

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Wen-Jiun Shen
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code	Issue Date	Name	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	8669615		2014-03-11	Chang	
	2	8373238		2013-02-12	Lee	

U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code	Publication Date	Name	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20080157225		2008-07-03	Datta	

FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number	Country Code	Kind Code	Publication Date	Name	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	
	1							

NON-PATENT LITERATURE DOCUMENTS								
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	Attorney Docket Number	NAUP2310USA

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.	
	1		
EXAMINER SIGNATURE			
Examiner Signature		Date Considered	
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

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	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA

CERTIFICATION STATEMENT			
Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):			
☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).			
OR			
☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).			
☐ See attached certification statement.			
☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.			
☒ None			
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	/Scott Margo/	Date (YYYY-MM-DD)	2014-10-08
Name/Print	Scott Margo	Registration Number	56277

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

Title of Invention:

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

As the below named inventor, I hereby declare that:
This declaration is directed to:

☒ The attached application, or

☐ United States application number _____ filed on _____, or

☐ PCT international application number _____ filed on _____

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

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

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

In consideration of the payment by **UNITED MICROELECTRONICS CORP.** having a postal address of _____

No.3, Li-Hsin Road 2, Science-Based Industrial Park, Hsin-Chu City 300, Taiwan, R.O.C.

(referred to as "ASSIGNEE" below) to I of the sum of One Dollar (\$ 1.00), the receipt of which is hereby acknowledged, and for other good and valuable consideration.

I hereby sell, assign and transfer to ASSIGNEE and the successors and assignees of the ASSIGNEE the entire right, title and interest in and to any and all improvements which are disclosed in the invention as above-identified application and, in and to, all Letters Patent to be obtained for said invention by the above application or any continuations, continuation-in-part, divisions, renewals, substitutes, or extensions thereof, and as to Letters Patent any reissue or re-examination thereof.

I hereby covenant that no assignment, sale, agreement or encumbrance has been or will be made or entered into which would conflict with this assignment;

I further covenant that ASSIGNEE will, upon its request, be provided promptly with all pertinent facts and documents relating to said invention and said Letters Patent and legal equivalents as may be known and accessible to I and will testify as to the same in any interference, litigation proceeding related thereto and will promptly execute and deliver to ASSIGNEE or its legal

representatives any and all papers, instruments or affidavits required to apply for, obtain, maintain, issue and enforce said application, said invention and said Letters Patent and said equivalents thereof which may be necessary or desirable to carry out the purposes thereof.

IN WITNESS WHEREOF, I have hereunto set hand and seal this JUL 17 2014 (Date of signing)

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

Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Wen-Jiun Shen**

Date: **JUL 17 2014**

Signature: Wen-Jiun Shen

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

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Ssu-I Fu**

Date: **JUL 17 2014**

Signature: Ssu-I Fu

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

Title of Invention:

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yen-Liang Wu**

Date: JUL 17 2014

Signature: Yen - Liang Wu

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

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FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Chia-Jong Liu**

Date: **JUL 17 2014**

Signature: Chia-Jong Liu

**COMBINE DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION
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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yu-Hsiang Hung**

Date: **JUL 17 2014**

Signature: Yu-Hsiang Hung

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

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Chung-Fu Chang**

Date:

2014.07.10

Signature:

Chung-Fu Chang

**COMBINE DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION
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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Man-Ling Lu**

Date: **JUL 17 2014**

Signature: Man-Ling Lu

**COMBINE DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION
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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yi-Wei Chen**

Date: JUL 17 2014

Signature: Yi-wei chen

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:



Practitioners associated with Customer Number:

27765

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:



The address associated with Customer Number:

27765

OR

☐	Firm or Individual Name		
	Address		
	City		
	Country		
	Telephone	Email	

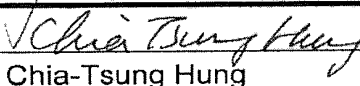
Assignee Name and Address:

UNITED MICROELECTRONICS CORP.
No.3, Li-Hsin Road 2, Science-Based Industrial Park, Hsin-Chu City, Taiwan, R.O.C.

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	SEP 26 2012
Name	Chia-Tsung Hung	Telephone	+886-3-5782258
Title	CHAIRMAN		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

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: UNITED MICROELECTRONICS CORP.

Application No./Patent No.: _____ Filed/Issue Date: _____

Titled: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOFUNITED MICROELECTRONICS CORP., 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.

[Page 1 of 2]

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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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4. From: _____ To: _____

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5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
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6. From: _____ To: _____

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☐ 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.

/Scott Margo/

Signature

Scott Margo

Printed or Typed Name

10/08/2014

Date

56277

Title or Registration Number

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

Title of Invention:

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

As the below named inventor, I hereby declare that:
This declaration is directed to:

☒ The attached application, or

☐ United States application number _____ filed on _____, or

☐ PCT international application number _____ filed on _____

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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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In consideration of the payment by **UNITED MICROELECTRONICS** having a postal address of **CORP.**

No.3, Li-Hsin Road 2, Science-Based Industrial Park, Hsin-Chu City 300, Taiwan, R.O.C.

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representatives any and all papers, instruments or affidavits required to apply for, obtain, maintain, issue and enforce said application, said invention and said Letters Patent and said equivalents thereof which may be necessary or desirable to carry out the purposes thereof.

IN WITNESS WHEREOF, I have hereunto set hand and seal this JUL 17 2014 (Date of signing)

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

Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Wen-Jiun Shen**

Date: **JUL 17 2014**

Signature: Wen-Jiun Shen

**COMBINE DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION
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Note: An application data sheet (PTO/SB/14 or equivalent), including naming the entire inventive entity, must accompany this form. Use this form for each additional inventor.

Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: Ssu-I Fu

Date: JUL 17 2014

Signature: Ssu-I Fu

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

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yen-Liang Wu**

Date: **JUL 17 2014**

Signature: Yen - Liang Wu

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

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Chia-Jong Liu**

Date: **JUL 17 2014**

Signature: Chia-Jong Liu

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

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yu-Hsiang Hung**

Date: **JUL 17 2014**

Signature: Yu-Hsiang Hung

**COMBINE DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION
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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Chung-Fu Chang**

Date: 2014.07.10

Signature: Chung-Fu Chang

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Man-Ling Lu**

Date: **JUL 17 2014**

Signature: Man-Ling Lu

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Docket No NAUP2310USA

LEGAL NAME OF INVENTOR(ASSIGNOR)

