated 09/07/2004

TOTAL PAGES: 9 PAGES (INCLUDING COVER PAGE)

Winston Hsu 2004/12/02

NAUP0557USA0_A2_1

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TRANSMITTAL FORM (to be used for all correspondence after initial filing)	Application Number	10/708,694	
	Filing Date	03/18/2004	
	First Named Inventor	Wen-Shiang Liao	
	Art Unit	2826	
	Examiner Name	ABRAHAM, FETSUM	
Total Number of Pages in This Submission	7	Attorney Docket Number	NAUP0557USA

ENCLOSURES (Check all that apply)		
☒ Fee Transmittal Form ☐ Fee Attached	☐ Drawing(s) ☐ Licensing-related Papers	☐ After Allowance Communication to TC
☒ Amendment/Reply ☐ After Final ☐ Affidavits/declaration(s)	☐ Petition ☐ Petition to Convert to a Provisional Application ☐ Power of Attorney, Revocation ☐ Change of Correspondence Address	☐ Appeal Communication to Board of Appeals and Interferences ☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
☐ Extension of Time Request ☐ Express Abandonment Request ☐ Information Disclosure Statement	☐ Terminal Disclaimer ☐ Request for Refund ☐ CD, Number of CD(s) _____ ☐ Landscape Table on CD	☐ Proprietary Information ☐ Status Letter ☐ Other Enclosure(s) (please identify below):
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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT		
Firm Name	North America Intellectual Property Corporation	
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Printed name	Winston Hsu	
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Effective 10/01/2004. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 0.00

Complete if Known

Application Number 10/708,694
Filing Date 03/18/2004
First Named Inventor Wen-Shiang Liao
Examiner Name ABRAHAM, FETSUM
Art Unit 2828
Attorney Docket No. NAUP0557USA

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1002 350	2002 175	Design filing fee	
1003 550	2003 275	Plant filing fee	
1004 790	2004 395	Reissue filing fee	
1005 180	2005 80	Provisional filing fee	
SUBTOTAL (1)			(\$) 0.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
1202 18	2202 9	Claims in excess of 20	
1201 88	2201 44	Independent claims in excess of 3	
1203 300	2203 150	Multiple dependent claim, if not paid	
1204 88	2204 44	** Reissue independent claims over original patent	
1205 18	2205 9	** Reissue claims in excess of 20 and over original patent	
SUBTOTAL (2)			(\$) 0.00

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code (\$)	Small Entity Fee Code (\$)	Fee Description	Fee Paid
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1052 50	2052 25	Surcharge - late provisional filing fee or cover sheet	
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1812 2,520	2812 1,260	For filing a request for ex parte reexamination	
1804 920*	2804 460*	Requesting publication of SIR prior to Examiner action	
1805 1,840*	2805 920*	Requesting publication of SIR after Examiner action	
1251 110	2251 55	Extension for reply within first month	
1252 430	2252 215	Extension for reply within second month	
1253 980	2253 490	Extension for reply within third month	
1254 1,530	2254 765	Extension for reply within fourth month	
1255 2,080	2255 1,040	Extension for reply within fifth month	
1401 340	2401 170	Notice of Appeal	
1402 340	2402 170	Filing a brief in support of an appeal	
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1501 1,370	2501 685	Utility issue fee (or reissue)	
1502 490	2502 245	Design issue fee	
1503 660	2503 330	Plant issue fee	
1480 130	2480 65	Petitions to the Commissioner	
1807 50	2807 25	Processing fee under 37 CFR 1.17(q)	
1806 180	2806 90	Submission of Information Disclosure Stmt	
8021 40	28021 20	Recording each patent assignment per property (times number of properties)	
1809 790	2809 395	Filing a submission after final rejection (37 CFR 1.129(a))	
1810 790	2810 395	For each additional invention to be examined (37 CFR 1.129(b))	
1801 790	2801 395	Request for Continued Examination (RCE)	
1802 900	2802 450	Request for expedited examination of a design application	

Other fee (specify)

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) (\$)

SUBMITTED BY

Name (Print/Type) Winston Hsu Registration No. 41,528 Telephone 302-729-1562
Signature [Signature] Date DEC - 2 2004

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TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

Appl. No.	:	10/708,694	Confirmation No.	2693
Applicant	:	Wen-Shiang Liao, Wei-Tsun Shiau		
Filed	:	March 18, 2004		
TC/A.U.	:	2826		
Examiner	:	Abraham, Fetsum		
Docket No.	:	NAUP0557USA0		
Customer No.	:	27765		

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AMENDMENT

In response to the Office action of September 07, 2004, please amend the
5 above-identified application as follows:

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

Remarks/Arguments begin on page 4 of this paper.

Appl. No. 10/708,694
Amdt. dated December 2, 2004
Reply to Office action of September 07, 2004

Amendments to the Claims:

Listing of Claims:

Claim 1 (original) A three dimensional Triple Gate (Tri-gate) device
5 comprising:

a composite fin structure consisting of a silicon germanium core
and a strained silicon epitaxy layer grown from surface of said silicon
germanium core;

10 a gate strip wrapping a portion of said composite fin structure,
wherein portions of said composite fin structure not covered by said
gate strip constitute source/drain regions of said Tri-gate device; and

a gate insulating layer interposed between said composite fin
structure and said gate strip.

15 Claim 2 (original) The Tri-gate device of claim 1 wherein said composite
fin structure has a substantially flat top surface and vertical
sidewalls.

20 Claim 3 (original) The Tri-gate device of claim 2 wherein said composite
fin structure has a width of said flat top surface that is
approximately equal to its height.

25 Claim 4 (original) The Tri-gate device of claim 1 wherein said strained
silicon epitaxy layer has a thickness of about 50~300 angstroms.

Claim 5 (original) The Tri-gate device of claim 1 wherein said gate strip is
made of polysilicon or metal gate.

Appl. No. 10/708,694
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Claim 6 (currently amended) A Tri-gate device comprising:

- a composite fin structure consisting of a semiconductor core and a strained epitaxy layer grown from surface of said semiconductor core,
5 said semiconductor core having a first lattice constant that
mis-matches a second lattice constant of said strained epitaxy layer;
a gate strip wrapping a portion of said composite fin structure,
wherein portions of said composite fin structure not covered by said
gate strip constitute source/drain regions of said Tri-gate device; and
10 a gate insulating layer interposed between said composite fin
structure and said gate strip.

Claim 7 (cancelled)

- 15 Claim 8 (original) The Tri-gate device of claim 6 wherein said
semiconductor core consists of silicon germanium.

- Claim 9 (original) The Tri-gate device of claim 6 wherein said strained
epitaxy layer is a strained silicon epitaxy layer.

- 20 Claim 10 (original) The Tri-gate device of claim 9 wherein said strained
silicon epitaxy layer has thickness of about 50~300 angstroms.

- Claim 11 (original) The Tri-gate device of claim 6 wherein said gate strip
25 is made of polysilicon or metal gate.