Inventor: **Yi-Wei Chen**

Date: JUL 17 2014

Signature: Yi-wei chen

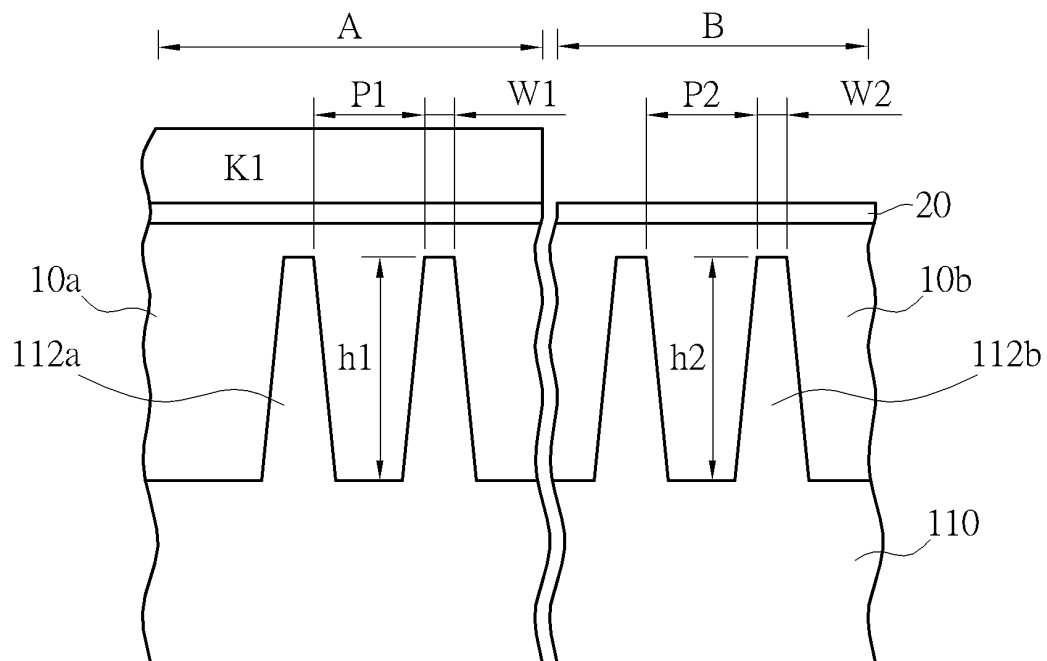


FIG. 1

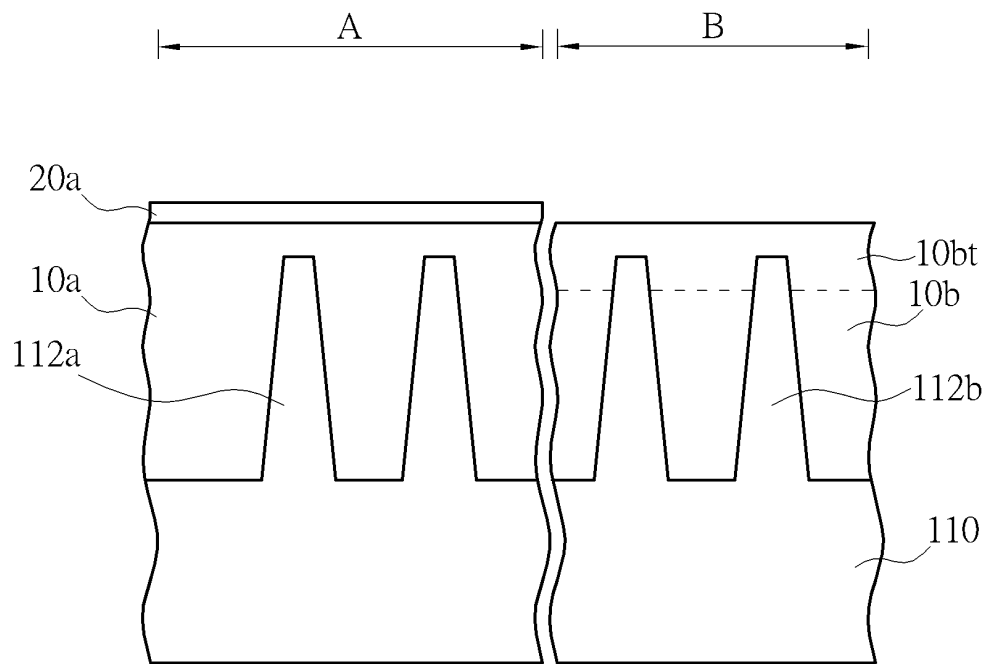


FIG. 2

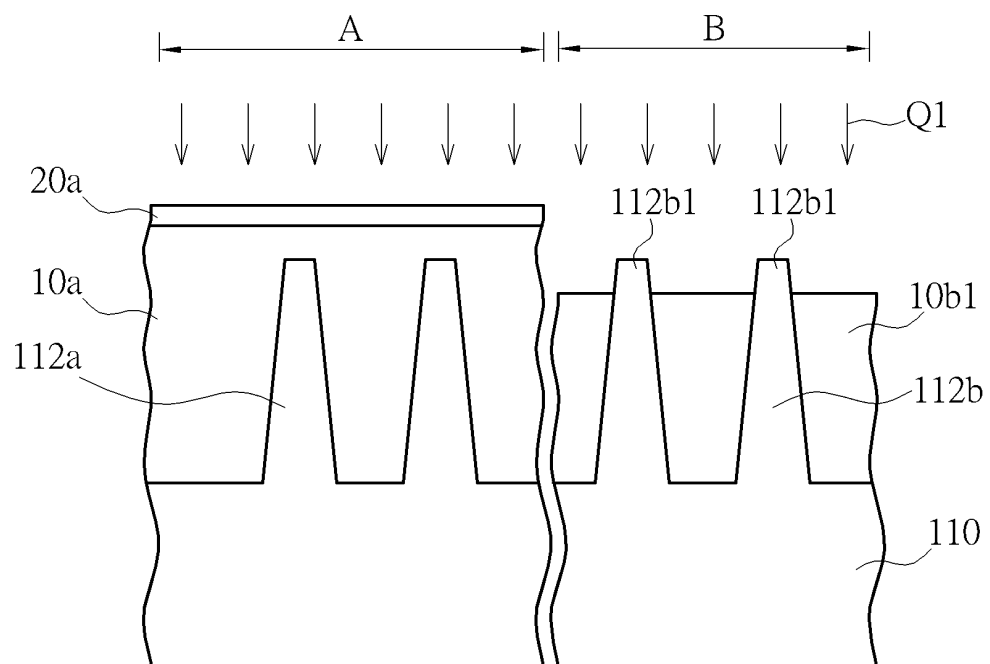


FIG. 3

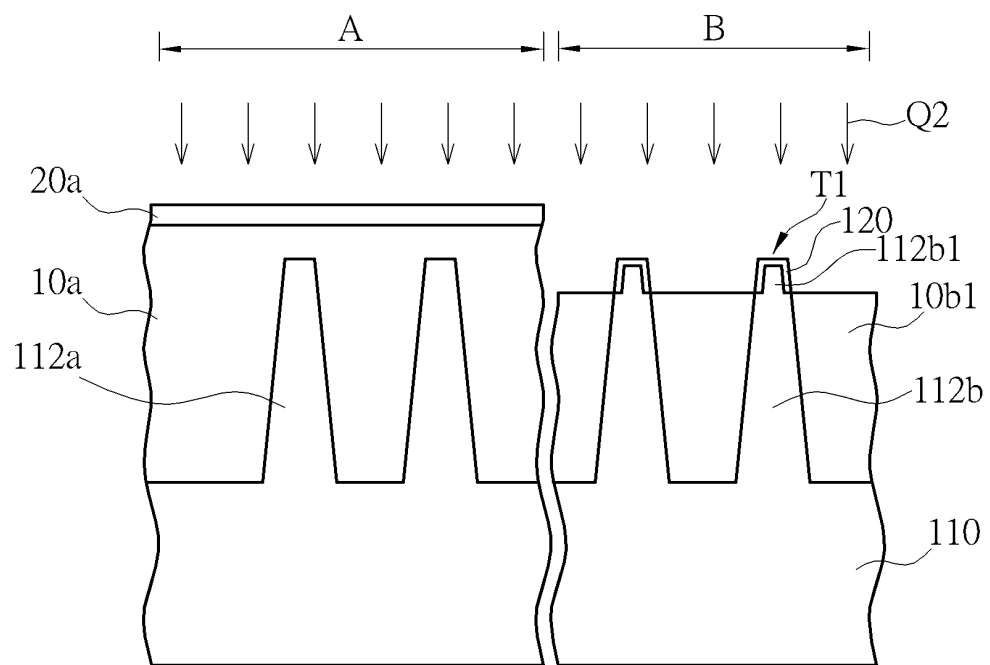


FIG. 4

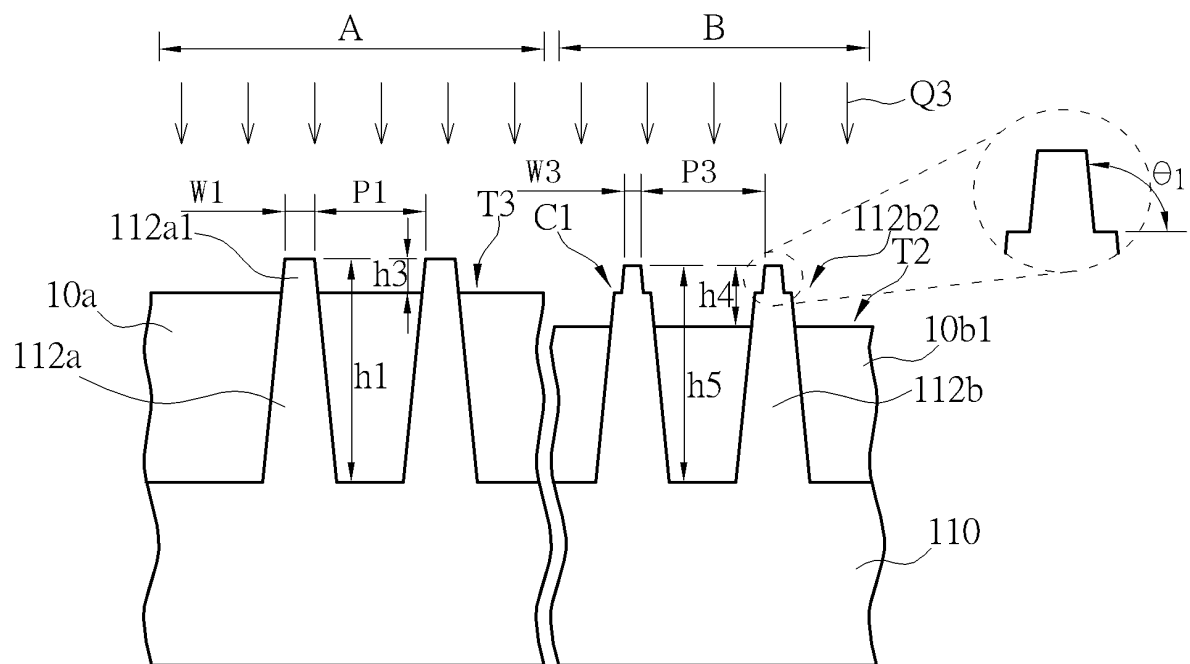


FIG. 5

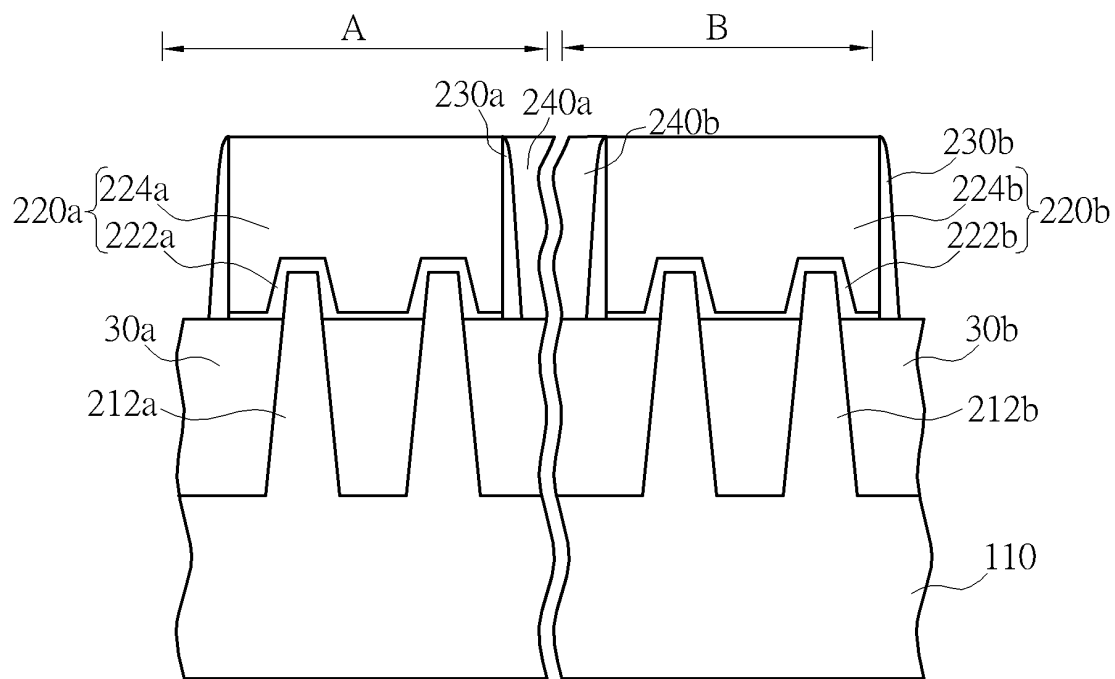


FIG. 6

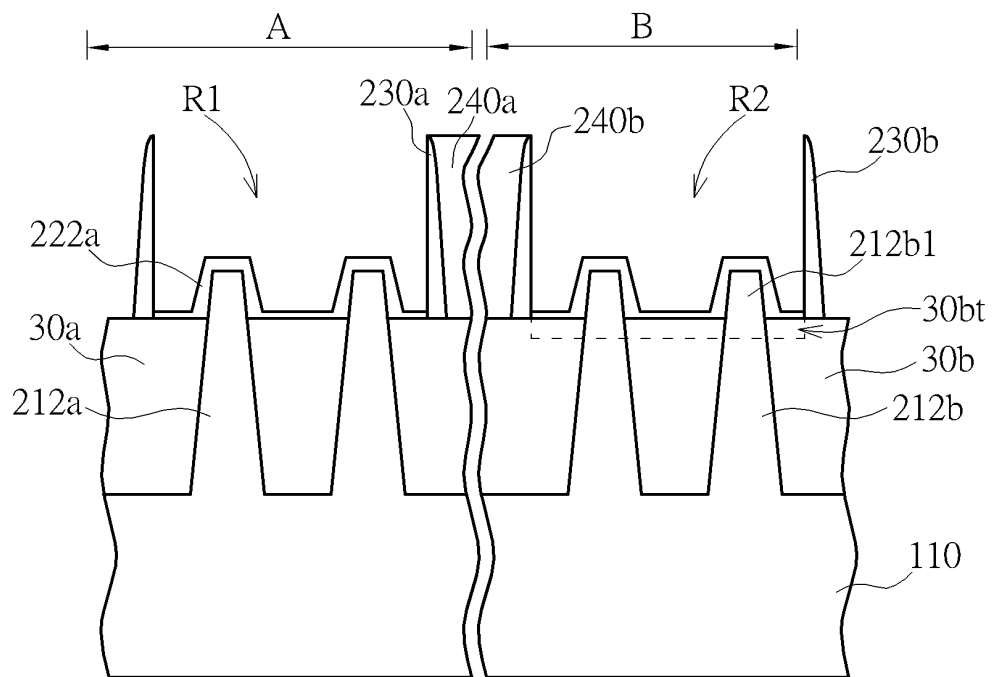


FIG. 7

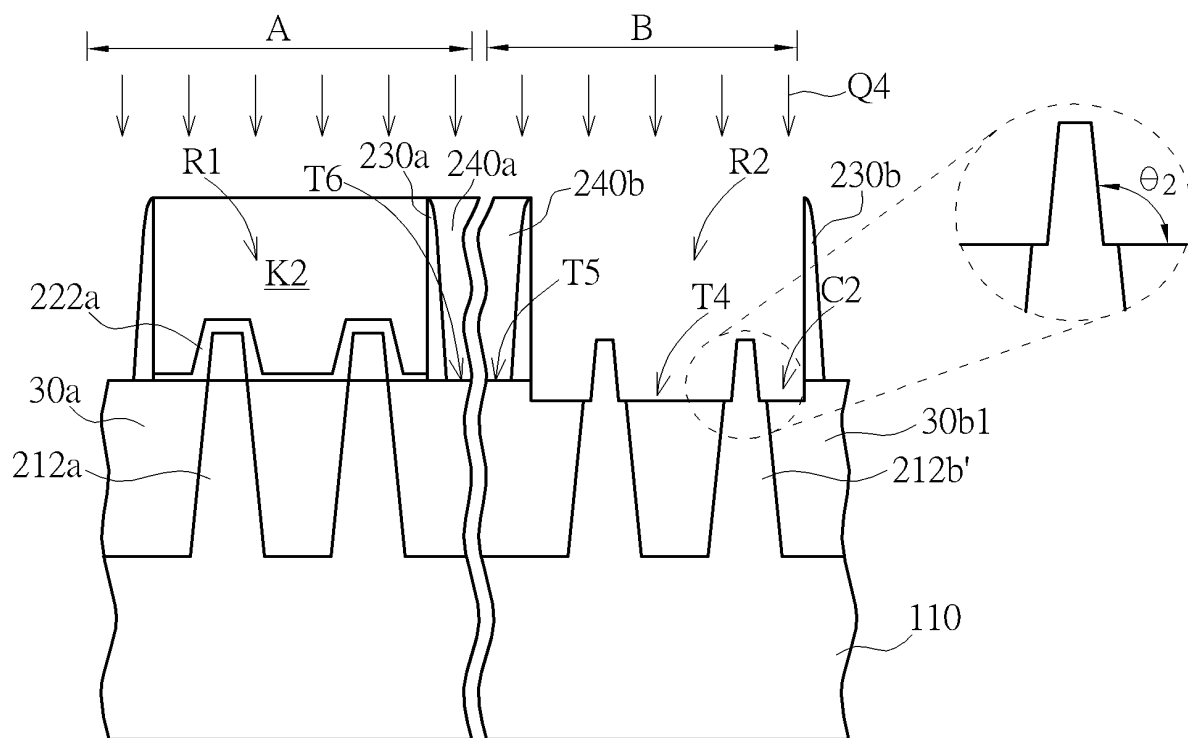


FIG. 8

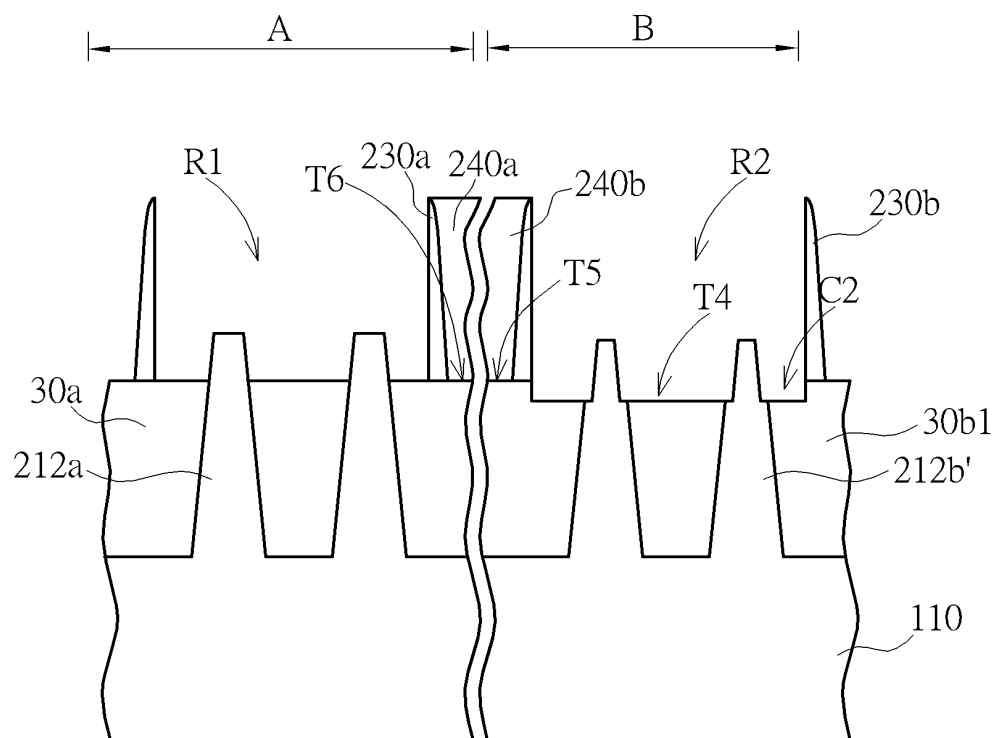


FIG. 9

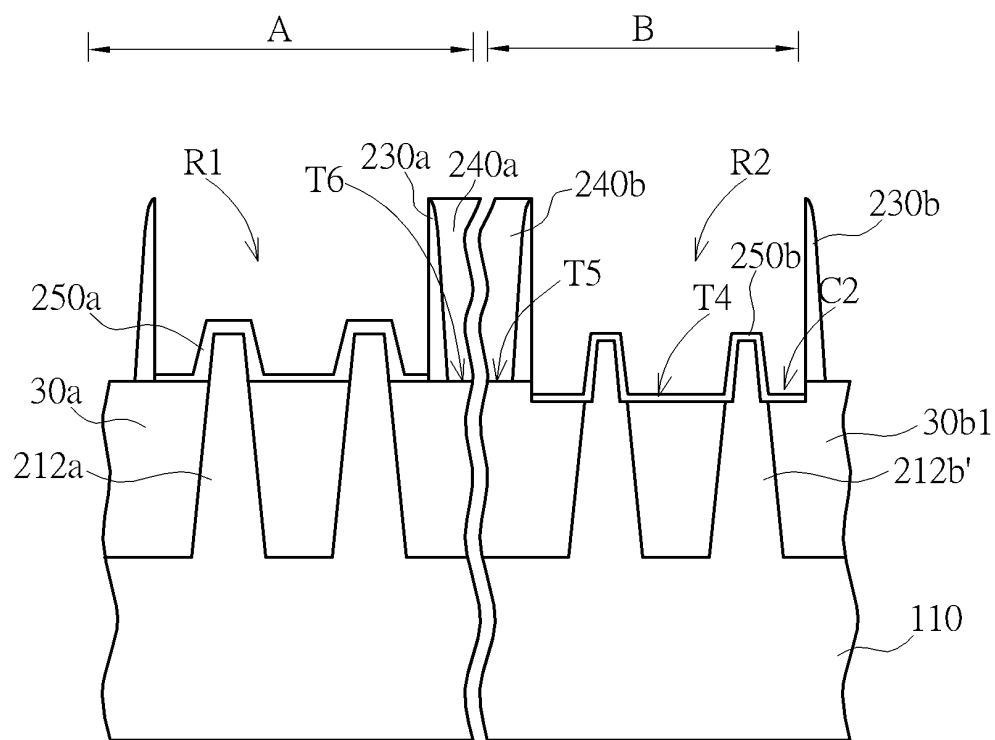


FIG. 10

Abstract of Disclosure

A fin-shaped structure includes a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area, wherein the second fin-shaped structure includes a ladder-shaped cross-sectional profile part. The present invention also provides two methods of forming this fin-shaped structure. In one case, a substrate having a first fin-shaped structure and a second fin-shaped structure is provided. A treatment process is performed to modify an external surface of the top of the second fin-shaped structure, thereby forming a modified part. A removing process is performed to remove the modified part through a high removing selectivity to the first fin-shaped structure and the second fin-shaped structure, and the modified part, thereby the second fin-shaped structure having a ladder-shaped cross-sectional profile part is formed.

Claims

What is claimed is:

1. A fin-shaped structure, comprising:
a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area, wherein the second fin-shaped structure comprises a ladder-shaped cross-sectional profile part.
2. The fin-shaped structure according to claim 1, wherein the width of a top part of the first fin-shaped structure is larger than the width of the top part of the second fin-shaped structure.
3. The fin-shaped structure according to claim 1, further comprising:
an isolation structure disposed beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area respectively, and the ladder-shaped cross-sectional profile part is higher than a top surface of the isolation structure.
4. The fin-shaped structure according to claim 1, wherein a top surface of the isolation structure of the first area is higher than a top surface of the isolation structure of the second area.
5. The fin-shaped structure according to claim 1, wherein a height of the first fin-shaped structure protruding from the isolation structure is lower than a height of the second fin-shaped structure protruding from the isolation structure.
6. The fin-shaped structure according to claim 1, wherein a height of the first fin-shaped structure protruding from the substrate is higher than a height of the second fin-shaped structure protruding from the substrate.
7. The fin-shaped structure according to claim 1, further comprising:
a plurality of first fin-shaped structures and a plurality of

second fin-shaped structures, and the pitch between each top part of the first fin-shaped structures is less than the pitch between each top part of the second fin-shaped structures.

8. The fin-shaped structure according to claim 1, wherein the first area comprises a high voltage threshold (HVT) area and the second area comprises a low voltage threshold (LVT) area.
9. A method of forming a fin-shaped structure, comprising:
 - providing a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area;
 - filling an isolation structure beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area respectively;
 - forming a patterned mask covering the first area but exposing the second area ;
 - removing a top part of the isolation structure of the second area, thereby exposing a first top part of the second fin-shaped structure;
 - performing a treatment process to modify an external surface of the first top part of the second fin-shaped structure, thereby forming a modified part covering the first top part of the second fin-shaped structure;
 - removing the patterned mask; and
 - performing a removing process to remove a part of the isolation structure and the modified part by the high removing selectivity to the first fin-shaped structure and the second fin-shaped structure, and the modified part and the isolation structure, thereby exposing a top part of the first fin-shaped structure and a second top part of the second fin-shaped structure.
10. The method of forming a fin-shaped structure according to claim 9, wherein the isolation structure comprises oxide and the

modified part comprises oxide.

11. The method of forming a fin-shaped structure according to claim 9, wherein the treatment process comprises an oxidation process.
12. The method of forming a fin-shaped structure according to claim 11, wherein the treatment process comprises an oxygen gas-containing process or an *in-situ* steam generated (ISSG) process.
13. The method of forming a fin-shaped structure according to claim 9, wherein the removing process comprises an ammonia and nitrogen trifluoride containing etching process.
14. A method of forming a fin-shaped structure, comprising:
 - providing a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area;
 - forming a first gate across the first fin-shaped structure and a second gate across the second fin-shaped structure, wherein the first gate sequentially comprises a first dielectric layer and a first sacrificial gate covering the first fin-shaped structure, and the second gate sequentially comprises a second dielectric layer and a second sacrificial gate covering the second fin-shaped structure;
 - removing the first sacrificial gate and the second sacrificial gate, thereby exposing the first dielectric layer and the second dielectric layer;
 - covering a mask in the first area but exposing the second area;
 - performing a removing process to remove an external surface of a top part of the second fin-shaped structure; and
 - removing the mask.
15. The method of forming a fin-shaped structure according to claim 14, further comprising:

forming a dielectric layer covering the first fin-shaped structure and the second fin-shaped structure after the mask is removed.

16. The method of forming a fin-shaped structure according to claim 14, wherein the external surface of the top part of the second fin-shaped structure and the whole second dielectric layer are removed by the removing process.
17. The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer completely after the mask is removed.
18. The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer and the second dielectric layer completely before covering the mask.
19. The method of forming a fin-shaped structure according to claim 14, further comprising:
forming an isolation structure beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area respectively after the substrate is provided, wherein a top part of the isolation structure of the second area is also removed while the removing process is performed.
20. The method of forming a fin-shaped structure according to claim 14, wherein the removing process has no removing selectivity to the isolation structure and the second fin-shaped structure.

Title

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Background of the Invention

1. Field of the Invention

[0001] The present invention relates generally to a fin-shaped structure and method thereof, and more specifically to a fin-shaped structure which has a ladder-shaped cross-sectional profile, and a method thereof.

2. Description of the Prior Art

[0002] With increasing miniaturization of semiconductor devices, various multi-gate MOSFET devices have been developed. The multi-gate MOSFET is advantageous for the following reasons. Manufacturing processes of multi-gate MOSFET devices can be integrated into traditional logic device processes, and thus are more compatible. In addition, since the three-dimensional structure of the multi-gate MOSFET increases the overlapping area between the gate and the substrate, the channel region is controlled more effectively, which reduces drain-induced barrier lowering (DIBL) effect and short channel effect. Moreover, the channel region is longer for the same gate length, so the current between the source and the drain is increased.

[0003] Since transistors in different areas such as logic areas and input/output areas have different purposes, structures of these transistors should be tailored to suit their particular purposes. When forming the structures, electrical demands in each area should be considered.

Summary of the Invention

[0004] The present invention provides a fin-shaped structure and method thereof, which selectively forms fin-shaped structures having

ladder-shaped cross-sectional profile parts in some areas, so that fin-shaped structures of different heights and critical dimensions (CD) can be formed, in order to form transistors for each area that meet each area's specific electrical demands.

[0005] The present invention provides a fin-shaped structure including a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area, wherein the second fin-shaped structure includes a ladder-shaped cross-sectional profile part.

[0006] The present invention provides a method of forming a fin-shaped structure including the following steps. A substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area is provided. An isolation structure is filled beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area. A patterned mask is formed to cover the first area and expose the second area. A top part of the isolation structure of the second area is removed, to expose a first top part of the second fin-shaped structure. A treatment process is performed to modify an external surface of the first top part of the second fin-shaped structure, to form a modified part covering the first top part of the second fin-shaped structure. The patterned mask is removed. A removing process is performed to remove a part of the isolation structure and the modified part by the high removing selectivity to the first fin-shaped structure and the second fin-shaped structure, and the modified part and the isolation structure, to expose a top part of the first fin-shaped structure and a second top part of the second fin-shaped structure.

[0007] The present invention provides a method of forming a fin-shaped structure including the following steps. A substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area is provided. A first gate across

the first fin-shaped structure and a second gate across the second fin-shaped structure are formed, wherein the first gate sequentially includes a first dielectric layer and a first sacrificial gate covering the first fin-shaped structure, and the second gate sequentially includes a second dielectric layer and a second sacrificial gate covering the second fin-shaped structure. The first sacrificial gate and the second sacrificial gate are removed, thereby exposing the first dielectric layer and the second dielectric layer. A mask covers the first area and exposes the second area. A removing process is performed to remove an external surface of a top part of the second fin-shaped structure. The mask is then removed.

[0008] According to the above, the present invention provides a fin-shaped structure and method thereof, which covers a mask in a first area, and then removes an external surface of a top part of a second fin-shaped structure of a second area, so that the second fin-shaped structure having a ladder-shaped cross-sectional profile in the second area is formed. Hence, fin-shaped structures of different heights and critical dimensions can be formed, and thus transistors for each area can achieve required electrical requirements. The methods of removing the external surface of the top part of the second fin-shaped structure in the second area may include: a removing process is performed to directly remove the external surface of the top part of the second fin-shaped structure; or, a treatment process may be performed to modify the external surface of the top part of the second fin-shaped structure, and a removing process may be performed to remove the modified part.

[0009] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

Brief Description of the Drawings

[0010] FIGs.1-5 schematically depict a cross-sectional view of a

method of forming a fin-shaped structure according to a first embodiment of the present invention.

[0011] FIGs.6-10 schematically depict a cross-sectional view of a method of forming a fin-shaped structure according to a second embodiment of the present invention.

Detailed Description

[0012] FIGs.1-5 schematically depict a cross-sectional view of a method of forming a fin-shaped structure according to a first embodiment of the present invention. As shown in FIG.1, a substrate 110 is provided. The substrate 110 can be divided into a first area A and a second area B. In this embodiment, the first area A is a high voltage threshold (HVT) area while the second area B is a low voltage threshold (LVT) area, but this is not limited thereto. The first area A may be an input/output high voltage area while the second area B may be a logic area. For illustrating the present invention clearly, there are only two areas depicted in this embodiment, but the present invention can also be applied to three or more areas at the same time, depending upon practical requirements.

[0013] The substrate 110 has two first fin-shaped structures 112a in the first area A and two second fin-shaped structures 112b in the second area B. In this embodiment, two first fin-shaped structures 112a are formed in the first area A and two second fin-shaped structures 112b are formed in the second area B, but the number of the first fin-shaped structures 112a or the second fin-shaped structures 112b is not restricted thereto. In this embodiment, the first fin-shaped structures 112a and the second fin-shaped structures 112b have the same structure. A height h_1 of each of the first fin-shaped structures 112a is common to a height h_2 of each of the second fin-shaped structures 112b; a width w_1 of a top part of each of the first fin-shaped structures 112a is the same as a width w_2 of a top part of each of second fin-shaped structures 112b; and a pitch p_1 between a top part of each of the first fin-shaped structures 112a is the same as a pitch p_2 between a top part of each of the second

fin-shaped structures 112b. Therefore, when a selective treatment process is performed on one single area or on a plurality of areas, symmetric structures in these areas will receive the same influence and uniform structures can be formed. The pitch p1 between a top part of each of the first fin-shaped structures 112a may also be different from the pitch p2 between a top part of each of the second fin-shaped structures 112b.

[0014] More precisely, the method of forming the first fin-shaped structures 112a in the first area A and forming the second fin-shaped structures 112b in the second area B may include, but is not limited to, the following steps. A bulk bottom substrate (not shown) is provided. A hard mask layer (not shown) may be formed on the bulk bottom substrate (not shown) and is patterned to define the location of the first fin-shaped structures 112a and the second fin-shaped structures 112b in the bulk bottom substrate (not shown) by a sidewall image transfer process. An etching process is performed to form the first fin-shaped structures 112a and the second fin-shaped structures 112b. The first fin-shaped structures 112a and the second fin-shaped structures 112b located in the substrate 110 are then formed completely. In one embodiment, the hard mask layer (not shown) is removed after the first fin-shaped structures 112a and the second fin-shaped structures 112b are formed, and a tri-gate MOSFET can be formed in the following processes. There are three contact faces between the first fin-shaped structures 112a and the second fin-shaped structures 112b and the following formed dielectric layer functions as a carrier channel whose width is wider than a channel width in a conventional planar MOSFET. When a driving voltage is applied, the tri-gate MOSFET produces a double on-current compared to the conventional planar MOSFET. In another embodiment, the hard mask layer (not shown) is reserved to form a fin field effect transistor (Fin FET), which is another kind of multi-gate MOSFET. Due to the hard mask layer (not shown) being reserved in the fin field effect transistor, there are only two contact faces between the first fin-shaped structures 112a and the second fin-shaped structures 112b

and the following formed dielectric layer.

[0015] The present invention can also be applied to other semiconductor substrates. For example, a silicon-on-insulator substrate (not shown) is provided, and then a single crystalline silicon layer being a top part of the silicon-on-insulator substrate (not shown) is etched till an oxide layer being a middle part of the silicon-on-insulator substrate (not shown) is exposed.

[0016] Isolation structures 10a and 10b are filled beside the first fin-shaped structures 112a in the first area A and beside the second fin-shaped structures 112b in the second area B. The isolation structures 10a and 10b may be shallow trench isolation (STI) structures, and may include oxide, but are not limited thereto. In this embodiment, the isolation structures 10a and 10b are filled beside the first fin-shaped structures 112a in the first area A and beside the second fin-shaped structures 112b in the second area B simultaneously, and the isolation structures 10a and 10b have the same height. Therefore, symmetric structures are formed in the first area A and the second area B. As a selective treatment process is performed on one single area or on a plurality of areas, symmetric structures in these areas can receive the same influence and thus uniform structures can be formed. In another embodiment, the isolation structures 10a and 10b may have different heights and may be formed by different processes, depending upon practical requirements.

[0017] After the first fin-shaped structures 112a and the second fin-shaped structures 112b are formed, a doping process may be selectively performed to form wells in the first area A and the second area B or to change threshold voltages in the two areas.

[0018] A patterned mask 20a is then formed to cover the first area A but expose the second area B. As shown in FIG.1, a mask 20 blanket-covers the first area A and the second area B. A photoresist (not shown) is deposited and patterned to form a patterned photoresist

K1 on the mask 20, wherein the patterned photoresist K1 covers the first area A but exposes the second area B. Thereafter, an etching process is performed to remove the exposed mask 20 in the second area B, so a patterned mask 20a is formed only in the first area A. Then, the patterned photoresist K1 is removed, as shown in FIG.2. In this embodiment, the patterned mask 20a is a silicon nitride layer, but it is not limited thereto.

[0019] A removing process Q1 may be performed to remove a top part 10bt of the isolation structure 10b in the second area B, to form an isolation structure 10b1 and expose first top parts 112b1 of the second fin-shaped structures 112b, as shown in FIG.3. It is emphasized that, due to the patterned mask 20a blanket-covering the first area A, the isolation structure 10a and the first fin-shaped structures 112a are reserved completely without being removed. In this embodiment, the removing process Q1 may be an ammonia and nitrogen trifluoride containing etching process, which has a high etching selectivity to the isolation structure 10b and the second fin-shaped structures 112b; that is, the etching rate of the removing process Q1 to the isolation structure 10b is much larger than to the second fin-shaped structures 112b, so only the isolation structure 10b is removed without removing the second fin-shaped structures 112b. In another embodiment, the removing process Q1 may be other processes, but these processes must have high removing selectivity to the isolation structure 10b and the second fin-shaped structures 112b in order to remove a part of the isolation structure 10b and expose a part of the second fin-shaped structures 112b.

[0020] As shown in FIG.4, a treatment process Q2 is performed to modify an external surface T1 of a first top part 112b1 of each of the second fin-shaped structures 112b, thereby a modified part 120 covering the first top part 112b1 of each of the second fin-shaped structures 112b is formed. In this embodiment, due to the isolation structures 10a and 10b being composed of oxide, the modified parts 120 are preferably composed of oxide, for being removed together with the isolation

structures 10a and 10b in later processes. The treatment process Q2 is preferably an oxidation process, which may be an oxygen gas-containing process or an *in situ* steam generation (ISSG) process.

[0021] After the modified parts 120 are formed, the patterned mask 20a is removed, as shown in FIG.5. Thereafter, a removing process Q3 is performed to remove the modified parts 120 and a part of the isolation structures 10a and 10b1 simultaneously, to form a top part 112a1 of each of the first fin-shaped structures 112a and a second top part 112b2 of each of the second fin-shaped structures 112b. In this embodiment, the modified parts 120 and the part of the isolation structures 10a and 10b1 are removed simultaneously without removing the first fin-shaped structures 112a and the second fin-shaped structures 112b by the high removing selectivity of the removing process Q3 to the first fin-shaped structures 112a and the second fin-shaped structures 112b, and the modified part 120 and the isolation structures 10a and 10b1.

[0022] Each of the second fin-shaped structures 112b having a ladder-shaped cross-sectional profile part C1 can be formed while reserving the original first fin-shaped structures 112a. The ladder-shaped cross-sectional profile part C1 has a bending angle θ_1 , which is preferably larger than or equal to 90° . It is emphasized that a specific following structure is formed by applying the method of forming a fin-shaped structure of the present invention. The width w_1 of the top part of each of the first fin-shaped structures 112a is larger than a width w_3 of a top part of each of the second fin-shaped structures 112b. The pitch p_1 of the top part between each of the first fin-shaped structures 112a is less than a pitch p_3 of a top part between each of the second fin-shaped structures 112b. The ladder-shaped cross-sectional profile part C1 of each of the second fin-shaped structures 112b is higher than a top surface T2 of the isolation structure 10b1. A top surface T3 of the isolation structure 10a in the first area A is higher than the top surface T2 of the isolation structure 10b1 in the second area B. A height h_3 of each

of the first fin-shaped structures 112a protruding from the isolation structure 10a is lower than a height h_4 of each of the second fin-shaped structures 112b protruding from the isolation structure 10b1. The height h_1 of each of the first fin-shaped structures 112a protruding from the substrate 110 is higher than a height h_5 of each of the second fin-shaped structures 112b protruding from the substrate 110.

[0023] Thereafter, processes such as forming gates or transistors may be performed. For instance, a gate may be formed across the first fin-shaped structures 112a of the first area A and the second fin-shaped structures 112b of the second area B respectively; a source/drain may be formed in the first fin-shaped structures 112a and the second fin-shaped structures 112b beside the gates respectively; and an interdielectric layer may be formed to cover the gates, the first fin-shaped structures 112a and the second fin-shaped structures 112b.

[0024] The first fin-shaped structures 112a and the second fin-shaped structures 112b having ladder-shaped cross-sectional profile parts C1 are formed and then the gates are formed on the first fin-shaped structures 112a and the second fin-shaped structures 112b, thereby the whole second fin-shaped structures 112b of the second area B have a ladder-shaped cross-sectional profile parts C1 in the first embodiment.

[0025] A second embodiment is presented in the following. Common first fin-shaped structures and second fin-shaped structures are formed firstly and gates are formed across the first fin-shaped structures and the second fin-shaped structures, and then parts of the first fin-shaped structures and the second fin-shaped structures are exposed to form the second fin-shaped structures having ladder-shaped cross-sectional profile parts by applying the present invention. In this way, only the parts of the second fin-shaped structure right below the gates have the ladder-shaped cross-sectional profile parts.

[0026] FIGS.6-10 schematically depict a cross-sectional view of a method of forming a fin-shaped structure according to a second embodiment of the present invention. As shown in FIG.6, a substrate 110 is provided. The substrate 110 can be divided into a first area A and a second area B. In this embodiment, two first fin-shaped structures 212a are formed in the first area A and two second fin-shaped structures 212b are formed in the second area B, but the number of the first fin-shaped structures 212a or the second fin-shaped structures 212b is not restricted thereto. As in the first embodiment, the first fin-shaped structures 212a and the second fin-shaped structures 212b are common structures. Therefore, symmetric structures are formed in the first area A and the second area B. When a selective treatment process performed on one single area or on a plurality of areas, symmetric structures in these areas can receive the same influence and thus uniform structures can be formed. The methods of forming the first fin-shaped structures 212a and the second fin-shaped structures 212b which are common to those of the first embodiment are not described herein.

[0027] Isolation structures 30a and 30b are filled beside the first fin-shaped structures 212a in the first area A and beside the second fin-shaped structures 212b in the second area B respectively. The isolation structures 30a and 30b may be shallow trench isolation (STI) structures, and may include oxide. In this embodiment, the isolation structures 10a and 10b are filled beside the first fin-shaped structures 212a in the first area A and beside the second fin-shaped structures 212b in the second area B simultaneously, therefore the isolation structures 30a and 30b will have the same height. Symmetric structures are formed in the first area A and the second area B. When a selective treatment process is performed on one single area or on a plurality of areas, symmetric structures in these areas can receive the same influence and thus uniform structures can be formed. In another embodiment, the isolation structures 30a and 30b may have different heights and may be formed by different processes, depending upon practical requirements. Moreover, after the first fin-shaped

structures 212a and the second fin-shaped structures 212b are formed, a doping process may be selectively performed to form wells in the first area A and the second area B respectively or to change threshold voltages in the two areas.

[0028] A first gate 220a is formed across the first fin-shaped structures 212a of the first area A and a second gate 220b is formed across the second fin-shaped structures 212b of the second area B. More precisely, the first gate 220a may include a first dielectric layer 222a and a first sacrificial gate 224a from bottom to top to cover the first fin-shaped structures 212a, and the second gate 220b may include a second dielectric layer 222b and a second sacrificial gate 224b from bottom to top to cover the second fin-shaped structures 220b. Spacers 230a and 230b may be formed on the isolation structures 30a and 30b beside the first gate 220a and the second gate 220b respectively. Interdielectric layers 240a and 240b may be formed to blanket the substrate 110 beside the first gate 220a and the second gate 220b. In this embodiment, the first dielectric layer 222a and the second dielectric layer 222b may be oxide layers, the first sacrificial gate 224a and the second sacrificial gate 224b may be polysilicon gates, the spacers 230a and 230b may be nitride spacers, and the interdielectric layers 240a and 240b may be oxide layers, but this is not limited thereto. The methods of forming the first gate 220a and the second gate 220b, the spacers 230a and 230b and the interdielectric layers 240a and 240b are known in the art, and are not described herein.

[0029] An etching process may be performed to remove the first sacrificial gate 224a and the second sacrificial gate 224b and expose the first dielectric layer 222a and the second dielectric layer 222b, to thereby form recesses R1 and R2 in the first area A and the second area B respectively, as shown in FIG.7.

[0030] As shown in FIG.8, a mask K2 is formed to cover only the first area A but expose the second area B. In this embodiment, the mask

K2 fills the recess R1 of the first area A. FIGs.7-8 illustrate a removing process Q4 being performed to remove an external surface S1 of a top part of each of the second fin-shaped structures 212b (as shown in FIG.7), to form second fin-shaped structures 212b' having ladder-shaped cross-sectional profile parts C2, wherein the ladder-shaped cross-sectional profile parts C2 have a bending angle θ_2 , and the bending angle θ_2 is preferably larger than or equal to 90° . In this embodiment, the second dielectric layer 222b and the top part 30bt of the isolation structure 30b below the second dielectric layers 222b are removed as the removing process Q4 is performed to remove the external surfaces S1 of the second fin-shaped structures 212b. An isolation structure 30b1 is formed, and a top surface T4 of the isolation structure 30b1 at the bottom of the recess R2 is lower than a top surface T5 of isolation structure 30b1 beside the recess R2, and even lower than a top surface T6 of the isolation structure 30a in the first area A, depending upon the etchants of the removing process Q4 and a desired formed structure. In another embodiment, modified parts may be formed from the top parts of the second fin-shaped structures 212b as described in the first embodiment, and then the modified parts are removed.

[0031] It is emphasized that, since the second dielectric layer 222b and the second fin-shaped structures 212b below the second dielectric layer 222b are removed by the removing process Q4, the removing process Q4 has non-removing selectivity to the second dielectric layer 222b and the second fin-shaped structures 212b. This means the removing rate of the removing process Q4 to the second dielectric layer 222b is equal to that of the second fin-shaped structures 212b. In one case, the removing process Q4 may be a fluorine containing process. Since the second dielectric layer 222b is an oxide layer and the isolation structure 30b is composed of oxide, a part of the isolation structure 30b in the recess R2 is also removed when the removing process Q4 for removing the second dielectric layer 222b is performed.

[0032] After the second fin-shaped structures 212b' having

ladder-shaped cross-sectional profile parts C2 are formed, the mask K2 and the first dielectric layer 222a in the first area A are removed, as shown in FIG.9. In this embodiment, the mask K2 may be removed by an O₂ stripping process, and the first dielectric layer 222a may be removed by an ammonia and nitrogen trifluoride containing etching process, but this is not limited thereto. As shown in FIG.10, dielectric layers 250a and 250b cover the first fin-shaped structures 212a and the second fin-shaped structures 212b' respectively. The dielectric layers 250a and 250b may be formed by the same process and have the same thickness, or may be formed by different processes or materials to have different thicknesses. For instance, the first area A is a high voltage threshold (HVT) area while the second area B is a low voltage threshold (LVT) area, so the thickness of the dielectric layer 250a of the first area A is larger than the thickness of the dielectric layer 250b of the second area B; or, the materials of the dielectric layers 250a and 250b may be different, enabling the dielectric layer 250a to have the capability of preventing high voltages while the dielectric layer 250b has lower Equivalent Oxide Thickness (EOT).

[0033] In this embodiment, the first dielectric layer 222a is removed and then the dielectric layers 250a and 250b are reformed. In other embodiments, the first dielectric layer 222a may not be removed while the dielectric layers 250a and 250b are formed directly on the first dielectric layer 222a; or, only the dielectric layer 250b in the second area B is formed. As shown in FIGs.8-9, the mask K2 is formed, and the first dielectric layer 222a is then removed completely in this embodiment. In another embodiment, the first dielectric layer 222a and the second dielectric layer 222b may be removed before the mask K2 is formed.

[0034] To summarize, the present invention provides a fin-shaped structure and method thereof, which covers a mask in a first area, and then removes an external surface of a top part of a second fin-shaped structure of a second area, so that a part, or all, of

the second fin-shaped structures in the second area having ladder-shaped cross-sectional profiles can be formed. Hence, fin-shaped structures having different heights and critical dimensions can be formed in different areas, and thus transistors for each area can achieve their electrical requirements.

[0035] The methods of removing the external surface of the top part of the second fin-shaped structure in the second area after covering the mask in the first area may include: performing a removing process to directly remove the external surface of the top part of the second fin-shaped structure, wherein the removing process has non-removing selectivity to the second fin-shaped structure and materials except for those above the second fin-shaped structure such as dielectric layers or isolation structures, to remove them. In addition, a treatment process may be performed to modify the external surface of the top part of the second fin-shaped structure in the second area, and then the removing process is performed to remove the modified part, wherein the removing process has high removing selectivity to the modified part and the original second fin-shaped structure, so that the modified part can be removed without removing the second fin-shaped structure.

[0036] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method 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.