Appl. No. 10/708,694
Amdt. dated December 2, 2004
Reply to Office action of September 07, 2004

REMARKS/ARGUMENTS

1. Rejection of claims 6, 9-11 under 35 U.S.C. 103(a) as being unpatentable over Yu et al. (6,764,884):

5

Claim 6 is amended to overcome this rejection. Specifically, the limitation of "said semiconductor core has a first lattice constant that mis-matches a second lattice constant of said strained epitaxy layer" is added. This amendment is fully supported in claim 7. No new matter is entered.

10

In US 6,764,884, Yu et al. disclose a method of forming a FINFET device. However, Yu et al. fail to teach or suggest the limitation of "the semiconductor core has a first lattice constant that mis-matches a second lattice constant of said strained epitaxy layer" recited in claim 7 of the present application. In addition, the applicant notes that claim 7 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims as the examiner has stated. Thus, the applicant asserts that the amended claim 6 including "said semiconductor core has a first lattice constant that mis-matches a second lattice constant of said strained epitaxy layer" should be patentable over Yu et al. Claims 9-11 are dependent on claim 6 and should be allowed if claim 6 is allowed.

15

20

Reconsideration of claims 6 and 9-11 is politely requested.

25

Appl. No. 10/708,694
Amdt. dated December 2, 2004
Reply to Office action of September 07, 2004

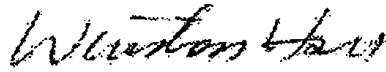
2. Objection to claims 7 and 8 as being dependant upon a rejected base claim:

5 Claims 7 and 8 would be allowable if rewritten in independent form including all limitations of the base claim and any intervening claims. The applicant notes this allowance, and believes the limitation included in claim 7 suffices for differentiating the claimed invention from the cited prior arts. Thus, the limitation originally recited in claim 7 has been added
10 to claim 6, and claim 7 is cancelled. Reconsideration of claim 8 is politely requested in view of the amendment made to claim 6.

Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

15

Sincerely yours,



Date: December 02, 2004

20 Winston Hsu, Patent Agent No. 41,526
P.O. BOX 506, Merrifield, VA 22116, U.S.A.
Voice Mail: 302-729-1562
Facsimile: 806-498-6673
e-mail : winstonhsu@naipo.com

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SERIAL NO.: 10/708,694

ATTORNEY DOCKET NO.: NAUP0557USA

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	Filing Date	03/18/2004	
	First Named Inventor	Wen-Shiang Liao	
	Art Unit	2826	
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Total Number of Pages in This Submission	7	Attorney Docket Number	NAUP0557USA

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Filing Date 03/18/2004
First Named Inventor Wen-Shiang Liao
Examiner Name ABRAHAM, FETSUM
Art Unit 2828
Attorney Docket No. NAUP0557USA

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1802 900	2802 450	Request for expedited examination of a design application	

Other fee (specify)

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SUBMITTED BY

Name (Print/Type) Winston Hsu Registration No. 41,528 Telephone 302-729-1562
Signature *Winston Hsu* Date DEC - 2 2004

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TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

Appl. No.	:	10/708,694	Confirmation No.	2693
Applicant	:	Wen-Shiang Liao, Wei-Tsun Shiau		
Filed	:	March 18, 2004		
TC/A.U.	:	2826		
Examiner	:	Abraham, Fetsum		
Docket No.	:	NAUP0557USA0		
Customer No.	:	27765		

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DEC 02 2004**

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P.O. Box 1450
Alexandria VA 22313-1450

AMENDMENT

In response to the Office action of September 07, 2004, please amend the
5 above-identified application as follows:

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

Remarks/Arguments begin on page 4 of this paper.



UNITED STATES PATENT AND TRADEMARK OFFICE

afm

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.
10/708,694	03/18/2004	Wen-Shiang Liao	NAUP0557USA	2693
27765	7590	09/07/2004	EXAMINER	
NAIPO (NORTH AMERICA INTERNATIONAL PATENT OFFICE) P.O. BOX 506 MERRIFIELD, VA 22116			ABRAHAM, FETSUM	
			ART UNIT	PAPER NUMBER
			2826	

DATE MAILED: 09/07/2004

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

Office Action Summary	Application No.	Applicant(s)	
	10/708,694	LIAO ET AL.	
	Examiner	Art Unit	
	Fetsum Abraham	2826	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☐ Responsive to communication(s) filed on ____.

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

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

Disposition of Claims

4) ☒ Claim(s) 1-11 is/are pending in the application.

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

5) ☒ Claim(s) 1-5 is/are allowed.

6) ☒ Claim(s) the rest is/are rejected.

7) ☒ Claim(s) 7 and 8 is/are objected to.

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

Application Papers

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

10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

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

Priority under 35 U.S.C. § 119

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

 a) ☒ All b) ☐ Some * c) ☐ None of:

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

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

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

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

Attachment(s)

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

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

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date ____.

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

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: ____.

DETAILED ACTION

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

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

Claims 6,9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yu et al (6,764,884).

The patent discloses a FINFET structure (see abstract) with triple-gate element as shown in figure 16, the gate structure (1150) formed around and at least on three sides of the channel region of the fin (1120) and separated from the channel by gate insulation film (1140). Although the patent may be silent about the claimed strained epitaxy layer, such layers are grown on semiconductor surfaces as normal practice in the art and commercially available today. Therefore, it would have been obvious to one skilled in the art to epitaxially grow a semiconducting layer on a substrate, since the method provides an overall self-aligned structure.

As for claim 9, any processed epitaxial layer is considered strained since the processing environment such as the temperature impose conditions on the material. Further, channel/source/drain regions can be formed epitaxially and the FinFet in the prior art is no different to the situation.

As for claim 10, layer thickness is variable and a function of subjective choice that depends on anticipated resistance, conductance, processing time, current leakage and even material strength that varies from a design to another with no patentable weight unless criticality is an issue. In this particular case, the specification contains no disclosure of either the critical nature of the claimed arrangement or any unexpected

Art Unit: 2826

results arising therefrom. Where patentability is said to be based upon particular chosen dimensions or upon another variable recited in a claim, the applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

As for claim 11, poly gate and metal gate are known materials for gate electrode of MOSFETs.

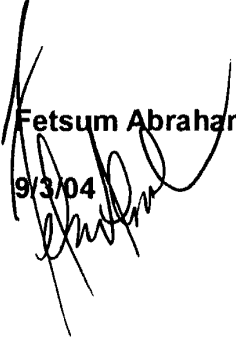
The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Refer to PN: 6,727,546.

Claims 7,8 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 1-5 have been allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fetsum Abraham whose telephone number is: 571-272-1911. The examiner can normally be reached on 8:00 - 18:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J Flynn can be reached on 571-272-1915.