Electronic Patent Application Fee Transmittal				
Application Number:				
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First Named Inventor/Applicant Name:		Wen-Jiun Shen		
Filer:		Winston Hsu/Hitomi Lin		
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Utility application filing	1011	1	280	280
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Utility Examination Fee	1311	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

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File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Application Data Sheet	2076551.PDF	1671638	no	9
			a48ec02c5ab1e2385f0cb07cd918f1761e2a441		
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	2076546.PDF	26774	no	3
			cdc0751c7d3770a15c3e1d431b5232cbfbc077de		
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3	Authorization to access Appl. by Trilateral Office	2076545.PDF	37768	no	1
			402fe3b40a696e81cffe7592ad3203d7e80fe4f		
Warnings:					
Information:					
4	Oath or Declaration filed	2076544.PDF	610618	no	16
			873679b489c8d454c41471ca90b09531ad427fc8		
Warnings:					
Information:					
5	Power of Attorney	2076543.pdf	3107522	no	19
			1ab6cf7876e9337774fd3a86f8ce804e7bde3c68		
Warnings:					
Information:					
6	Drawings-only black and white line drawings	2076377.PDF	90818	no	5
			bd1e3a42d8e63f45e3d91217ea6c2988d1334829		
Warnings:					
Information:					
7	Abstract	2076376.PDF	24508	no	1
			dc1cf4392410ae22e92d478f28a07ea34cbc109a		
Warnings:					
Information:					

8	Claims	2076374.PDF	60617 bf0d4d1582088a1c5e194698be2c2f09e0c b4773	no	4
Warnings:					
Information:					
9	Specification	2076373.PDF	89780 0f67d808a2a552e98be1115993ac211d6c6 c18a6	no	14
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	32890 e17b1e3552a0a373c63ba2eace504390d75 a99b0	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			5752933		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		
<p>The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.</p> <p>This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.</p>			

Secrecy Order 37 CFR 5.2

☐	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	
	Wen-Jiun		Shen		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Yunlin County	Country of Residence i	TW		
Mailing Address of Inventor:					
Address 1		No.50, Kaixuan St., Douliu City			
Address 2					
City	Yunlin County	State/Province			
Postal Code		Country i	TW		
Inventor 2					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Ssu-I		Fu		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Kaohsiung City	Country of Residence i	TW		
Mailing Address of Inventor:					
Address 1		No.48-2, Yuliao Rd., Yuliao Vil., Qiaotou Dist.			
Address 2					
City	Kaohsiung City	State/Province			
Postal Code		Country i	TW		
Inventor 3					Remove
Legal Name					

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yen-Liang		Wu	
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				

City	Taipei City	Country of Residence i	TW
------	-------------	------------------------	----

Mailing Address of Inventor:

Address 1	4F.-1, No.61, Sec. 1, Heping W. Rd.		
Address 2			
City	Taipei City	State/Province	
Postal Code		Country i	TW

Inventor 4	Remove
------------	------------------------

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Chia-Jong		Liu	

Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
---	--	--	--	--

City	Ping-Tung County	Country of Residence i	TW
------	------------------	------------------------	----

Mailing Address of Inventor:

Address 1	No.71, Nanxing Rd., Gaoshu Vil., Gaoshu Township		
Address 2			
City	Ping-Tung County	State/Province	
Postal Code		Country i	TW

Inventor 5	Remove
------------	------------------------

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yu-Hsiang		Hung	

Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service				
---	--	--	--	--

City	Tainan City	Country of Residence i	TW
------	-------------	------------------------	----

Mailing Address of Inventor:

Address 1	No.18-2, Aly. 39, Ln. 174, Anchang St., Annan Dist.		
Address 2			
City	Tainan City	State/Province	
Postal Code		Country i	TW

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		

Inventor 6					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Chung-Fu		Chang		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Tainan City	Country of Residence i	TW		

Mailing Address of Inventor:

Address 1	No.38, Aly. 2, Ln. 88, Dongqiao 10th St., Yongkang Dist.				
Address 2					
City	Tainan City	State/Province			
Postal Code		Country i	TW		

Inventor 7					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Man-Ling		Lu		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Taoyuan County	Country of Residence i	TW		

Mailing Address of Inventor:

Address 1	No.11, Ziqiang S. Rd., Guishan Township				
Address 2					
City	Taoyuan County	State/Province			
Postal Code		Country i	TW		

Inventor 8					Remove
Legal Name					
Prefix	Given Name	Middle Name	Family Name	Suffix	
	Yi-Wei		Chen		
Residence Information (Select One) ☐ US Residency ☒ Non US Residency ☐ Active US Military Service					
City	Taichung City	Country of Residence i	TW		

Mailing Address of Inventor:

Address 1	No.159, Zhenzheng Rd., Dajia Dist.				
Address 2					

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		
City	Taichung City	State/Province	
Postal Code		Country i	TW
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	27765		
Email Address	scottmargo@naipo.com	Add Email	Remove Email

Application Information:

Title of the Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		
Attorney Docket Number	NAUP2310USA	Small Entity Status Claimed ☐	
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	5	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 i	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ Request Not to Publish. I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

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	NAUP2310USA								
		Application Number									
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF										
<p>Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.</p>											
<table border="1"> <tr> <td>Please Select One:</td> <td>☒ Customer Number</td> <td>☐ US Patent Practitioner</td> <td>☐ Limited Recognition (37 CFR 11.9)</td> </tr> <tr> <td>Customer Number</td> <td colspan="3">27765</td> </tr> </table>				Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)	Customer Number	27765		
Please Select One:	☒ Customer Number	☐ US Patent Practitioner	☐ Limited Recognition (37 CFR 11.9)								
Customer Number	27765										

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this 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 blank.

Prior Application Status		Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the Add button.			Add

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(d). When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(h)(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 ^j (if applicable)
201410454915.X	CN	2014-09-09	
Additional Foreign Priority Data may be generated within this form by selecting the Add button.			Add

Application Data Sheet 37 CFR 1.76		Attorney Docket Number	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		

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

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

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices
<p>If 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 World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.</p> <p>In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.</p> <p>In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.</p>

Applicant Information:

<p>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.</p>
--

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		

Applicant 1			Remove	
<p>If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.</p>				
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 : <input type="text"/>				
If the Applicant is an Organization check here. ☒				
Organization Name	UNITED MICROELECTRONICS CORP.			
Mailing Address Information:				
Address 1	No.3, Li-Hsin Road 2,			
Address 2	Science-Based Industrial Park			
City	Hsin-Chu City	State/Province		
Country ⁱ	TW	Postal Code		
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:

<p>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.</p>	
Assignee 1	
<p>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.</p>	
Remove	
<p>If the Assignee or Non-Applicant Assignee is an Organization check here. ☐</p>	

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	NAUP2310USA
		Application Number	
Title of Invention	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		

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			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button.

Add

Signature:

Remove

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications					
Signature	/Scott Margo/		Date (YYYY-MM-DD)	2014-10-08	
First Name	Scott	Last Name	Margo	Registration Number	56277
Additional Signature may be generated within this form by selecting the Add button.				Add	

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

Privacy Act Statement

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

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

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 14/512,475		
APPLICATION AS FILED - PART I <div style="display: flex; justify-content: space-between; font-size: small;"> (Column 1) (Column 2) </div>								
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)	OR	RATE(\$)	FEE(\$)	
BASIC FEE <small>(37 CFR 1.16(a), (b), or (c))</small>	N/A	N/A	N/A			N/A	280	
SEARCH FEE <small>(37 CFR 1.16(k), (i), or (m))</small>	N/A	N/A	N/A			N/A	600	
EXAMINATION FEE <small>(37 CFR 1.16(o), (p), or (q))</small>	N/A	N/A	N/A			N/A	720	
TOTAL CLAIMS <small>(37 CFR 1.16(i))</small>	20	minus 20 = *			OR	x 80 =	0.00	
INDEPENDENT CLAIMS <small>(37 CFR 1.16(h))</small>	3	minus 3 = *				x 420 =	0.00	
APPLICATION SIZE FEE <small>(37 CFR 1.16(s))</small>	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$310 (\$155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00	
MULTIPLE DEPENDENT CLAIM PRESENT <small>(37 CFR 1.16(j))</small>							0.00	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1600	
APPLICATION AS AMENDED - PART II <div style="display: flex; justify-content: space-between; font-size: x-small;"> (Column 1) (Column 2) (Column 3) </div>								
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	OR	RATE(\$)	ADDITIONAL FEE(\$)
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =	OR	x =	
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =	OR	x =	
	Application Size Fee <small>(37 CFR 1.16(s))</small>					OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>					OR		
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	OR	RATE(\$)	ADDITIONAL FEE(\$)
	Total <small>(37 CFR 1.16(i))</small>	*	Minus **	=	x =	OR	x =	
	Independent <small>(37 CFR 1.16(h))</small>	*	Minus ***	=	x =	OR	x =	
	Application Size Fee <small>(37 CFR 1.16(s))</small>					OR		
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM <small>(37 CFR 1.16(j))</small>					OR		
			TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.								



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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
14/512,475	10/13/2014	2812	1600	NAUP2310USA	20	3

CONFIRMATION NO. 5891

27765
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
P.O. BOX 506
MERRIFIELD, VA 22116

FILING RECEIPT



OC000000071402699

Date Mailed: 10/21/2014

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)

Wen-Jiun Shen, Yunlin County, TAIWAN;
Ssu-I Fu, Kaohsiung City, TAIWAN;
Yen-Liang Wu, Taipei City, TAIWAN;
Chia-Jong Liu, Ping-Tung County, TAIWAN;
Yu-Hsiang Hung, Tainan City, TAIWAN;
Chung-Fu Chang, Tainan City, TAIWAN;
Man-Ling Lu, Taoyuan County, TAIWAN;
Yi-Wei Chen, Taichung City, TAIWAN;

Applicant(s)

UNITED MICROELECTRONICS CORP., Hsin-Chu City, TAIWAN

Power of Attorney: The patent practitioners associated with Customer Number 27765

Domestic Applications for which benefit is claimed - None.

A proper domestic benefit claim must be provided in an Application Data Sheet in order to constitute a claim for domestic benefit. See 37 CFR 1.76 and 1.78.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

CHINA 201410454915.X 09/09/2014

Permission to Access - A proper **Authorization to Permit Access to Application by Participating Offices** (PTO/SB/39 or its equivalent) has been received by the USPTO.

Request to Retrieve - This application either claims priority to one or more applications filed in an intellectual property Office that participates in the Priority Document Exchange (PDX) program or contains a proper **Request to Retrieve Electronic Priority Application(s)** (PTO/SB/38 or its equivalent). Consequently, the USPTO will attempt to electronically retrieve these priority documents.

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FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Preliminary Class

438

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Priority Document for

证 明

USA Appl. No. 14/512,475

本证明之附件是向本局提交的下列专利申请文件副本。

请 号: 201410454915.X

类 型: 发明专利

发 造 名称: 鳍状结构及其制造方法

申 日: 2014年09月09日

申 人: 联华电子股份有限公司

发明 计人: 沈文骏、傅思逸、吴彦良、刘家荣、洪裕祥、张仲甫、吕曼绫、陈意维

局长

申长雨

申长雨

2014 年 09 月 15 日



权 利 要 求 书

1. 一种鳍状结构, 包含有:

5 基底, 具有第一鳍状结构, 位于一第一区; 以及第二鳍状结构, 位于一第二区, 其中该第二鳍状结构包含一阶梯状的剖面结构部分。

2. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构的顶部宽度大于该第二鳍状结构的顶部宽度。

3. 如权利要求 1 所述的鳍状结构, 还包含:

10 绝缘结构, 分别设置于该第一区的该第一鳍状结构侧边以及该第二区的该第二鳍状结构侧边, 且该阶梯状的剖面结构部分高于该绝缘结构的一顶面。

4. 如权利要求 1 所述的鳍状结构, 其中位于该第一区的该绝缘结构的一顶面高于位于该第二区的该绝缘结构的一顶面。

15 5. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构突出于该绝缘结构的一高度, 小于该第二鳍状结构突出于该绝缘结构的一高度。

6. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构突出于该基底的一高度, 大于该第二鳍状结构突出于该基底的一高度。

7. 如权利要求 1 所述的鳍状结构, 还包含:

20 多个该第一鳍状结构以及多个该第二鳍状结构, 且各该第一鳍状结构的顶部之间的间距小于各该第二鳍状结构的顶部之间的间距。

8. 如权利要求 1 所述的鳍状结构, 其中该第一区包含一高临界电压 (high voltage threshold, HVT) 区以及该第二区包含一低临界电压 (low voltage threshold, LVT) 区。

9. 一种形成鳍状结构的方法, 包含有:

25 提供一基底, 具有第一鳍状结构, 位于一第一区; 以及第二鳍状结构位于一第二区;

分别填入一绝缘结构于该第一区的该第一鳍状结构侧边以及该第二区的该第二鳍状结构侧边;

形成一图案化掩模, 覆盖该第一区但暴露出该第二区;

30 移除该第二区的该绝缘结构的一顶部, 因而暴露出该第二鳍状结构的第一顶部;





进行一处理制作工艺，将该第二鳍状结构的该第一顶部的一外表面改质，因而形成一改质部，覆盖该第二鳍状结构的该第一顶部；

移除该图案化掩模；以及

- 5 进行一移除制作工艺，经由对于该第一鳍状结构以及该第二鳍状结构与对于该改质部以及该绝缘结构的高移除选择比，而移除该绝缘结构的一部分以及该改质部，因而暴露出该第一鳍状结构的一顶部以及该第二鳍状结构的一第二顶部。

10. 如权利要求 9 所述的形成鳍状结构的方法，其中该绝缘结构包含氧化物，且该改质部包含氧化物。

- 10 11. 如权利要求 9 所述的形成鳍状结构的方法，其中该处理制作工艺包含一氧化制作工艺。

12. 如权利要求 11 所述的形成鳍状结构的方法，其中该处理制作工艺包含一含氧气的制作工艺或一原位蒸汽产生制作工艺。

- 15 13. 如权利要求 9 所述的形成鳍状结构的方法，其中该移除制作工艺包含一含氮及三氟化氮的蚀刻制作工艺。

14. 一种形成鳍状结构的方法，包含有：

提供一基底，具有第一鳍状结构，位于一第一区；以及第二鳍状结构位于一第二区；

- 20 形成一第一栅极跨设该第一鳍状结构，以及一第二栅极跨设该第二鳍状结构，其中该第一栅极依序包含一第一介电层以及一第一牺牲栅极覆盖该第一鳍状结构，且该第二栅极依序包含一第二介电层以及一第二牺牲栅极覆盖该第二鳍状结构；

移除该第一牺牲栅极以及该第二牺牲栅极，因而暴露出该第一介电层以及该第二介电层；

- 25 覆盖一掩模于该第一区但暴露出该第二区；
进行一移除制作工艺，移除该第二鳍状结构的一顶部的一外表面；以及移除该掩模。

15. 如权利要求 14 所述的形成鳍状结构的方法，在移除掩模之后，还包含：

- 30 形成一介电层覆盖该第一鳍状结构以及该第二鳍状结构。

16. 如权利要求 14 所述的形成鳍状结构的方法，其中该移除制作工艺完





完全移除该第一介电层。

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完全移除该第一介电层以及该第二介电层。

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20. 如权利要求 14 所述的形成鳍状结构的方法, 其中该移除制作工艺对于该绝缘结构以及该第二鳍状结构无移除选择比。

5 技术领域

背景技术

随着半导体元件尺寸的缩小,维持小尺寸半导体元件的效能是目前业界的主要目标。为了提高半导体元件的效能,目前已逐渐发展出各种多栅极场效晶体管元件(multi-gate MOSFET)。多栅极场效晶体管元件包含以下几项优点。首先,多栅极场效晶体管元件的制作工艺能与传统的逻辑元件制作工艺整合,因此具有相当的制作工艺相容性;其次,由于立体结构增加了栅极与基底的接触面积,因此可增加栅极对于通道区域电荷的控制,从而降低小尺寸元件带来的漏极引发的能带降低(Drain Induced Barrier Lowering, DIBL)效应以及短通道效应(short channel effect);此外,由于同样长度的栅极具有更大的通道宽度,因此也可增加源极与漏极间的电流量。

更进一步而言,由于位于不同区域,例如逻辑电路区以及输出/输入高压电路区,的晶体管用途不同,其所需的立体结构应当不相同,才能达到个别所需的电性要求。因此,如何在各别区域分别形成能符合该区域的电性要求的立体结构,已为当今产业的一重要议题。

发明内容

25 本发明的目的在于提出一种鳍状结构及其方法，其选择性地在部分区域形成具有阶梯状的剖面结构的鳍状结构，以能分别在各区域形成具有不同高度以及临界尺寸（critical dimension, CD）的鳍状结构，因而能形成符合各区域的电性要求的晶体管。

为达上述目的，本发明提供一种鳍状结构，包含有一基底，具有一第一鳍状结构位于一第一区，以及一第二鳍状结构位于一第二区，其中第二鳍状结构包含一阶梯状的剖面结构部分。



5 续之，移除第二区的绝缘结构的一顶部，因而暴露出第二鳍状结构的第一顶部。继之，进行一处理制作工艺，将第二鳍状结构的第一顶部的一外表面改质，因而形成一改质部，覆盖第二鳍状结构的第一顶部。而后，移除图案化掩模。其后，进行一移除制作工艺，经由对于第一鳍状结构以及第二鳍状结构对于改质部以及绝缘结构的高移除选择比，而移除绝缘结构的一部分以及改质部，因而暴露出第一鳍状结构的一顶部以及第二鳍状结构的一第二顶部。

本发明提供一种形成鳍状结构的方法，包含有下述步骤。首先，提供一基底，具有一第一鳍状结构位于一第一区，以及一第二鳍状结构位于一第二区。接续，形成一第一栅极跨设第一鳍状结构，以及一第二栅极跨设第二鳍状结构，其中第一栅极依序包含一第一介电层以及一第一牺牲栅极覆盖第一鳍状结构，且第二栅极依序包含一第二介电层以及一第二牺牲栅极覆盖第二鳍状结构。续之，移除第一牺牲栅极以及第二牺牲栅极，因而暴露出第一介电层以及第二介电层。继之，覆盖一掩模于第一区但暴露出第二区。而后，进行一移除制作工艺，移除第二鳍状结构的一顶部的一外表面。之后，移除掩模。

基于上述,本发明提出一种鳍状结构及其方法,其先以掩模覆盖第一区,再移除第二区的第二鳍状结构的顶部的外表面,因而能仅在第二区形成具有阶梯状的剖面结构的第二鳍状结构,进而能分别在不同区域形成具有不同高度以及临界尺寸的鳍状结构,使能形成符合各区域的电性要求的晶体管。再者,移除第二区的第二鳍状结构顶部的外表面的方法可包含:直接进行移除制作工艺移除部分的第二区的第二鳍状结构的顶部的外表面;或者,先进行处理制作工艺将第二区的第二鳍状结构的顶部的外表面改质,再进行移除制作工艺移除改质的部分。

30 附图说明

图 1-图 5 为本发明一第一实施例的形成鳍状结构的方法的剖面示意图:



图 6-图 10 为本发明一第二实施例的形成鳍状结构的方法的剖面示意图。

主要元件符号说明

10a、10b、10b1、30a、30b、30b1: 绝缘结构

10bt、112a1、212b1、30bt: 顶部

5 20、K2: 掩模

20a: 图案化掩模

110: 基底

112a、212a: 第一鳍状结构

112b、212b、212b': 第二鳍状结构

10 112b1: 第一顶部

112b2: 第二顶部

120: 改质部

220a: 第一栅极

220b: 第二栅极

15 222a: 第一介电层

222b: 第二介电层

224a: 第一牺牲栅极

224b: 第二牺牲栅极

230a、230b: 间隙壁

20 240a、240b: 层间介电层

250a、250b: 介电层

A: 第一区

B: 第二区

C1、C2: 阶梯状的剖面结构部分

25 K1: 图案化光致抗蚀剂

Q1、Q3、Q4: 移除制作工艺

Q2: 处理制作工艺

R1、R2: 凹槽

S1: 外表面

30 T1: 外表面

T2、T3、T4、T5、T6: 顶面



θ_1, θ_2 : 弯曲角度

具体实施方式

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此外，在形成第一鳍状结构 112a 以及第二鳍状结构 112b 之后，可选择性进行一掺杂制作工艺等，以分别于第一区 A 以及第二区 B 中形成井(Well)或者改变二区的临界电压。