Fetsum Abraham
9/3/04

ELECTRONIC INFORMATION DISCLOSURE STATEMENT

Electronic Version v18

Stylesheet Version v18.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL						
Application Number : 101708694 Confirmation Number: First Named Applicant: Wen-Shiang Liao Attorney Docket Number: NAUP0557USA Art Unit: Examiner: Search string: (4996574 or 5338959 or 6413802).pn							
US Patent Documents							
Note: Applicant is not required to submit a paper copy of cited US Patent Documents							
init	Cite.No.	Patent No.	Date	Patentee	Kind	Class	Subclass
	1	4996574	1991-02-26	Shirasaki			
	2	5338959	1994-08-16	Kim , et al.			
	3	6413802	2002-07-02	Hu , et al.			
Signature							
Examiner Name				Date			
				7/3/04			

Notice of References Cited	Application/Control No. 10/708,694	Applicant(s)/Patent Under Reexamination LIAO ET AL.	
	Examiner Fetsum Abraham	Art Unit 2826	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-6,764,884	07-2004	Yu et al.	438/157
	B	US-6,727,546	04-2004	Krivokapic et al	257
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Index of Claims 		Application No. 10/708,694 Examiner Fetsum Abraham		Applicant(s) LIAO ET AL. Art Unit 2826	
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√ Rejected = Allowed	- (Through numeral) Cancelled + Restricted	N Non-Elected I Interference	A Appeal O Objected
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Claim		Date		Claim		Date		Claim		Date	
Final	Original			Final	Original			Final	Original		
	1				51				101		
	2				52				102		
	3				53				103		
	4				54				104		
	5				55				105		
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	46				96				146		
	47				97				147		
	48				98				148		
	49				99				149		
	50				100				150		

Search Notes 		Application No. 10/708,694	Applicant(s) LIAO ET AL.	
		Examiner Fetsum Abraham	Art Unit 2826	

SEARCHED			
Class	Subclass	Date	Examiner
257	331-369	9/3/2004	FA

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
WEST	9/3/2004	FA



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BIBDATASHEET**CONFIRMATION NO. 2693**

Bib Data Sheet

SERIAL NUMBER 10/708,694	FILING DATE 03/18/2004 RULE	CLASS 257	GROUP ART UNIT 2826	ATTORNEY DOCKET NO. NAUP0557USA
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APPLICANTS

Wen-Shiang Liao, Miao- Li Hsien, TAIWAN;
 Wei-Tsun Shiau, Kao-Hsiung Hsien, TAIWAN;

**** CONTINUING DATA *******

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

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
**** 05/20/2004**

Foreign Priority claimed ☒ yes ☐ no	STATE OR COUNTRY TAIWAN	SHEETS DRAWING 6	TOTAL CLAIMS 11	INDEPENDENT CLAIMS 2
35 USC 119 (a-d) conditions met ☒ yes ☐ no ☐ Met after allowance				
Verified and Acknowledged Examiner's Signature _____ Initials _____				

ADDRESS
 027765
 NAIPO (NORTH AMERICA INTERNATIONAL PATENT OFFICE)
 P.O. BOX 506
 MERRIFIELD , VA
 22116

TITLE
 TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

FILING FEE RECEIVED 770	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐
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Refine Search

Search Results -

Terms	Documents
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Database:

☐ US Pre-Grant Publication Full-Text Database
☒ US Patents Full-Text Database
☐ US OCR Full-Text Database
☐ EPO Abstracts Database
☐ JPO Abstracts Database
☐ Derwent World Patents Index
☐ IBM Technical Disclosure Bulletins

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L12

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Search History

DATE: Friday, September 03, 2004 [Printable Copy](#) [Create Case](#)

Set Name Query

side by side

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result set

DB=USPT; PLUR=YES; OP=OR

L12 L4 and epitax\$70 L12

DB=TDBD; PLUR=YES; OP=OR

L11 L100 L11

DB=DWPI; PLUR=YES; OP=OR

L10 L90 L10

DB=JPAB; PLUR=YES; OP=OR

L9 L80 L9

DB=EPAB; PLUR=YES; OP=OR

L8 L70 L8

DB=USOC; PLUR=YES; OP=OR

L7 L60 L7

DB=PGPB; PLUR=YES; OP=OR

L6 L50 L6

DB=USPT; PLUR=YES; OP=OR

<u>L3</u>	finfet or "fin structure"	1259	<u>L3</u>
<u>L2</u>	6727546 and fin	0	<u>L2</u>
<u>L1</u>	finfet	57	<u>L1</u>

END OF SEARCH HISTORY

TRANSMITTAL

Electronic Version v1.1

Stylesheet Version v1.1.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL				
Application Number : Date : First Named Applicant: Wen-Shiang Liao Confirmation Number: Attorney Docket Number: NAUP0557USA					
I hereby certify that the use of this system is for OFFICIAL correspondence between patent applicants or their representatives and the USPTO. Fraudulent or other use besides the filing of official correspondence by authorized parties is strictly prohibited, and subject to a fine and/or imprisonment under applicable law. I , the undersigned, certify that I have viewed a display of document(s) being electronically submitted to the United States Patent and Trademark Office, using either the USPTO provided style sheet or software, and that this is the document(s) I intend for initiation or further prosecution of a patent application noted in the submission. This document(s) will become part of the official electronic record at the USPTO.					
<table border="1"><tr><td>Submitted By:</td><td>Elec. Sign.</td></tr><tr><td>Winston Hsu Registered Number: 41,526</td><td>Winston Hsu</td></tr></table>		Submitted By:	Elec. Sign.	Winston Hsu Registered Number: 41,526	Winston Hsu
Submitted By:	Elec. Sign.				
Winston Hsu Registered Number: 41,526	Winston Hsu				

Documents being submitted:	Files
us-assignment	NAUP0557-usassn.xml us-assignment.xsl us-assignment.dtd NAUP0557ASS1.tif NAUP0557ASS2.tif
us-request	NAUP0557-usrequ.xml us-request.dtd us-request.xsl
us-declaration	NAUP0557-usdecl.xml us-declaration.dtd us-declaration.xsl
us-fee-sheet	NAUP0557-usfees.xml us-fee-sheet.xsl us-fee-sheet.dtd
us-power-of-attorney-grant	NAUP0557-uspoat.xml us-power-of-attorney-grant.dtd us-power-of-attorney-grant.xsl
us-ids	NAUP0557-usidst.xml us-ids.dtd us-ids.xsl
us-declaration	NAUP0557DEC1.tif
us-declaration	NAUP0557DEC2.tif
application-body	NAUP0557-trans.xml us-application-body.xsl application-body.dtd wipo.ent mathml2.dtd mathml2-qname-1.mod isoamsa.ent isoamsb.ent isoamsc.ent isoamsn.ent isoamso.ent isoamsr.ent isogr3.ent isomfrk.ent isomopf.ent isomscr.ent isotech.ent isobox.ent isocyr1.ent isocyr2.ent isodia.ent isolat1.ent isolat2.ent isonum.ent isopub.ent mmlextra.ent mmlalias.ent

	soextblx.dtd naup0557usa-01.tif naup0557usa-02.tif naup0557usa-03.tif naup0557usa-04.tif naup0557usa-05.tif naup0557usa-06.tif
Comments	

APPLICATION DATA SHEET

Electronic Version v14

Stylesheet Version v14.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL		
Application Type : regular, utility Attorney Docket Number : NAUP0557USA			
Correspondence address: Customer Number: 027765			
			
Inventors Information:			
<u>Inventor 1:</u>			
Applicant Authority Type:	Inventor		
Citizenship:	TW		
Given Name:	Wen-Shiang		
Family Name:	Liao		
Residence:			
City of Residence:	Miao- Li Hsien		
Country of Residence:	TW		
Address-1 of Mailing Address:	No. 252, Jong-Jeng Rd., Community 18, Tou-Fen Li,		
Address-2 of Mailing Address:	Tou-Fen Town		
City of Mailing Address:	Miao- Li Hsien		
State of Mailing Address:			
Postal Code of Mailing Address:			
Country of Mailing Address:	TW		
Phone:			
Fax:			
E-mail:			
<u>Inventor 2:</u>			
Applicant Authority Type:	Inventor		
Citizenship:	TW		
Given Name:	Wei-Tsun		
Family Name:	Shiau		
Residence:			
City of Residence:	Kao-Hsiung Hsien		

Country of Residence: TW
Address-1 of Mailing Address: No. 19, Wen-Hua St., Long-Shan Li, Mei-Nong Town
Address-2 of Mailing Address:
City of Mailing Address: Kao-Hsiung Hsien
State of Mailing Address:
Postal Code of Mailing Address:
Country of Mailing Address: TW
Phone:
Fax:
E-mail:

Attorney Information:

practitioner(s) at Customer Number:

027765



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

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Electronic Version v11

Stylesheet Version v10

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL								
As the below named inventors, we declare that: This declaration is directed to the invention titled: " TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL" We believe that we are the original and first inventors of the subject matter which is claimed and for which a patent is sought; We have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above; We acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application. All statements made herein of own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.									
FULL NAME OF INVENTORS: <table border="1" style="width: 100%; border-collapse: collapse;"><tr><td style="width: 50%; padding: 5px;">Inventor 1: Wen-Shiang Liao</td><td style="width: 50%; padding: 5px;">Inventor</td></tr><tr><td style="padding: 5px;">Signature :</td><td style="padding: 5px;">Citizen of : TW</td></tr><tr><td style="padding: 5px;">Inventor 2: Wei-Tsun Shiau</td><td style="padding: 5px;">Inventor</td></tr><tr><td style="padding: 5px;">Signature :</td><td style="padding: 5px;">Citizen of : TW</td></tr></table>		Inventor 1: Wen-Shiang Liao	Inventor	Signature :	Citizen of : TW	Inventor 2: Wei-Tsun Shiau	Inventor	Signature :	Citizen of : TW
Inventor 1: Wen-Shiang Liao	Inventor								
Signature :	Citizen of : TW								
Inventor 2: Wei-Tsun Shiau	Inventor								
Signature :	Citizen of : TW								

Docket No NAUP0557USA

I believe I am the sole (if only one name appears below) , or joint (if more than one name appears) , original and first inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled :

"TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL"

_____ + _____ The specification for the above entitled invention is filed herewith.
 _____ The specification for the above entitled invention was filed previously
 with application serial number: _____ Filing Date: _____

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

I acknowledge the duty to disclose information which is material to the patentability of the invention disclosed in this application in accordance with Title 37, Code of Federal Regulations, Section 1.56 (a). I further acknowledge the duty in any continuation-in-part application to disclose to the Patent and Trademark Office all information known to be material to the patentability of the invention disclosed in this application, as defined in 1.56, which became available to me between the filing date of the prior application and the filing date of this application.

PRIORITY CLAIM

 + There is no claim of priority

 Claim of priority is based on the following:

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorneys to prosecute this application and to transact all related business in the Patent and Trademark Office:

Winston Hsu Registration# 41,526

P.O. Box 506,
Merrifield, Virginia 22116,
U.S.A
E-mail : winstonhsu@naipo.com.tw
TEL: +886-2-89237350 *100

DECLARATION

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

(請發明人務必簽署日期)

Date:	<u>2/17/2004</u>	<u>Wen-Shiang Liao</u>
	Printed Name:	<u>Wen-Shiang Liao</u>
	Post Office Address:	<u>No. 252, Jong-Jeng Rd., Community 18, Tou-Fen Li,</u>
	and Residence	<u>Tou-Fen Town, Miao- Li Hsien, Taiwan, R.O.C.</u>
	Citizen of:	<u>R.O.C.</u>
Date:	<u>2/18/2004</u>	<u>Wei-Tsun Shiau</u>
	Printed Name:	<u>Wei-Tsun Shiau</u>
	Post Office Address:	<u>No. 19, Wen-Hua St., Long-Shan Li, Mei-Nong Town,</u>
	and Residence	<u>Kao-Hsiung Hsien, Taiwan, R.O.C.</u>
	Citizen of:	<u>R.O.C.</u>

FEE TRANSMITTAL

Electronic Version v08

Stylesheet Version v08.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL																																																		
Application Number : Date : First Named Applicant: Wen-Shiang Liao Attorney Docket Number: NAUP0557USA																																																			
TOTAL FEE AUTHORIZED \$ 810 Patent fees are subject to annual revisions on or about October 1st of each year.																																																			
Filing as large entity BASIC FILING FEE <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>Fee Description</th><th>Fee Code</th><th>Amount \$</th><th>Fee Paid \$</th></tr></thead><tbody><tr><td>Utility Filing Fee</td><td>1001</td><td style="text-align: right;">770</td><td style="text-align: right;">770</td></tr><tr><td colspan="4" style="text-align: right;">Subtotal For Basic Filing Fees: \$ 770</td></tr></tbody></table> EXTRA CLAIM FEES <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>Fee Description</th><th>Extra Claim</th><th>Fee Code</th><th>Amount \$</th><th>Fee Paid \$</th></tr></thead><tbody><tr><td>Total Claims : 11</td><td style="text-align: center;">0</td><td style="text-align: center;">1202</td><td style="text-align: right;">18</td><td style="text-align: right;">0</td></tr><tr><td>Independent Claims : 2</td><td style="text-align: center;">0</td><td style="text-align: center;">1201</td><td style="text-align: right;">86</td><td style="text-align: right;">0</td></tr><tr><td colspan="5" style="text-align: right;">Subtotal For Extra Claims Fees: \$ 0</td></tr></tbody></table> ASSIGNMENT FEES <table border="1" style="width: 100%; border-collapse: collapse;"><thead><tr><th>Fee Description</th><th>Property Number</th><th>Quantity</th><th>Fee Code</th><th>Amount \$</th><th>Fee Paid \$</th></tr></thead><tbody><tr><td>Recording Each Patent Assignment Per Property Fee</td><td style="text-align: center;">00000000</td><td style="text-align: center;">1</td><td style="text-align: center;">8021</td><td style="text-align: right;">40</td><td style="text-align: right;">40</td></tr><tr><td colspan="6" style="text-align: right;">Subtotal For Additional Fees: \$40</td></tr></tbody></table>		Fee Description	Fee Code	Amount \$	Fee Paid \$	Utility Filing Fee	1001	770	770	Subtotal For Basic Filing Fees: \$ 770				Fee Description	Extra Claim	Fee Code	Amount \$	Fee Paid \$	Total Claims : 11	0	1202	18	0	Independent Claims : 2	0	1201	86	0	Subtotal For Extra Claims Fees: \$ 0					Fee Description	Property Number	Quantity	Fee Code	Amount \$	Fee Paid \$	Recording Each Patent Assignment Per Property Fee	00000000	1	8021	40	40	Subtotal For Additional Fees: \$40					
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AUTHORIZED BILLING INFORMATION The commissioner is hereby authorized to charge indicated fees and credit any overpayments to: Deposit account number: 500801 Access Code: **** Deposit name: NORTH AMERICA INTERNATIONAL PATENT OFFICE Deposit authorized name: WINSTON HSU																																																			

Signature: VAEB-JMXX-8IIL

Date (YYYYMMDD): 2004-03-17

Charge Assignment Fees Required Under 37 C.F.R. Section 1.21 (h).