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图 6-图 10 绘示本发明一第二实施例的形成鳍状结构的方法的剖面示意图。如图 6 所示，形成一基底 110，可分为一第一区 A 以及一第二区 B。基

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及第二介电层 222b 为氧化层, 第一牺牲栅极 224a 以及第二牺牲栅极 224b 为多晶硅栅极, 间隙壁 230a 及 230b 可由氮化硅所组成, 层间介电层 240a 及 240b 为氧化层, 但本发明不以此为限。详细而言, 形成第一栅极 220a 以及一第二栅极 220b, 形成间隙壁 230a 及 230b, 形成层间介电层 240a 及 240b 的方法为本领域所熟知, 故不再赘述。

接着, 可例如以蚀刻等制作工艺移除第一牺牲栅极 224a 以及第二牺牲栅极 224b, 并暴露出第一介电层 222a 以及第二介电层 222b, 而分别于第一区 A 及第二区 B 中形成凹槽 R1 及 R2, 如图 7 所示。

如图 8 所示, 仅覆盖一掩模 K2 于第一区 A 但暴露出第二区 B。在本实施例中, 掩模 K2 则全面填满第一区 A 的凹槽 R1, 但本发明不以此为限。然后, 请同时参阅图 7-图 8, 进行一移除制作工艺 Q4, 移除第二鳍状结构 212b (如图 7 所示) 的一顶部 212b1 的一外表面 S1, 而形成一第二鳍状结构 212b', 其具有一阶梯状的剖面结构部分 C2, 其中阶梯状的剖面结构部分 C2 有一明显的弯曲角度 θ_2 , 而此弯曲角度 θ_2 优选大于或等于 90° 。在本实施例中, 在进行移除制作工艺 Q4 移除第二鳍状结构 212b 的外表面 S1 时, 可一并完全移除第二区 B 中暴露出的第二介电层 222b 以及位于第二介电层 222b 下方的绝缘结构 30b 的一顶部 30bt, 如此, 会形成一绝缘结构 30b1, 其在凹槽 R2 的底端的一顶面 T4 会低于凹槽 R2 外的一顶面 T5, 甚至是第一区 A 中的绝缘结构 30a 的一顶面 T6, 但本发明不以此为限, 视移除制作工艺 Q4 的蚀刻剂等参数以及所需结构而定。例如, 在其他实施例中, 也可改以第一实施例的于第二鳍状结构 212b 的顶部形成改质部, 再以移除选择比移除改质部的方法。

在此强调, 由于本实施例的移除制作工艺 Q4 必须同时移除第二介电层 222b 以及位于第二介电层 222b 下方的部分的第二鳍状结构 212b, 故移除制作工艺 Q4 对于第二介电层 222b 以及第二鳍状结构 212b 无移除选择比。意即, 本实施例的移除制作工艺 Q4 对于第二介电层 222b 的移除率与对于第二鳍状结构 212b 的移除率实质上相等。在一例中, 移除制作工艺 Q4 可例如为一含氟的蚀刻制作工艺, 但本发明不以此为限。再者, 由于第二介电层 222b 为一氧化层, 且绝缘结构 30b 也由氧化物组成, 故进行可移除第二介电层 222b 的移除制作工艺 Q4 时, 也会移除部分的凹槽 R2 中的绝缘结构 30b。

其后, 在形成具有一阶梯状的剖面结构部分 C2 的第二鳍状结构 212b'







化与修饰，都都应属本发明的涵盖范围。

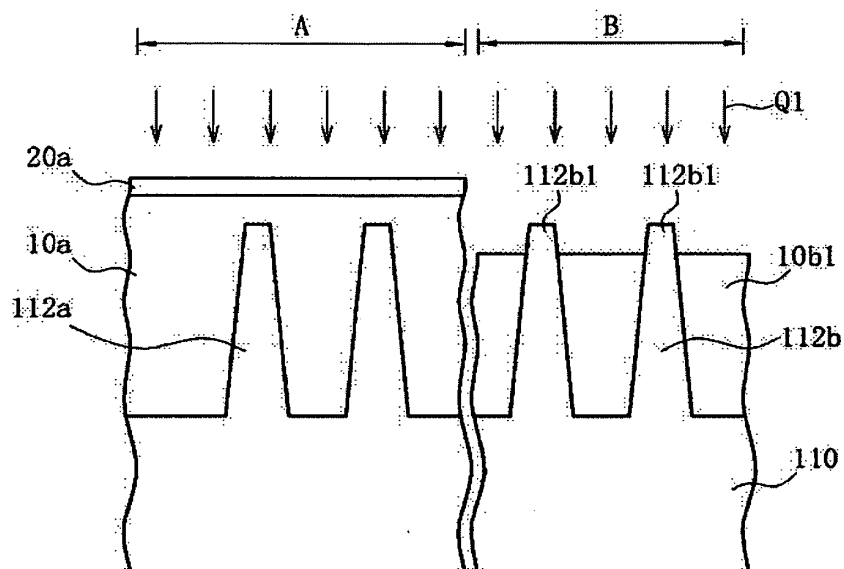


图 3

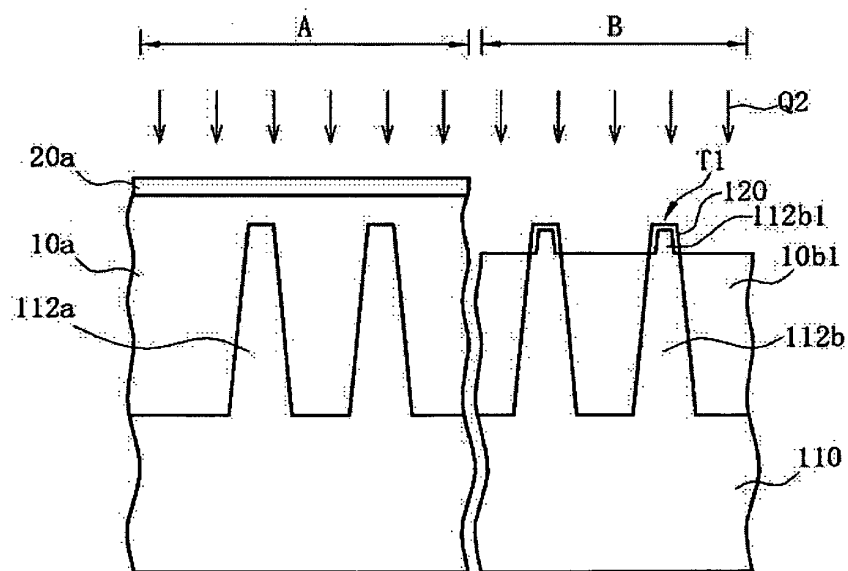


图 4



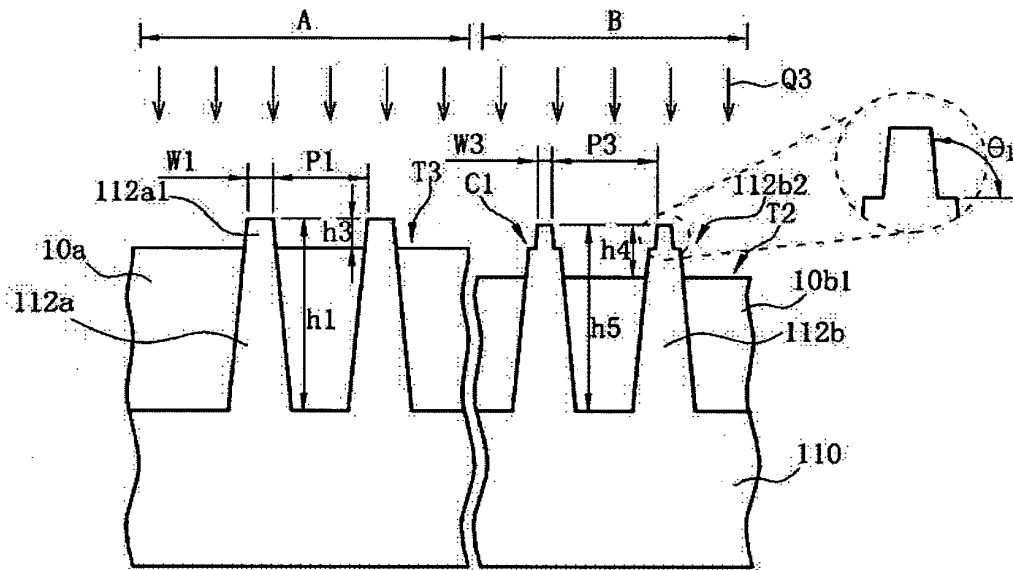


图 5

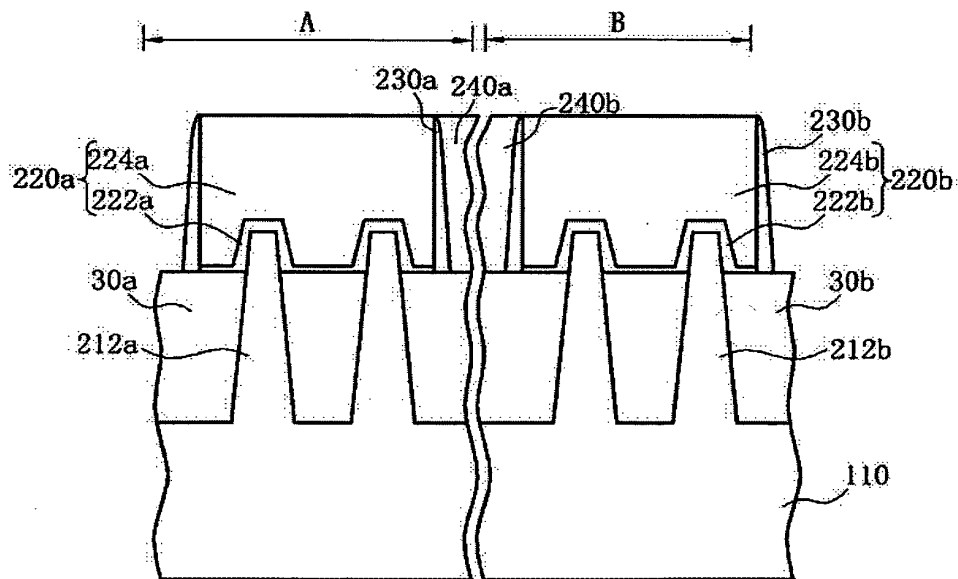


图 6



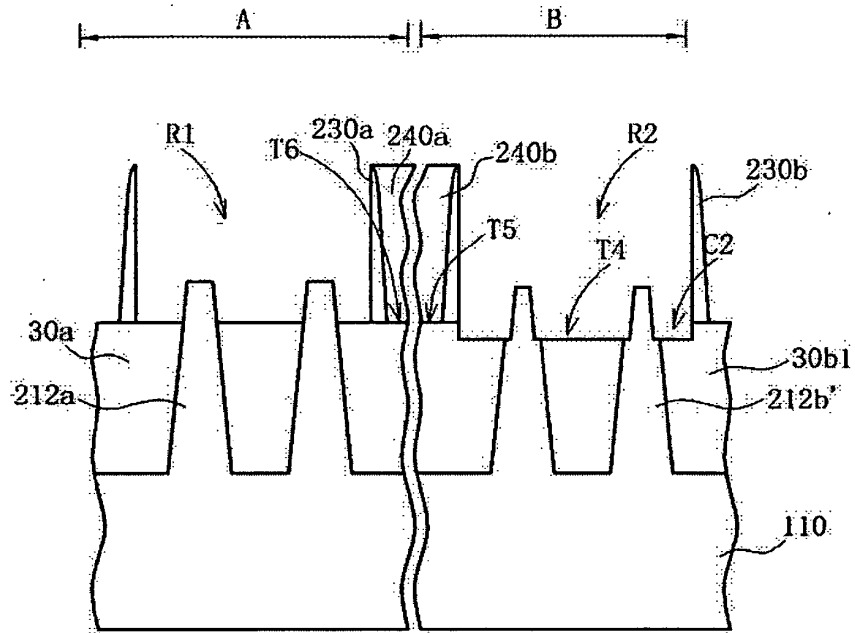


图 9

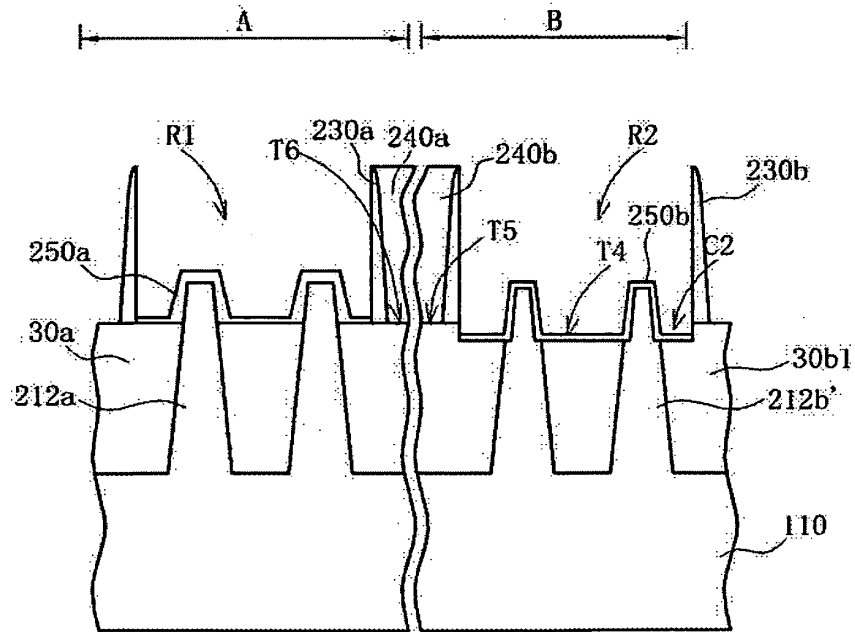


图 10

Doc Code: TRAN.LET

Document Description: Transmittal Letter



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PTO/SB/21 (07-09)

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	Filing Date	10/13/2014
	First Named Inventor	Wen-Jiun Shen
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA
Total Number of Pages in This Submission	3	

ENCLOSURES (Check all that apply)		
☒ Fee Transmittal Form	☐ Drawing(s)	☐ After Allowance Communication to TC
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FEE TRANSMITTAL		Complete if known	
		Application Number	14/512,475
☐ Applicant asserts small entity status. See 37 CFR 1.27.		Filing Date	10/13/2014
☐ Applicant certifies micro entity status. See 37 CFR 1.29. Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.		First Named Inventor	Wen-Jiun Shen
TOTAL AMOUNT OF PAYMENT (\$)		Examiner Name	N/A
		Art Unit	N/A
(\$)		Practitioner Docket No.	NAUP2310USA

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____☒ Deposit Account Deposit Account Number: 50-3105 Deposit Account Name: North America Intellectual Property Corporation

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☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee☒ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayment of fee(s)**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.

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES (U = undiscounted fee; S = small entity fee; M = micro entity fee)

Application Type	FILING FEES			SEARCH FEES			EXAMINATION FEES			Fees Paid (\$)
	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	U (\$)	S (\$)	M (\$)	
Utility	280	140*	70	600	300	150	720	360	180	
Design	180	90	45	120	60	30	460	230	115	
Plant	180	90	45	380	190	95	580	290	145	
Reissue	280	140	70	600	300	150	2,160	1,080	540	
Provisional	260	130	65	0	0	0	0	0	0	

* The \$140 small entity status filing fee for a utility application is further reduced to \$70 for a small entity status applicant who files the application via EFS-Web.

2. EXCESS CLAIM FEES

Fee Description	Undiscounted Fee (\$)	Small Entity Fee (\$)	Micro Entity Fee (\$)
Each claim over 20 (including Reissues)	80	40	20
Each independent claim over 3 (including Reissues)	420	210	105
Multiple dependent claims	780	390	195
Total Claims			
-20 or HP = _____ x _____ = _____			
HP = highest number of total claims paid for, if greater than 20.			
Indep. Claims			
-3 or HP = _____ x _____ = _____			
HP = highest number of independent claims paid for, if greater than 3.			