Charge Any Additional Fee Required Under 37 C.F.R. Sections 1.16 and 1.17.

POWER OF ATTORNEY OR AUTHORIZATION OF AGENT

Electronic Version v05

Stylesheet Version v05.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL		
First Named Applicant :	Wen-Shiang Liao		
Attorney Docket Number :	NAUP0557USA		
I hereby appoint the registered practitioner(s) at Customer Number:			
027765			
as attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.			
I am the Applicant/Inventor.			
Full Name of Applicant of Record:			
Winston Hsu			
Signature: Winston Hsu		Date: 2004-03-17	

ELECTRONIC INFORMATION DISCLOSURE STATEMENT

Electronic Version v18

Stylesheet Version v18.0

Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL																																
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Description

TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

BACKGROUND OF INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a Triple Gate(Tri-gate) device, and more particularly, to a three dimensional transistor device having a three-sided strained-Si channel and its manufacturing method.

[0003] 2. Description of the Prior Art

[0004] Transistors are the miniscule on/off switches that make up the integrated circuits in today's microprocessors. Three dimensional (3D) vertical double-gate transistors are known in the art. Chipmakers keep announcing that they have fabricated the smallest vertical double-gate transistors reported to date using industry standard technology. These transistors, measuring below ten nanometers, or ten billionths of a meter in length (gate), are about

six times smaller than the smallest transistors currently in production.

[0005] A double-gate transistor structure effectively doubles the electrical current that can be sent through a given transistor. The Fin Field Effect Transistor (FinFET) design relies upon a thin vertical silicon "fin" to help control leakage of current through the transistor when it is in the "off" stage. Moreover, while the gate length is shrunk to below 65nm, the wrapped-around gate upon the very thin Si-fin body can provide excellent gate control capability for effectively suppressing short channel effect through the fully depleted silicon-on-insulator (SOI) operation mode. The superior leakage control characteristics and excellent gate control for effectively suppressing short channel effect make FinFET transistors an attractive candidate for future nano-scale CMOS generations, which are expected to be in manufacturing within the next decade.

[0006] Typically, FinFET is built on a silicon-on-insulator (SOI) substrate. The silicon layer of the SOI substrate is etched into "fin" like shaped body of the transistor. The gate is wrapped around and over the fin.

[0007] U.S. Pat. No. 4,996,574 filed June 30, 1989 by Shirasaki, entitled "MIS transistor structure for increasing conduc-

tance between source and drain regions" discloses a metal-insulator-semiconductor transistor comprising an insulator layer, a silicon body provided on the insulator layer and comprising a source region, a drain region and a channel region extending in a first direction between and interconnecting the source region and the drain region, a gate insulator film provided on the silicon body so as to cover the channel region except for the part of the channel region in contact with the insulator layer, and a gate electrode of a conductive material provided in contact with the gate insulator film so as to cover the channel region underneath the gate insulator film except for the part of the channel region in contact with the insulator layer.

[0008] U.S. Pat. No. 5,338,959 filed March 30, 1993 by Kim et al. discloses a thin film transistor gate structure with a three-dimensional multi-channel structure. The thin film transistor gate structure comprises source/drain electrodes formed so as to be spaced from and opposite to each other on a substrate. The TFT has a plurality of channel regions for high carrier mobility. Each channel region has three-dimensional structure. The polycrystalline silicon channel regions are surrounded by gates.

[0009] U.S. Pat. No. 6,413,802 filed October 23, 2000 by Hu et

al. discloses a FinFET device that is fabricated using conventional planar MOSFET technology. The device is fabricated in a silicon layer overlying an insulating layer (e.g., SIMOX) with the device extending from the insulating layer as a fin. Double gates are provided over the sides of the channel to provide enhanced drive current and effectively suppress short channel effects. A plurality of channels can be provided between a source and a drain for increased current capacity.

[0010] However, the electrical performance such as carrier mobility or device driving current of the above-described SOI-based FinFET and Tri-gate devices can be further improved.

SUMMARY OF INVENTION

[0011] It is therefore a primary object of the claimed invention to provide a Triple Gate (Tri-gate) device having improved electrical performance such as higher carrier mobility and higher driving current.

[0012] According to the claimed invention, a Tri-gate device with a strained silicon channel is provided. The Tri-gate device includes a composite fin structure consisting of a silicon germanium core and a strained silicon epitaxy layer grown from surface of said silicon germanium core. A gate strip

wraps a channel portion of the composite fin structure. Two distal end portions of the composite fin structure not covered by the gate strip constitute source/drain regions of the Tri-gate device. A gate insulating layer is interposed between the composite fin structure and the gate strip.

[0013] Other objects, advantages and novel features of the invention will become more clearly and readily apparent from the following detailed description when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0014] The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention. In the drawings:

[0015] Fig.1 is a schematic perspective view showing a portion of an improved Tri-gate device in accordance with one preferred embodiment of the present invention;

[0016] Fig.2 is a cross-sectional view of the Tri-gate device along line a-a of Fig.1; and

[0017] Fig.3 to Fig.6 are schematic cross-sectional diagrams

showing the method for fabricating the Tri-gate device in accordance with one preferred embodiment of the present invention.

DETAILED DESCRIPTION

[0018] Please refer to Fig.1 and Fig.2. Fig.1 is a schematic perspective view showing a germane portion of an improved Tri-gate device in accordance with one preferred embodiment of the present invention. Fig.2 is a cross-sectional view of the Tri-gate device along line a-a of Fig.1. As shown in Fig.1, the Tri-gate device 1 comprises a thin fin structure 30 upwardly extending from a horizontal surface of an insulating layer (or buried oxide) 20 that is supported by a substrate 10. The thin fin structure 30 standing perpendicular to the substrate 10 is separated from the substrate 10 by the insulating layer 20. The center portion of the thin fin structure 30 is wrapped by a gate strip 60 and defines a channel region thereto. A gate insulating film 70 such as high quality silicon dioxide is interposed between the gate strip 60 and the thin fin structure 30. Alternatively, the gate insulating film 70 can be silicon nitride or a high-k gate dielectric material. The gate strip 30 may be made of polysilicon, metal gate or the like. The thin fin portions that are not covered by the

gate strip 60 constitute source or drain (S/D) of the Tri-gate device 1. The source/drain (S/D) of the Tri-gate device 1 may be implanted with high concentration of impurities. For the sake of simplicity, it is to be understood that the contact portions electrically connected to the S/D and gate strip 60 respectively are not shown.

[0019] As shown in Fig.1 and Fig.2, the thin fin structure 30 has a flat top surface 31 having a width denoted as "W", and two vertical sidewalls 33 having a height denoted as "H". The channel length (L) of the Tri-gate device 1 is defined by the width of the gate strip 60. The channel width of the Tri-gate device 1 is the combination of the width (W) of the flat top surface 31 and the height (H) of both sidewalls 33 (Channel width = W + 2H). According to the preferred embodiment of the present invention, the width (W) of the flat top surface 31 is approximately equal to the height (H) of sidewall 33. Preferably, the strained silicon epitaxy layer 34 has a substantially uniform thickness of about 10~300 angstroms. The present invention features the thin fin structure 30 that comprises a silicon germanium ($\text{Si}_{1-x}\text{Ge}_x$) core 32 and a strained silicon epitaxy layer 34 grown from surface of the silicon germanium core 32. The electrical performance of the Tri-gate device 1 can be

greatly improved since the strained silicon epitaxy layer 34 provides superior carrier mobility, and thus higher drive current.

[0020] A method for forming the Tri-gate device 1 of Fig.1 will now be explained with reference to Fig.3 to Fig.6. As shown in Fig.3, a commercially available uni-bond $\text{Si}_x\text{Ge}_{1-x}/\text{SiO}_2/\text{Si}$ wafer 100 is prepared. The uni-bond $\text{Si}_x\text{Ge}_{1-x}/\text{SiO}_2/\text{Si}$ wafer 100 comprises a silicon bottom layer 10, SiO_2 film 20 supported by the silicon bottom layer 10, and a silicon germanium layer 40. Preferably, the silicon germanium layer 40 has a predetermined thickness of about 500~1200 angstroms, but not limited thereto. An etching mask 80 is formed on the silicon germanium layer 40. The etching mask 80 may include a silicon nitride hard mask 81 and a photoresist 82. A reactive ion etching (RIE) is carried out to etch away the un-masked silicon germanium layer 40 from the wafer 100. The anisotropic RIE stops on the SiO_2 film 20. The remaining photoresist 81 and hard mask 82 are removed, thereby forming a silicon germanium island 90 on the SiO_2 film 20.

[0021] As shown in Fig.5, an epitaxy process is performed to grow a strained silicon layer 34 on the surface of the silicon germanium island 90. The grown strained silicon layer

34 and the silicon germanium island 90 constitute a composite thin fin structure 30, part of which will be used as the channel region in a later stage. As specifically indicated in Fig.5, the composite thin fin structure 30 has a width (top surface) denoted as "W" and a height (sidewalls) denoted as "H". According to the preferred embodiment of the present invention, the width (W) of the composite thin fin structure 30 is approximately equal to the height (H) of the composite thin fin structure 30. Preferably, the strained silicon epitaxy layer 34 has a uniform thickness of about 50~300 angstroms. Channel threshold voltage (V_t) implantation may be carried out after the formation of the composite thin fin structure 30. The channel threshold voltage (V_t) adjustment may be tilt angle ion implantation. It is understood that a screen oxide or sacrificial oxide (about 50Å thick, for example) may be thermally formed on the surface of the composite thin fin structure 30 before the channel threshold voltage (V_t) adjustment. This sacrificial oxide is removed prior to the formation of high quality gate insulating layer.

[0022] As shown in Fig.6, a gate insulating layer 70 is formed on the top surface and sidewalls of the composite thin fin structure 30. Preferably, the gate insulating layer 70 is

formed by performing a dry or wet thermal oxidation, but not limited thereto. According to the preferred embodiment, the thickness of the gate insulating layer 70 ranges between 10 and 30 angstroms. Subsequently, a conventional chemical vapor deposition (CVD) such as PECVD or LPCVD is carried out to deposit a polysilicon or metal gate layer on the SiO₂ film 20 and over the gate insulating layer 70. A lithographic process is then carried out to pattern the polysilicon or metal gate layer, thereby forming a gate strip 60 wrapping a portion of the fin structure 30. An offset spacer (not shown) is then formed on sidewalls of the gate strip 60. A lightly doped source/drain ion implantation may be carried out. After that, a spacer such as silicon nitride (not shown) is formed on the offset spacers. A high concentration source/drain ion implantation is then carried out to dope the source and drain regions on the fin structure 30.

[0023] Those skilled in the art will readily observe that numerous modification and alterations of the device may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

Claims

[c1] What is Claimed is:

1. A three dimensional Triple Gate (Tri-gate) device comprising:

a composite fin structure consisting of a silicon germanium core and a strained silicon epitaxy layer grown from surface of said silicon germanium core;

a gate strip wrapping a portion of said composite fin structure, wherein portions of said composite fin structure not covered by said gate strip constitute source/drain regions of said Tri-gate device; and

a gate insulating layer interposed between said composite fin structure and said gate strip.

[c2] 2. The Tri-gate device of claim 1 wherein said composite fin structure has a substantially flat top surface and vertical sidewalls.

[c3] 3. The Tri-gate device of claim 2 wherein said composite fin structure has a width of said flat top surface that is approximately equal to its height.

[c4] 4. The Tri-gate device of claim 1 wherein said strained silicon epitaxy layer has a thickness of about 50~300

angstroms.

- [c5] 5. The Tri-gate device of claim 1 wherein said gate strip is made of polysilicon or metal gate.
- [c6] 6. A Tri-gate device comprising:
 - a composite fin structure consisting of a semiconductor core and a strained epitaxy layer grown from surface of said semiconductor core;
 - a gate strip wrapping a portion of said composite fin structure, wherein portions of said composite fin structure not covered by said gate strip constitute source/drain regions of said Tri-gate device; and
 - a gate insulating layer interposed between said composite fin structure and said gate strip.
- [c7] 7. The Tri-gate device of claim 6 wherein said semiconductor core has a first lattice constant that mismatching a second lattice constant of said strained epitaxy layer.
- [c8] 8. The Tri-gate device of claim 6 wherein said semiconductor core consists of silicon germanium.
- [c9] 9. The Tri-gate device of claim 6 wherein said strained epitaxy layer is a strained silicon epitaxy layer.
- [c10] 10. The Tri-gate device of claim 9 wherein said strained silicon epitaxy layer has thickness of about 50~300

angstroms.

- [c11] 11. The Tri-gate device of claim 6 wherein said gate strip is made of polysilicon or metal gate.

TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL

Abstract

A three-dimensional Triple-Gate (Tri-gate) device having a three-sided strained silicon channel and superior drive current is provided. The Tri-gate device includes a composite fin structure consisting of a silicon germanium core and a three-sided strained silicon epitaxy layer grown from surface of said silicon germanium core. A gate strip wraps a channel portion of the composite fin structure. Two distal end portions of the composite fin structure not covered by the gate strip constitute source/drain regions of the Tri-gate device. A high quality gate insulating layer is interposed between the composite fin structure and the gate strip.