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$400 (\$200 for small entity) (\$100 for micro entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fee Paid (\$)
- 100 = _____ / 50 = _____ (round up to a whole number) x _____ = _____				

4. OTHER FEE(S)

Non-English specification, \$130 fee (no small or micro entity discount)

Non-electronic filing fee under 37 CFR 1.16(t) for a utility application, \$400 fee (\$200 small or micro entity)

Other (e.g., late filing surcharge): _____

SUBMITTED BY			
Signature	/WINSTON HSU/	Registration No. (Attorney/Agent)	41,526
Name (Print/Type)	WINSTON HSU	Telephone	3027291562
		Date	12/16/2014

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0104



证 明

本证明之附件是向本局提交的下列专利申请文件副本。

申 请 号：201410454915.X

申 请 类 型：发明专利

发 明 创 造 名 称：鳍状结构及其制造方法

申 请 日：2014 年 09 月 09 日

申 请 人：联华电子股份有限公司

发明人或设计人：沈文骏、傅思逸、吴彦良、刘家荣、洪裕祥、张仲甫、吕曼绫、陈意维

局长

申长雨

2015 年 02 月 12 日



PXJ04315

权 利 要 求 书

1. 一种鳍状结构, 包含有:

5 基底, 具有第一鳍状结构, 位于一第一区; 以及第二鳍状结构, 位于一第二区, 其中该第二鳍状结构包含一阶梯状的剖面结构部分。

2. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构的顶部宽度大于该第二鳍状结构的顶部宽度。

3. 如权利要求 1 所述的鳍状结构, 还包含:

10 绝缘结构, 分别设置于该第一区的该第一鳍状结构侧边以及该第二区的该第二鳍状结构侧边, 且该阶梯状的剖面结构部分高于该绝缘结构的一顶面。

4. 如权利要求 1 所述的鳍状结构, 其中位于该第一区的该绝缘结构的一顶面高于位于该第二区的该绝缘结构的一顶面。

15 5. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构突出于该绝缘结构的一高度, 小于该第二鳍状结构突出于该绝缘结构的一高度。

6. 如权利要求 1 所述的鳍状结构, 其中该第一鳍状结构突出于该基底的一高度, 大于该第二鳍状结构突出于该基底的一高度。

7. 如权利要求 1 所述的鳍状结构, 还包含:

20 多个该第一鳍状结构以及多个该第二鳍状结构, 且各该第一鳍状结构的顶部之间的间距小于各该第二鳍状结构的顶部之间的间距。

8. 如权利要求 1 所述的鳍状结构, 其中该第一区包含一高临界电压 (high voltage threshold, HVT) 区以及该第二区包含一低临界电压 (low voltage threshold, LVT) 区。

9. 一种形成鳍状结构的方法, 包含有:

25 提供一基底, 具有第一鳍状结构, 位于一第一区; 以及第二鳍状结构位于一第二区;

分别填入一绝缘结构于该第一区的该第一鳍状结构侧边以及该第二区的该第二鳍状结构侧边;

形成一图案化掩模, 覆盖该第一区但暴露出该第二区;

30 移除该第二区的该绝缘结构的一顶部, 因而暴露出该第二鳍状结构的第一顶部;



进行一处理制作工艺，将该第二鳍状结构的该第一顶部的一外表面改质，因而形成一改质部，覆盖该第二鳍状结构的该第一顶部；

移除该图案化掩模；以及

- 5 进行一移除制作工艺，经由对于该第一鳍状结构以及该第二鳍状结构与对于该改质部以及该绝缘结构的高移除选择比，而移除该绝缘结构的一部分以及该改质部，因而暴露出该第一鳍状结构的一顶部以及该第二鳍状结构的一第二顶部。

10. 如权利要求 9 所述的形成鳍状结构的方法，其中该绝缘结构包含氧化物，且该改质部包含氧化物。

- 10 11. 如权利要求 9 所述的形成鳍状结构的方法，其中该处理制作工艺包含一氧化制作工艺。

12. 如权利要求 11 所述的形成鳍状结构的方法，其中该处理制作工艺包含一含氧气的制作工艺或一原位蒸汽产生制作工艺。

- 15 13. 如权利要求 9 所述的形成鳍状结构的方法，其中该移除制作工艺包含一含氨及三氟化氮的蚀刻制作工艺。

14. 一种形成鳍状结构的方法，包含有：

提供一基底，具有第一鳍状结构，位于一第一区；以及第二鳍状结构位于一第二区；

- 20 形成一第一栅极跨设该第一鳍状结构，以及一第二栅极跨设该第二鳍状结构，其中该第一栅极依序包含一第一介电层以及一第一牺牲栅极覆盖该第一鳍状结构，且该第二栅极依序包含一第二介电层以及一第二牺牲栅极覆盖该第二鳍状结构；

移除该第一牺牲栅极以及该第二牺牲栅极，因而暴露出该第一介电层以及该第二介电层；

- 25 覆盖一掩模于该第一区但暴露出该第二区；

进行一移除制作工艺，移除该第二鳍状结构的一顶部的一外表面；以及移除该掩模。

15. 如权利要求 14 所述的形成鳍状结构的方法，在移除掩模之后，还包含：

- 30 形成一介电层覆盖该第一鳍状结构以及该第二鳍状结构。

16. 如权利要求 14 所述的形成鳍状结构的方法，其中该移除制作工艺完



全移除该第二介电层，且移除该第二鳍状结构的该顶部的该外表面。

17. 如权利要求 14 所述的形成鳍状结构的方法，在移除掩模之后，还包含：

完全移除该第一介电层。

5 18. 如权利要求 14 所述的形成鳍状结构的方法，在覆盖掩模之前，还包含：

完全移除该第一介电层以及该第二介电层。

19. 如权利要求 14 所述的形成鳍状结构的方法，其中在提供该基底之后，还包含形成一绝缘结构分别于该第一区的该第一鳍状结构侧边以及该第二区的该第二鳍状结构侧边，且位于该第二区的该绝缘结构的一顶部在进行移除制作工艺时一并移除。

10

20. 如权利要求 14 所述的形成鳍状结构的方法，其中该移除制作工艺对于该绝缘结构以及该第二鳍状结构无移除选择比。



PXJ04315

说明书

鳍状结构及其制造方法

5 技术领域

本发明涉及一种鳍状结构及其制造方法，且特别是涉及一种具有一阶梯状的剖面结构的鳍状结构及其制造方法。

背景技术

- 10 随着半导体元件尺寸的缩小，维持小尺寸半导体元件的效能是目前业界的主要目标。为了提高半导体元件的效能，目前已逐渐发展出各种多栅极场效晶体管元件（multi-gate MOSFET）。多栅极场效晶体管元件包含以下几项优点。首先，多栅极场效晶体管元件的制作工艺能与传统的逻辑元件制作工艺整合，因此具有相当的制作工艺相容性；其次，由于立体结构增加了栅极与基底的接触面积，因此可增加栅极对于通道区域电荷的控制，从而降低小尺寸元件带来的漏极引发的能带降低(Drain Induced Barrier Lowering, DIBL)效应以及短通道效应(short channel effect)；此外，由于同样长度的栅极具有更大的通道宽度，因此也可增加源极与漏极间的电流量。

- 20 更进一步而言，由于位于不同区域，例如逻辑电路区以及输出/输入高压电路区，的晶体管用途不同，其所需的立体结构应当不相同，才能达到个别所需的电性要求。因此，如何在各别区域分别形成能符合该区域的电性要求的立体结构，已为当今产业的一重要议题。

发明内容

- 25 本发明的目的在于提出一种鳍状结构及其方法，其选择性地在部分区域形成具有阶梯状的剖面结构的鳍状结构，以能分别在各区域形成具有不同高度以及临界尺寸（critical dimension, CD）的鳍状结构，因而能形成符合各区域的电性要求的晶体管。

- 30 为达上述目的，本发明提供一种鳍状结构，包含有一基底，具有一第一鳍状结构位于一第一区，以及一第二鳍状结构位于一第二区，其中第二鳍状结构包含一阶梯状的剖面结构部分。

本发明提供一种形成鳍状结构的方法，包含有下述步骤。首先，提供一基底，具有一第一鳍状结构位于一第一区，以及一第二鳍状结构位于一第二区。接着，填入一绝缘结构分别于第一区的第一鳍状结构侧边以及第二区的第二鳍状结构侧边。接续，形成一图案化掩模，覆盖第一区但暴露出第二区。

5 续之，移除第二区的绝缘结构的一顶部，因而暴露出第二鳍状结构的一第一顶部。继之，进行一处理制作工艺，将第二鳍状结构的第一顶部的一外表面改质，因而形成一改质部，覆盖第二鳍状结构的第一顶部。而后，移除图案化掩模。其后，进行一移除制作工艺，经由对于第一鳍状结构以及第二鳍状结构对于改质部以及绝缘结构的高移除选择比，而移除绝缘结构的一部分

10 以及改质部，因而暴露出第一鳍状结构的一顶部以及第二鳍状结构的一第二顶部。

本发明提供一种形成鳍状结构的方法，包含有下述步骤。首先，提供一基底，具有一第一鳍状结构位于一第一区，以及一第二鳍状结构位于一第二区。接续，形成一第一栅极跨设第一鳍状结构，以及一第二栅极跨设第二鳍状结构，其中第一栅极依序包含一第一介电层以及一第一牺牲栅极覆盖第一鳍状结构，且第二栅极依序包含一第二介电层以及一第二牺牲栅极覆盖第二鳍状结构。续之，移除第一牺牲栅极以及第二牺牲栅极，因而暴露出第一介电层以及第二介电层。继之，覆盖一掩模于第一区但暴露出第二区。而后，进行一移除制作工艺，移除第二鳍状结构的一顶部的一外表面。之后，移除掩模。

15 20

基于上述，本发明提出一种鳍状结构及其方法，其先以掩模覆盖第一区，再移除第二区的第二鳍状结构的顶部的外表面，因而能仅在第二区形成具有阶梯状的剖面结构的第二鳍状结构，进而能分别在不同区域形成具有不同高度以及临界尺寸的鳍状结构，使能形成符合各区域的电性要求的晶体管。再者，移除第二区的第二鳍状结构顶部的外表面的方法可包含：直接进行移除制作工艺移除部分的第二区的第二鳍状结构的顶部的外表面；或者，先进行处理制作工艺将第二区的第二鳍状结构的顶部的外表面改质，再进行移除制作工艺移除改质的部分。

25

30 附图说明

图 1-图 5 为本发明一第一实施例的形成鳍状结构的方法的剖面示意图；



图6-图10为本发明一第二实施例的形成鳍状结构的方法的剖面示意图。

主要元件符号说明

	10a、10b、10b1、30a、30b、30b1: 绝缘结构
	10bt、112a1、212b1、30bt: 顶部
5	20、K2: 掩模
	20a: 图案化掩模
	110: 基底
	112a、212a: 第一鳍状结构
	112b、212b、212b': 第二鳍状结构
10	112b1: 第一顶部
	112b2: 第二顶部
	120: 改质部
	220a: 第一栅极
	220b: 第二栅极
15	222a: 第一介电层
	222b: 第二介电层
	224a: 第一牺牲栅极
	224b: 第二牺牲栅极
	230a、230b: 间隙壁
20	240a、240b: 层间介电层
	250a、250b: 介电层
	A: 第一区
	B: 第二区
	C1、C2: 阶梯状的剖面结构部分
25	K1: 图案化光致抗蚀剂
	Q1、Q3、Q4: 移除制作工艺
	Q2: 处理制作工艺
	R1、R2: 凹槽
	S1: 外表面
30	T1: 外表面
	T2、T3、T4、T5、T6: 顶面



$h1$ 、 $h2$ 、 $h3$ 、 $h4$ 、 $h5$: 高度

$p1$ 、 $p2$ 、 $p3$: 顶部间距

$w1$ 、 $w2$ 、 $w3$: 顶部宽度

θ_1 、 θ_2 : 弯曲角度

5

具体实施方式

图 1-图 5 绘示本发明一第一实施例的形成鳍状结构的方法的剖面示意图。如图 1 所示, 形成一基底 110, 可分为一第一区 A 以及一第二区 B。在本实施例中, 第一区 A 为一高临界电压 (high voltage threshold, HVT) 区, 而第二区 B 为一低临界电压 (low voltage threshold, LVT) 区; 例如第一区 A 为一输出/输入高压区, 而第二区 B 为一逻辑电路区, 但本发明不以此为限。此外, 为能清晰揭示本发明, 本实施例仅绘示二区域, 但本发明也可同时应用于三个或三个以上的区域, 视实际需要而定。

基底 110 具有二第一鳍状结构 112a 于第一区 A, 二第二鳍状结构 112b 于第二区 B。本实施例于第一区 A 中形成二个第一鳍状结构 112a, 以及于第二区 B 中形成二个第二鳍状结构 112b, 但所形成的第一鳍状结构 112a 或者第二鳍状结构 112b 的个数非限于此。在本实施例中, 第一鳍状结构 112a 与第二鳍状结构 112b 为相同的结构; 意即, 第一鳍状结构 112a 的一高度 $h1$ 与第二鳍状结构 112b 的一高度 $h2$ 相同, 第一鳍状结构 112a 的一顶部宽度 $w1$ 与第二鳍状结构 112b 的一顶部宽度 $w2$ 相同, 各第一鳍状结构 112a 之间的一顶部间距 $p1$ 与各第二鳍状结构 112b 之间的一顶部间距 $p2$ 相同, 如此一来, 对称的结构可方便后续制作工艺对于单一区域或者同时对于多个区域进行选择性的处理制作工艺时, 能于各区域产生相同的效果, 而形成均匀的结构, 但本发明不以此为限, 例如各第一鳍状结构 112a 之间的一顶部间距 $p1$ 与各第二鳍状结构 112b 之间的一顶部间距 $p2$ 可不相同。

详细而言, 形成第一鳍状结构 112a 于第一区 A, 以及形成第二鳍状结构 112b 于第二区 B 的方法, 可包含但不限于下述步骤。首先, 提供一块状底材 (未绘示), 利用例如 SIT (sidewall image transfer) 制作工艺, 在其上形成硬掩模层 (未绘示), 并将其图案化以先定义出其下的块状底材中欲对应形成的第一鳍状结构 112a 以及第二鳍状结构 112b 的位置。接着, 进行一蚀刻制作工艺, 在块状底材 (未绘示) 中同时形成第一鳍状结构 112a 以及第

二鳍状结构 112b。如此，完成第一鳍状结构 112a 以及第二鳍状结构 112b 于基底 110 中的制作。在一实施例中，形成第一鳍状结构 112a 以及第二鳍状结构 112b 后即移除硬掩模层（未绘示），可于后续制作工艺中形成三栅极场效晶体管(tri-gate MOSFET)。如此一来，由于第一鳍状结构 112a 以及第二鳍状结构 112b 与后续形成的介电层之间具有三直接接触面（包含二接触侧面及一接触顶面），因此被称作三栅极场效晶体管(tri-gate MOSFET)。相较于平面场效晶体管，三栅极场效晶体管可通过将上述三直接接触面作为载流子流通的通道，而在同样的栅极长度下具有较宽的载流子通道宽度，使在相同的驱动电压下可获得加倍的漏极驱动电流。而在另一实施例中，也可保留硬掩模层（未绘示），而于后续制作工艺中形成另一具有鳍状结构的多栅极场效晶体管(multi-gate MOSFET)-鳍式场效晶体管(fin field effect transistor, Fin FET)。鳍式场效晶体管中，由于保留了硬掩模层（未绘示），第一鳍状结构 112a 以及第二鳍状结构 112b 与后续将形成的介电层之间仅有两接触侧面。

此外，如前所述，本发明也可应用于其他种类的半导体基底，例如在另一实施态样中，提供一硅覆绝缘基底（未绘示），并以蚀刻暨光刻的方法蚀刻硅覆绝缘基底（未绘示）上的单晶硅层而停止于氧化层，即可完成鳍状结构于硅覆绝缘基底上的制作。

接着，分别填入一绝缘结构 10a 及 10b 于第一区 A 的第一鳍状结构 112a 侧边以及第二区 B 的第二鳍状结构 112b 侧边。

绝缘结构 10a 及 10b 可例如为一浅沟槽绝缘（shallow trench isolation, STI）结构，但本发明不以此为限。绝缘结构 10a 及 10b 可包含氧化物，但本发明不以此为限。在本实施例中，绝缘结构 10a 及 10b 同时填入第一区 A 的第一鳍状结构 112a 侧边以及第二区 B 的第二鳍状结构 112b 侧边，而于第一区 A 以及第二区 B 中形成等高的绝缘结构 10a 及 10b，如此于第一区 A 以及第二区 B 中的对称结构，可方便对于单一区域或者同时对于多个区域进行选择性的处理制作工艺时，能于各区域产生相同的效果，而形成均匀的结构，但本发明不以此为限。在其他实施例中，绝缘结构 10a 及 10b 可不等高，且分别由独立的制作工艺形成，视实际需要而定。

此外，在形成第一鳍状结构 112a 以及第二鳍状结构 112b 之后，可选择性进行一掺杂制作工艺等，以分别于第一区 A 以及第二区 B 中形成井(Well)或者改变二区的临界电压。

接着，如图 1-图 2 所示，形成一图案化掩模 20a，覆盖第一区 A 但暴露出第二区 B。详细而言，如图 1 所示，可先全面覆盖一掩模 20 于第一区 A 以及第二区 B。接着，沉积并图案化一光致抗蚀剂（未绘示）而形成一图案化光致抗蚀剂 K1 于掩模 20 上，且图案化光致抗蚀剂 K1 覆盖第一区 A 但暴露出第二区 B。然后，例如以蚀刻等制作工艺移除位于第二区 B 的暴露出的掩模 20，而仅于第一区 A 形成一图案化掩模 20a。随即，移除图案化光致抗蚀剂 K1，如图 2 所示。在本实施例中，图案化掩模 20a 为一氮化硅层，但本发明不以此为限。

接着，进行一移除制作工艺 Q1，移除第二区 B 的绝缘结构 10b 的一顶部 10bt，因而形成一绝缘结构 10b1 并暴露出第二鳍状结构 112b 的一第一顶部 112b1，如图 3 所示。在此强调，由于图案化掩模 20a 全面覆盖第一区 A，故第一区 A 的绝缘结构 10a 及第一鳍状结构 112a 都未被移除而完全保留。在本实施例中，移除制作工艺 P1 可例如为一含氟及三氟化氮的蚀刻制作工艺，其对于绝缘结构 10b 以及第二鳍状结构 112b 具有高蚀刻选择比，意即对于绝缘结构 10b 的蚀刻率远大于对于第二鳍状结构 112b 的蚀刻率，因此仅移除绝缘结构 10b 但实质上不移除第二鳍状结构 112b，但本发明不以此为限。在其他实施例中，移除制作工艺 P1 也可为其他制作工艺，但此制作工艺必须对于绝缘结构 10b 以及第二鳍状结构 112b 具有高移除选择比，以移除部分的绝缘结构 10b 并暴露出部分的第二鳍状结构 112b。

如图 4 所示，进行一处理制作工艺 Q2，将第二鳍状结构 112b 的第一顶部 112b1 的一外表面 T1 改质，因而形成一改质部 120，覆盖第二鳍状结构 112b 的第一顶部 112b1。在本实施例中，由于绝缘结构 10a 及 10b 由氧化物组成，改质部 120 优选也由氧化物组成，如此于后续制作工艺中可一并移除。因此，处理制作工艺 P2 搭配优选为一氧化制作工艺，例如一含氧气的制作工艺或一原位蒸汽产生（in situ steam generation, ISSG）制作工艺，但本发明不以此为限。

之后，在形成改质部 120 之后，移除图案化掩模 20a，如图 5 所示。其后，全面性进行一移除制作工艺 Q3，同时移除绝缘结构 10a 及 10b1 的一部分以及改质部 120，因而暴露出第一鳍状结构 112a 的一顶部 112a1 以及第二鳍状结构 112b 的一第二顶部 112b2。在本实施例中经由移除制作工艺 P3 对于第一鳍状结构 112a 以及第二鳍状结构 112b 与对于改质部 120 以及绝缘结

构 10a 及 10b1 的高移除选择比，因而能仅移除绝缘结构 10a 及 10b1 的一部分以及完全移除改质部 120，而实质上不移除第一鳍状结构 112a 以及第二鳍状结构 112b。

如此一来，即可形成具有一阶梯状的剖面结构部分 C1 的第二鳍状结构 112b，但保留原来的第一鳍状结构 112a，其中阶梯状的剖面结构部分 C1 有明显的一弯曲角度 θ_1 ，而此弯曲角度 θ_1 优选大于或等于 90° 。在此强调，以本发明的形成鳍状结构的方法，形成下述独特的结构特征。第一鳍状结构 112a 的顶部宽度 w_1 大于第二鳍状结构 112b 的一顶部宽度 w_3 。各第一鳍状结构 112a 顶部之间的顶部间距 p_1 小于各第二鳍状结构 112b 顶部之间的一顶部间距 p_3 。第二鳍状结构 112b 的阶梯状的剖面结构部分 C1 高于绝缘结构 10b1 的一顶面 T2。位于第一区 A 的绝缘结构 10a 的一顶面 T3 高于位于第二区 B 的绝缘结构 10b1 的顶面 T2。第一鳍状结构 112a 突出于绝缘结构 10a 的一高度 h_3 小于第二鳍状结构 112b 突出于绝缘结构 10b1 的一高度 h_4 。第一鳍状结构 112a 突出于基底 110 的高度 h_1 ，大于第二鳍状结构 112b 突出于基底 110 的一高度 h_5 。

之后，可再进行后续的形成栅极或晶体管等制作工艺。例如，分别形成一栅极跨设于第一区 A 的第一鳍状结构 112a 以及第二区 B 的第二鳍状结构 112b；分别形成源/漏极于栅极侧边的第一鳍状结构 112a 以及第二鳍状结构 112b 上；形成层间介电层覆盖栅极、第一鳍状结构 112a 以及第二鳍状结构 112b 等。

承上，第一实施例是先形成第一鳍状结构 112a 以及具有阶梯状的剖面结构部分 C1 的第二鳍状结构 112b，才形成栅极等结构于第一鳍状结构 112a 以及第二鳍状结构 112b 上，故在第二区 B 的一整条的第二鳍状结构 112b 都会具有阶梯状的剖面结构部分 C1，但本发明不限用于此。以下，再提出第二实施例，先形成相同的第一鳍状结构以及第二鳍状结构，以及栅极分别跨设于第一鳍状结构以及第二鳍状结构之后，才再暴露出部分的第一鳍状结构以及第二鳍状结构并进行本发明的形成鳍状结构的方法，而形成具有阶梯状的剖面结构部分的第二鳍状结构，其中第二鳍状结构的阶梯状的剖面结构部分仅会形成于栅极下方。

图 6-图 10 绘示本发明一第二实施例的形成鳍状结构的方法的剖面示意图。如图 6 所示，形成一基底 110，可分为一第一区 A 以及一第二区 B。基



底 110 具有二第一鳍状结构 212a 于第一区 A，二第二鳍状结构 212b 于第二区 B。本实施例于第一区 A 中形成二个第一鳍状结构 212a，以及于第二区 B 中形成二个第二鳍状结构 212b，但所形成的第一鳍状结构 212a 或者第二鳍状结构 212b 的个数非限于此。类似于第一实施例，本实施例的第一鳍状结构 212a 与第二鳍状结构 212b 为相同的结构。如此一来，对称的结构可方便后续制作工艺对于单一区域或者同时对于多个区域进行选择性的处理制作工艺时，能于各区域产生相同的效果，而形成均匀的结构，但本发明不以此为限。形成第一鳍状结构 212a 以及第二鳍状结构 212b 的方法与第一实施例相同，故不再赘述。

- 10 接着，分别填入一绝缘结构 30a 及 30b 于第一区 A 的第一鳍状结构 212a 侧边以及第二区 B 的第二鳍状结构 212b 侧边。

- 绝缘结构 30a 及 30b 可例如为一浅沟槽绝缘 (shallow trench isolation, STI) 结构，其例如以一浅沟槽绝缘制作工艺形成，但本发明不以此为限。绝缘结构 30a 及 30b 可例如为氧化物，但本发明不以此为限。在本实施例中，绝缘结构 30a 及 30b 同时填入第一区 A 的第一鳍状结构 212a 侧边以及第二区 B 的第二鳍状结构 212b 侧边，而于第一区 A 以及第二区 B 中形成等高的绝缘结构 30a 及 30b，如此于第一区 A 以及第二区 B 中的对称结构，可方便对于单一区域或者同时对于多个区域进行选择性的处理制作工艺时，能于各区域产生相同的效果，而形成均匀的结构，但本发明不以此为限。在其他实施例中，绝缘结构 30a 及 30b 可不等高，且分别由独立的制作工艺形成，视实际需要而定。另外，在形成第一鳍状结构 212a 以及第二鳍状结构 212b 之后，可选择性进行一掺杂制作工艺等，以分别于第一区 A 以及第二区 B 中形成井(Well)或者改变二区的临界电压。

- 之后，形成一第一栅极 220a 跨设位于第一区 A 的第一鳍状结构 212a，以及一第二栅极 220b 跨设位于第二区 B 的第二鳍状结构 212b。详细而言，第一栅极 220a 由下至上依序包含一第一介电层 222a 以及一第一牺牲栅极 224a 覆盖第一鳍状结构 212a，第二栅极 220b 由下至上依序包含一第二介电层 222b 以及一第二牺牲栅极 224b 覆盖第二鳍状结构 220b。接续，分别形成一间隙壁 230a 及 230b 分别于第一栅极 220a 以及第二栅极 220b 侧边的绝缘结构 30a 及 30b 上。分别形成一层间介电层 240a 及 240b 全面覆盖第一栅极 220a 及第二栅极 220b 侧边的基底 110。在本实施例中，第一介电层 222a 以

及第二介电层 222b 为氧化层，第一牺牲栅极 224a 以及第二牺牲栅极 224b 为多晶硅栅极，间隙壁 230a 及 230b 可由氮化硅所组成，层间介电层 240a 及 240b 为氧化层，但本发明不以此为限。详细而言，形成第一栅极 220a 以及一第二栅极 220b，形成间隙壁 230a 及 230b，形成层间介电层 240a 及 240b 的方法为本领域所熟知，故不再赘述。

接着，可例如以蚀刻等制作工艺移除第一牺牲栅极 224a 以及第二牺牲栅极 224b，并暴露出第一介电层 222a 以及第二介电层 222b，而分别于第一区 A 及第二区 B 中形成凹槽 R1 及 R2，如图 7 所示。

如图 8 所示，仅覆盖一掩模 K2 于第一区 A 但暴露出第二区 B。在本实施例中，掩模 K2 则全面填满第一区 A 的凹槽 R1，但本发明不以此为限。然后，请同时参阅图 7-图 8，进行一移除制作工艺 Q4，移除第二鳍状结构 212b（如图 7 所示）的一顶部 212b1 的一外表面 S1，而形成一第二鳍状结构 212b'，其具有一阶梯状的剖面结构部分 C2，其中阶梯状的剖面结构部分 C2 有一明显的弯曲角度 θ_2 ，而此弯曲角度 θ_2 优选大于或等于 90° 。在本实施例中，在进行移除制作工艺 Q4 移除第二鳍状结构 212b 的外表面 S1 时，可一并完全移除第二区 B 中暴露出的第二介电层 222b 以及位于第二介电层 222b 下方的绝缘结构 30b 的一顶部 30bt，如此，会形成一绝缘结构 30b1，其在凹槽 R2 的底端的一顶面 T4 会低于凹槽 R2 外的一顶面 T5，甚至是第一区 A 中的绝缘结构 30a 的一顶面 T6，但本发明不以此为限，视移除制作工艺 Q4 的蚀刻剂等参数以及所需结构而定。例如，在其他实施例中，也可改以第一实施例的于第二鳍状结构 212b 的顶部形成改质部，再以移除选择比移除改质部的方法。

在此强调，由于本实施例的移除制作工艺 Q4 必须同时移除第二介电层 222b 以及位于第二介电层 222b 下方的部分的第二鳍状结构 212b，故移除制作工艺 Q4 对于第二介电层 222b 以及第二鳍状结构 212b 无移除选择比。意即，本实施例的移除制作工艺 Q4 对于第二介电层 222b 的移除率与对于第二鳍状结构 212b 的移除率实质上相等。在一例中，移除制作工艺 Q4 可例如为一含氟的蚀刻制作工艺，但本发明不以此为限。再者，由于第二介电层 222b 为一氧化层，且绝缘结构 30b 也由氧化物组成，故进行可移除第二介电层 222b 的移除制作工艺 Q4 时，也会移除部分的凹槽 R2 中的绝缘结构 30b。

其后，在形成具有一阶梯状的剖面结构部分 C2 的第二鳍状结构 212b'

之后，移除掩模 K2 以及位于第一区 A 的第一介电层 222a，如图 9 所示。在本实施例中，掩模 K2 可由例如一氧脱离（O₂ stripping）制作工艺移除，而第一介电层 222a 可例如由一含氮及三氟化氮的蚀刻制作工艺移除，但本发明不以此为限。接着，如图 10 所示，分别形成一介电层 250a 及 250b 覆盖
5 第一鳍状结构 212a 以及第二鳍状结构 212b'。介电层 250a 及 250b 可例如由同一制作工艺形成，而具有相同的厚度，或者分别于不同制作工艺形成，而具有不同的厚度或不同的材质。例如，由于第一区 A 为一高临界电压区，而第二区 B 包含一低临界电压区，故第一区 A 中的介电层 250a 的厚度优选大于第二区 B 的介电层 250b，或者二者由不同材质组成，使介电层 250a 可
10 抵挡较高的电压，而介电层 250b 具有较低的等效氧化层厚度（Equivalent Oxide Thickness, EOT），但本发明不以此为限。

另外，本实施例是先移除第一介电层 222a，在重新形成介电层 250a 及 250b，但在其他实施例中可不移除第一介电层 222a 而在另外形成介电层 250a 于第一介电层 222a 上，或者仅于第二区 B 中形成介电层 250b。再者，如图
15 8-图 9 所示，本实施例是先形成掩模 K2，再完全移除第一介电层 222a；在其他实施例中，也可在形成掩模 K2 之前，先完全移除第一介电层 222a 及第二介电层 222b，然后再形成掩模 K2。

综上所述，本发明提出一种鳍状结构及其方法，其先以掩模覆盖第一区，再移除第二区的第二鳍状结构的顶部的外表面，因而能仅在全部分或部分的第
20 二区形成具有阶梯状的剖面结构的第二鳍状结构，进而能分别在不同区域形成具有不同高度以及临界尺寸的鳍状结构，以能形成符合各区域的电性要求的晶体管。

覆盖掩模于第一区之后，移除第二区的第二鳍状结构顶部的外表面的方法可包含：直接进行移除制作工艺移除部分的第二区的第二鳍状结构的顶部
25 的外表面，其中此移除制作工艺对于第二鳍状结构以及第二鳍状结构以外或之上的材料层，例如介电层或者绝缘结构无移除选择比，以便一并移除之；或者，先进行处理制作工艺将第二区的第二鳍状结构的顶部的外表面改质，再进行移除制作工艺移除改质的部分，其中此移除制作工艺则对于改质部分以及原来的第二鳍状结构具有高移除选择比，以能仅移除改质部分但实质上
30 不移除第二鳍状结构。