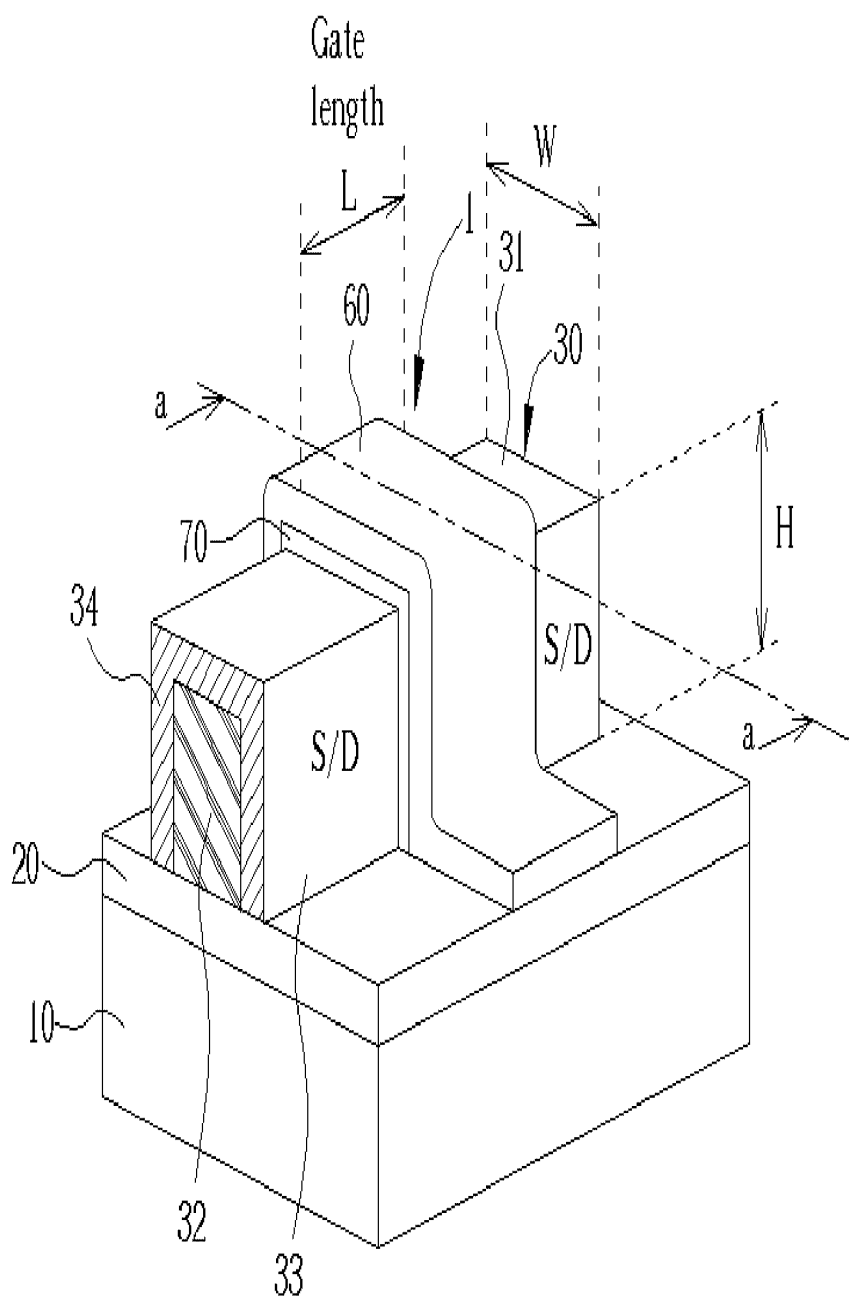


Fig. 1

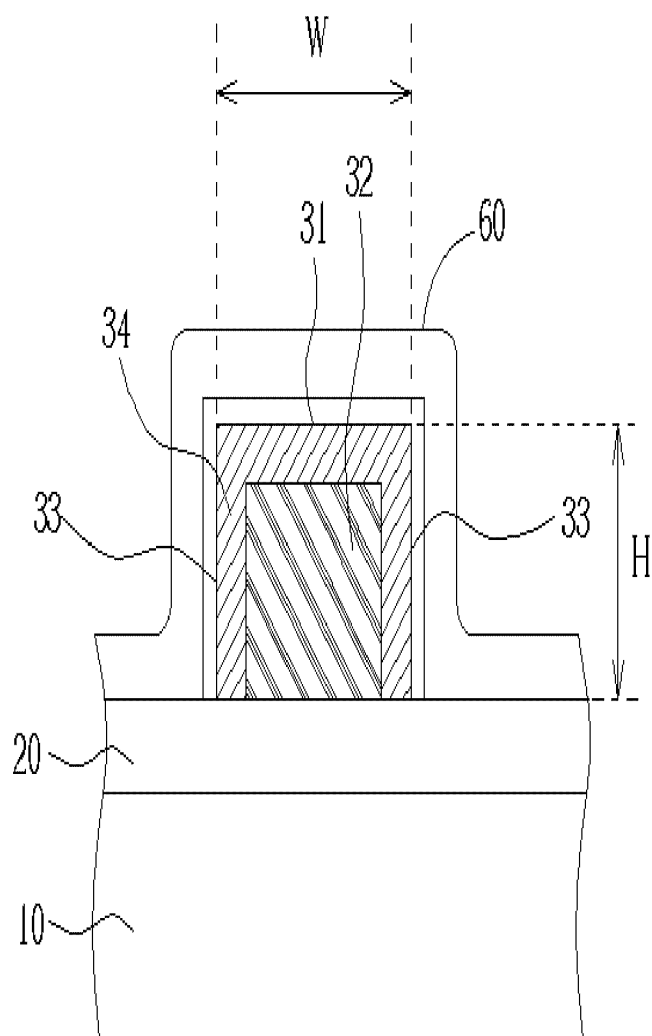


Fig. 2

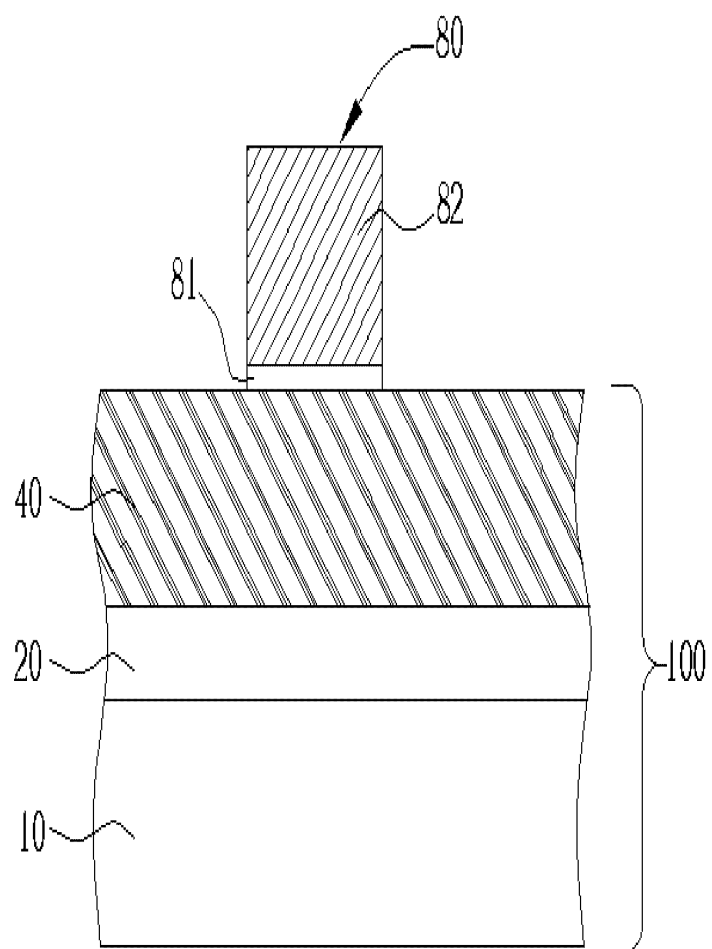


Fig. 3

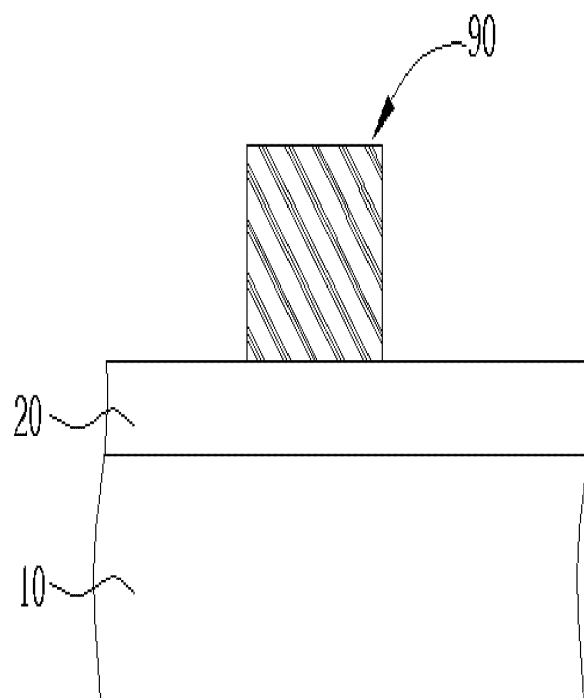


Fig. 4

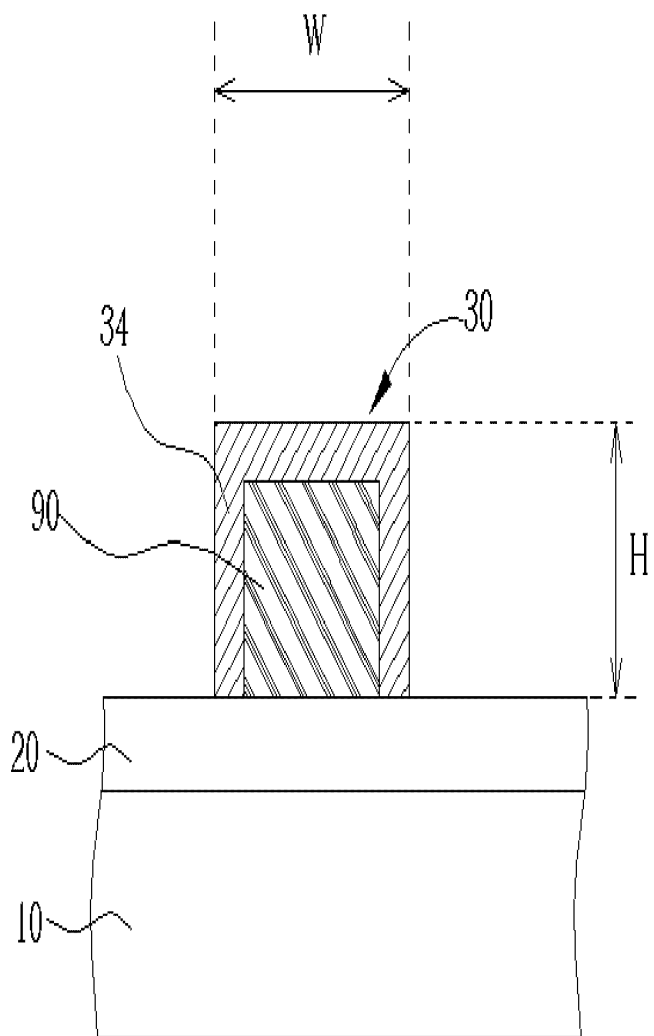


Fig. 5

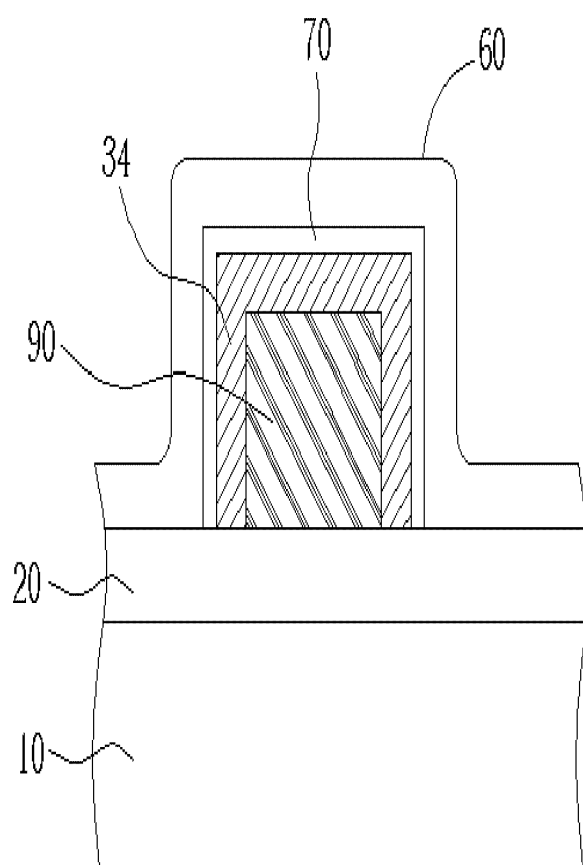


Fig. 6

ACKNOWLEDGEMENT RECEIPT

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Title of Invention	TRIPLE GATE DEVICE HAVING STRAINED-SILICON CHANNEL																																																																																																																														
Submission Type : Utility Patent Filing Application Number: 10/708694  EFS ID: 57442 Server Response: <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 20%;">Confirmation Code</th> <th>Message</th> </tr> </thead> <tbody> <tr> <td>ISVR1</td> <td>Submission was successfully submitted - Even if Informational or Warning Messages appear below, please do not resubmit this application</td> </tr> <tr> <td>ICON1</td> <td>2693</td> </tr> </tbody> </table>				Confirmation Code	Message	ISVR1	Submission was successfully submitted - Even if Informational or Warning Messages appear below, please do not resubmit this application	ICON1	2693																																																																																																																						
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