以上所述仅为本发明的优选实施例，凡依本发明权利要求所做的均等变



化与修饰，都都应属本发明的涵盖范围。

PXJ04315

说明书附图

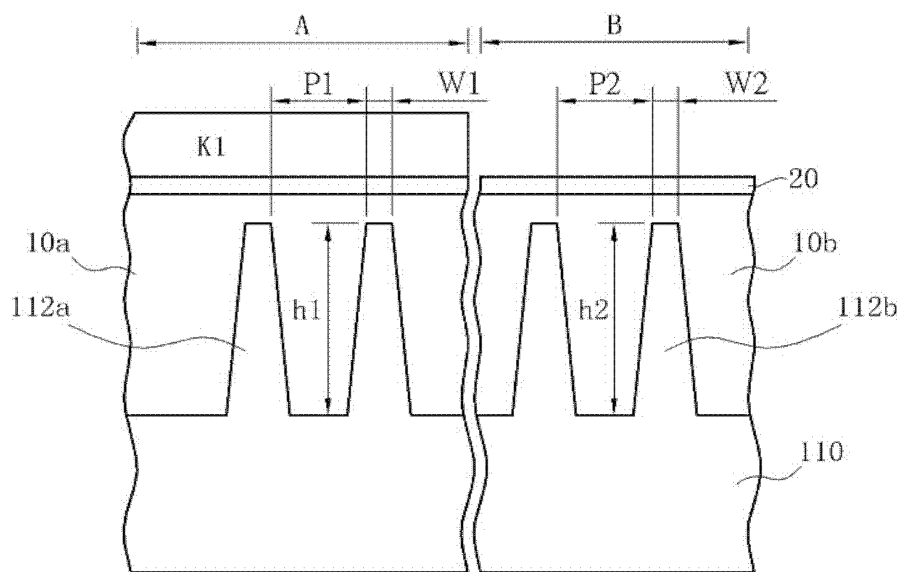


图 1

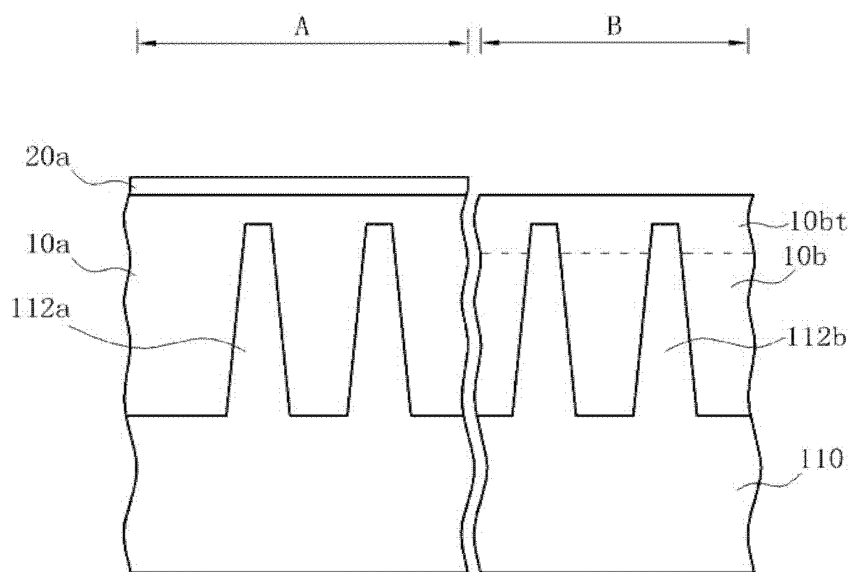


图 2

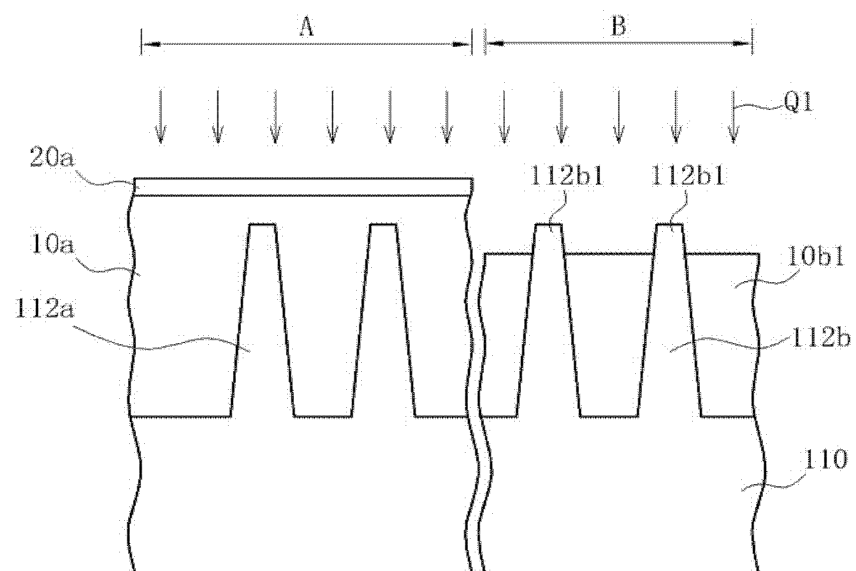


图 3

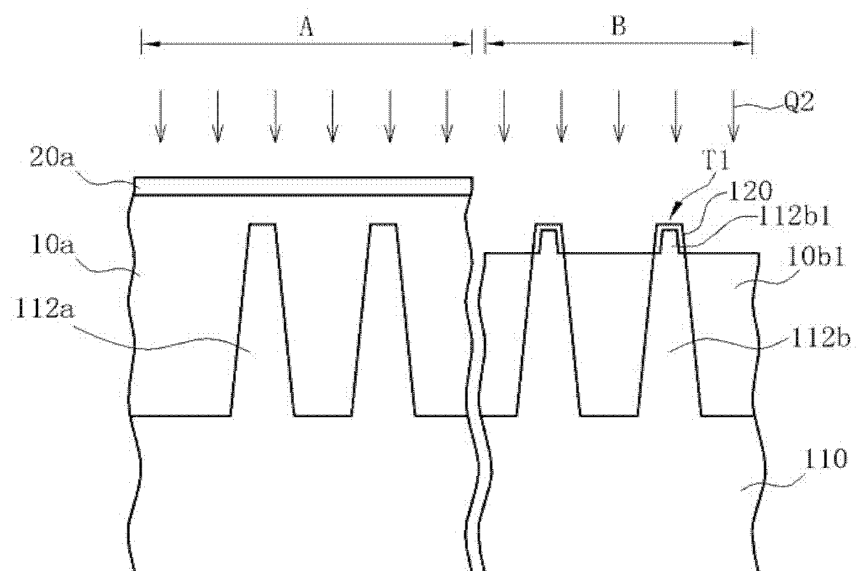


图 4

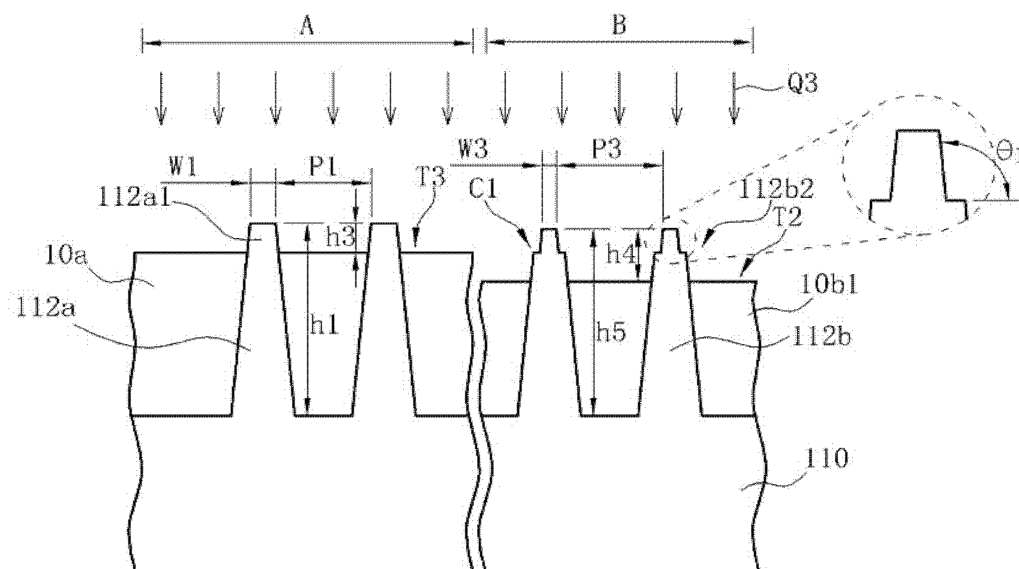


图 5

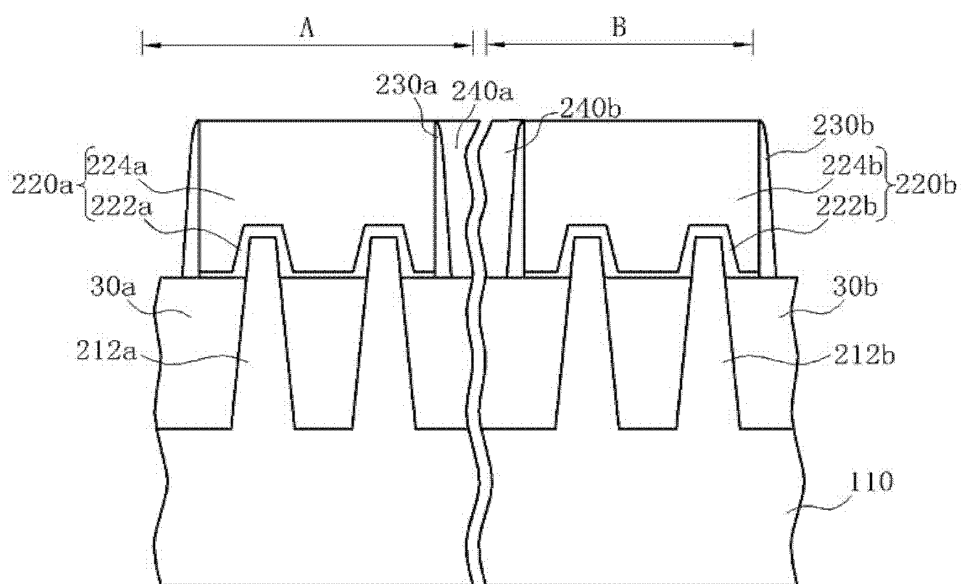


图 6

4

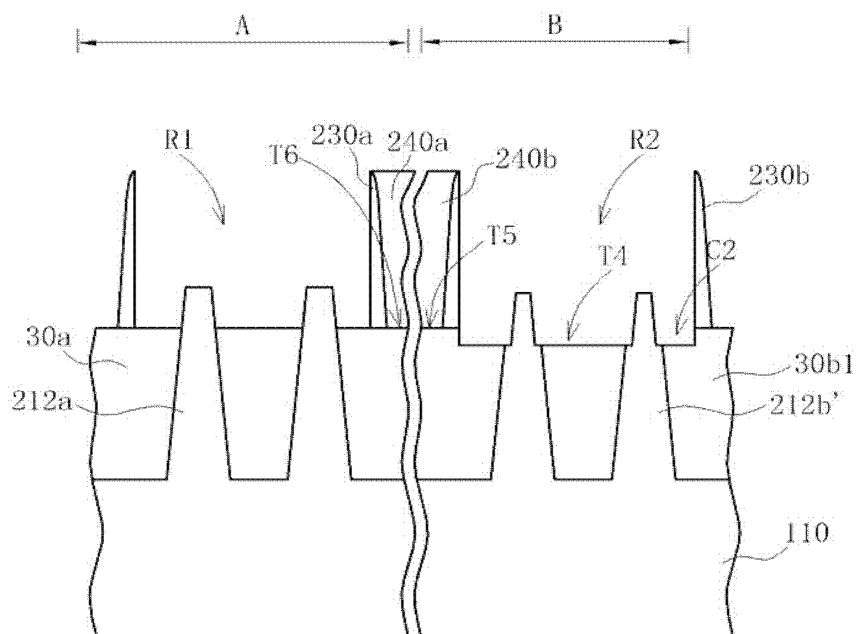


图 9

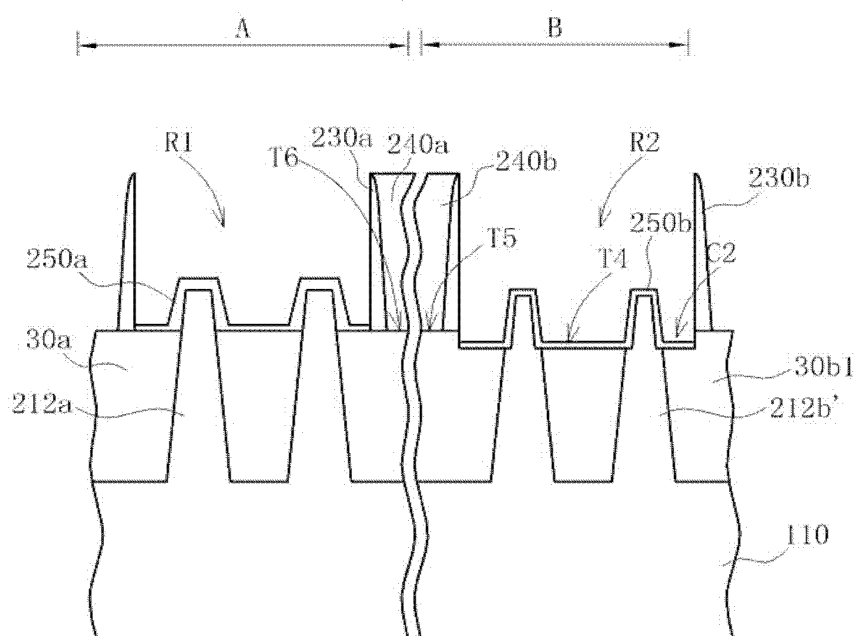


图 10



UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 08/11/2015 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER DRYE, TYLER B	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			08/11/2015	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com

Office Action Summary	Application No. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner Tyler Drye	Art Unit 2829	AIA (First Inventor to File) Status Yes

-- 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 2 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☒ Responsive to communication(s) filed on 13 Oct. 2014.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☐ Claim(s) ____ is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☒ Claim(s) 1-20 are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 13 Oct. 2014 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).

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).

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)).

** 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) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. This application is being examined under the first inventor to file provisions of the AIA.

Priority

2. Receipt is acknowledged of certified copies of papers submitted under 35 U.S.C. 119(a)-(d); papers have been placed of record in the file.

Election/Restrictions

3. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. **Claims 1-8**, drawn to a fin-shaped **device**, classified in CPC classes H01L 29/0657, H01L 21/76232, H01L 21/764, H01L 29/0661, and H01L 29/6609. This invention contains claims directed to the following patentably distinct **species**: a first **species** comprising a first embodiment (e.g. Fig. 5) depicting a fin-shaped structure with two regions of fins; and a second **species** comprising a second embodiment (e.g. Fig. 10) depicting a fin-shaped structure with spacers dielectric layers between regions.

II. **Claims 9-20**, drawn to a **method** for forming a fin-shaped device, classified in CPC classes H01L 27/10852, H01L 27/10817, H01L 28/91, H01L 28/87, and H01L 27/10855. This invention contains claims directed to the following patentably distinct **species**: a first **species** comprising a first embodiment (e.g. Figs. 1-5) depicting a method for forming a fin-shaped structure with two regions of fins; and a second **species** comprising a second embodiment (e.g. Figs. 6-10) depicting a method for forming a fin-shaped structure with spacers dielectric layers between regions.

4. Inventions I and II are related as product and process of making. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case, the product as claimed can be made by another and materially different process such as providing a

Art Unit: 2829

substrate, growing a fin-shaped structure in a first area using a mask over the second area, growing a fin-shaped structure in the second area using a mask over the first area, and using another mask over the second area to grow a different shape at the top of the second fin-shaped structure (that is, epitaxially growing the fin structure rather than etching or treating a pre-grown fin structure).

5. In the event that Applicant elects Group I, it further requires **species** restriction as follows: Applicant is required under 35 U.S.C. 121 to elect a single disclosed **species** for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. The **species** are independent or distinct because the **species** disclose differing fin-shaped structures that are not considered identical or obvious variants of one another. There is a search and/or examination burden for the patentably distinct **species** as set forth above for at least the following reason(s) apply: the **species** or groupings of patentably indistinct **species** require a different field of search.

6. In the event that Applicant elects Group II, it further requires **species** restriction as follows: Applicant is required under 35 U.S.C. 121 to elect a single disclosed **species** for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. The **species** are independent or distinct because the **species** disclose differing methods of forming fin-shaped structures that are not considered identical or obvious variants of one another. There is a search and/or examination burden for the patentably distinct **species** as set forth above for at least the following reason(s) apply: the **species** or groupings of patentably indistinct **species** require a different field of search.

7. Restriction for examination purposes as indicated is proper because all the inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because one or more of the following reasons apply:

Art Unit: 2829

- (a) The inventions have acquired a separate status in the art in view of their different classification; and
- (b) The inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries).

Applicant is advised that the reply to this requirement **to be complete** must include (i) **an election of an invention to be examined** even though the requirement may be traversed (37 CFR 1.143) and (ii) **identification of the claims** encompassing the elected invention.

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

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

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tyler Drye, whose telephone number is (571)270-0635. The examiner can normally be reached on Monday-Thursday: 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ha Nguyen can be reached on 2-1678. 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

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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.

/TYLER DRYE/

Examiner, Art Unit 2829

/Michelle Mandala/

Primary Examiner, Art Unit 2829

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No. : 14/512,475 Confirmation No. 5891
First Named Inventor : Wen-Jiun Shen
Filed : October 13, 2014
TC/A.U. : 2829
Examiner : DRYE, TYLER B
Docket No. : NAUP2310USA
Customer No. : 27765

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

AMENDMENT

Sir:

In response to the Office action of August 11, 2015, please amend the above-identified
5 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 6 of this paper.

Amendments to the Claims:

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

Listing of Claims:

- 5 Claim 1 (original): A fin-shaped structure, comprising:
 a substrate having a first fin-shaped structure located in a first area and a second
 fin-shaped structure located in a second area, wherein the second
 fin-shaped structure comprises a ladder-shaped cross-sectional profile part.
- 10 Claim 2 (original): The fin-shaped structure according to claim 1, wherein the width
 of a top part of the first fin-shaped structure is larger than the width of the top part
 of the second fin-shaped structure.
- Claim 3 (original): The fin-shaped structure according to claim 1, further comprising:
15 an isolation structure disposed beside the first fin-shaped structure of the first area
 and beside the second fin-shaped structure of the second area respectively,
 and the ladder-shaped cross-sectional profile part is higher than a top
 surface of the isolation structure.
- 20 Claim 4 (original): The fin-shaped structure according to claim 1, wherein a top
 surface of the isolation structure of the first area is higher than a top surface of the
 isolation structure of the second area.
- Claim 5 (original): The fin-shaped structure according to claim 1, wherein a height of
25 the first fin-shaped structure protruding from the isolation structure is lower than
 a height of the second fin-shaped structure protruding from the isolation structure.
- Claim 6 (original): The fin-shaped structure according to claim 1, wherein a height of
 the first fin-shaped structure protruding from the substrate is higher than a height
30 of the second fin-shaped structure protruding from the substrate.

Claim 7 (original): The fin-shaped structure according to claim 1, further comprising:
a plurality of first fin-shaped structures and a plurality of second fin-shaped
structures, and the pitch between each top part of the first fin-shaped
structures is less than the pitch between each top part of the second
fin-shaped structures.

Claim 8 (original): The fin-shaped structure according to claim 1, wherein the first
area comprises a high voltage threshold (HVT) area and the second area
comprises a low voltage threshold (LVT) area.

Claim 9 (withdrawn): A method of forming a fin-shaped structure, comprising:
providing a substrate having a first fin-shaped structure located in a first area
and a second fin-shaped structure located in a second area;
filling an isolation structure beside the first fin-shaped structure of the first area
and beside the second fin-shaped structure of the second area respectively;
forming a patterned mask covering the first area but exposing the second area ;
removing a top part of the isolation structure of the second area, thereby exposing
a first top part of the second fin-shaped structure;
performing a treatment process to modify an external surface of the first top part
of the second fin-shaped structure, thereby forming a modified part
covering the first top part of the second fin-shaped structure;
removing the patterned mask; and
performing a removing process to remove a part of the isolation structure and the
modified part by the high removing selectivity to the first fin-shaped
structure and the second fin-shaped structure, and the modified part and the
isolation structure, thereby exposing a top part of the first fin-shaped
structure and a second top part of the second fin-shaped structure.

Claim 10 (withdrawn): The method of forming a fin-shaped structure according to

Claim 15 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
forming a dielectric layer covering the first fin-shaped structure and the second fin-shaped structure after the mask is removed.

5

Claim 16 (withdrawn): The method of forming a fin-shaped structure according to claim 14, wherein the external surface of the top part of the second fin-shaped structure and the whole second dielectric layer are removed by the removing process.

10

Claim 17 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer completely after the mask is removed.

15 Claim 18 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer and the second dielectric layer completely before covering the mask.

20 Claim 19 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
forming an isolation structure beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area respectively after the substrate is provided, wherein a top part of the
25 isolation structure of the second area is also removed while the removing process is performed.

Claim 20 (withdrawn): The method of forming a fin-shaped structure according to claim 14, wherein the removing process has no removing selectivity to the
30 isolation structure and the second fin-shaped structure.

Electronic Acknowledgement Receipt

EFS ID:	23271742
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Winston Hsu/Eve Hsieh
Filer Authorized By:	Winston Hsu
Attorney Docket Number:	NAUP2310USA
Receipt Date:	21-AUG-2015
Filing Date:	13-OCT-2014
Time Stamp:	04:26:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	2335520.PDF	582682 a1bf8566c6178c8124e67e14d32e5c124b61578	no	2

Warnings:

Information:

2	Response to Election / Restriction Filed	2335519.PDF	76001 f8dea21a51e0256ef563f28a082908659955ffa7	no	1
Warnings:					
Information:					
3	Claims	2335518.PDF	108636 c955f41da8b309f573d262d66948008eb5a77a2f	no	4
Warnings:					
Information:					
Total Files Size (in bytes):			767319		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

REMARKS/ARGUMENTS

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record
5 in the application file.

Election/Restriction

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-8, drawn to a fin-shaped device, classified in CPC classes H01L
10 29/0657, H01L 21/76232, H01L 21/764, H01L 29/0661, and H01L 29/6609. This invention contains claims directed to the following patentably distinct species: a first species comprising a first embodiment (e.g. Fig. 5) depicting a fin-shaped structure with two regions of fins; and a second species comprising a second embodiment (e.g. Fig. 10) depicting a fin-shaped structure with spacers dielectric layers between
15 regions.

II. Claims 9-20, drawn to a method for forming a fin-shaped device, classified in CPC classes H01L 27/10852, H01L 27/10817, H01L 28/91, H01L 28/87, and H01L 27/10855. This invention contains claims directed to the following patentably distinct species: a first species comprising a first embodiment (e.g. Figs. 1-5) depicting a
20 method for forming a fin-shaped structure with two regions of fins; and a second species comprising a second embodiment (e.g. Figs. 6-10) depicting a method for forming a fin-shaped structure with spacers dielectric layers between regions.

Response

25 Applicant hereby elects Invention I, first species as the subject matter to be examined in response to the above restriction requirement. The claims and the figure readable upon the elected Invention I, first species are claims 1-8 and FIG.5. Claims 9-20 are therefore withdrawn from consideration in the instant application, and applicant reserves the right to file divisional applications based on these claims.
30 Consideration of the elected claims 1-8 is polity requested.

Appl. No. 14/512,475
Reply to Office action of August 11, 2015

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

5 Sincerely yours,

/Scott Margo/

Date: 08/21/2015

Scott Margo, Patent Agent No. 56,277

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

10 Voice Mail: 302-729-1562

Facsimile: 806-498-6673

e-mail : ScottMargo@naipo.com

Note: Please leave a message in my voice mail if you need to talk to me. (The time in

15 D.C. is 12 hours behind the Taiwan time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/512,475	Filing Date 10/13/2014	☐ To be Mailed
---	---	----------------------------------	---------------------------------------

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

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

APPLICATION AS AMENDED – PART II

AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	08/21/2015	CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0
AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
		CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>							

SLIE
/TONGELINA TUBBS/

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

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 09/22/2015 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER DRYE, TYLER B	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			09/22/2015	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com

Office Action Summary	Application No. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner Tyler Drye	Art Unit 2829	AIA (First Inventor to File) Status Yes

-- 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 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☒ Responsive to communication(s) filed on 21 Aug 2015.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) 9-20 is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-8 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 13 Oct. 2014 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).

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).

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)).

** 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) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. This application is being examined under the first inventor to file provisions of the AIA. In the event the determination of the status of the application as subject to AIA 35 U.S.C. 102 and 103 (or as subject to pre-AIA 35 U.S.C. 102 and 103) is incorrect, any correction of the statutory basis for the rejection will not be considered a new ground of rejection if the prior art relied upon, and the rationale supporting the rejection, would be the same under either status.

Priority

2. Receipt is acknowledged of certified copies of papers submitted in accordance with 35 U.S.C. 119(a)-(d); these papers have been placed of record in the file.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

3. **Claim 1** is rejected under 35 U.S.C. 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor regards as the invention. Specifically, the phrase "ladder-shaped cross-sectional profile" fails to fully and explicitly describe the relationship between the top portion and the lower portion of the second fin-shaped structure. For the purposes of further examination on the merits, this limitation shall be understood by the examiner to mean "a top portion with a width smaller than the width of a lower portion, wherein the change of width from the lower portion to the top portion is step-like."

Claim Rejections - 35 USC § 103

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

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claims 1-5** are rejected under 35 U.S.C. 103 as being obvious over Lee *et al.* (US 2013/0259823 A1, hereafter “Lee”) in view of Kim *et al.* (US 2014/0335673 A1, hereafter “Kim”).

Regarding claim 1, Figs. 5 and 6 of Lee disclose a fin-shaped structure (a FinFET device), comprising: a substrate (20) having a first fin-shaped structure (238) located in a first area (200) and a second fin-shaped structure (138) located in a second area (100). Lee specifically discloses that the two regions are used to form different device regions (¶0014), thus, it would be essential that the two regions have different electronic properties.

Lee fails to disclose a structure wherein the second fin-shaped structure comprises a ladder-shaped cross-sectional profile part.

However, Fig. 4 of Kim teaches a FinFET device comprising an upper portion (110) and a lower portion (120 and 103) with a ladder-shaped cross-sectional profile such that the width of the top part (W1) is larger than the width of the lower portion (W2) (see ¶0039). A capping layer (130) is disposed over the top and sides of the top portion (110) to act as an etch resist etching the substrate (100) to form the lower fin (120 and 103) before forming an insulation region (105). Kim teaches that the benefit of this structure is to prevent a short-channel effect in the fin structure (¶0003).

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee with the structure of Kim for the benefit of reducing short channel effects in a FinFET device. As mentioned above, only one fin region of Lee (e.g. 100, ¶0014) is to be used as a transistor region, so that the modification would obviously not need to be made on both regions.

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Regarding claim 2, the combination of Lee and Kim teaches the device as recited in claim 1. The modification of Lee with Kim, as shown above, makes obvious the device wherein the width of a top part of the first fin-shaped structure (200 of Lee, unmodified by Kim per argument to claim 1) is larger than the width of the top part of the second fin-shaped structure (100 of Lee, modified by Kim to reduce the short channel effect of the transistor).

Regarding claims 3-5, the combination of Lee and Kim teaches the device as recited in claim 1. Lee further discloses a structure further comprising: an isolation structure (30_1 and 30_2) disposed beside the first fin-shaped structure 238) of the first area (200) and beside the second fin-shaped structure (138) of the second area (100) respectively (*claim 3*); wherein a top surface of the isolation structure of the first area (30_2) is higher than a top surface of the isolation structure of the second area (30_1, see Fig. 5 and ¶0018) (*claim 4*); and wherein a height of the first fin-shaped structure (238, H_{fin2}) protruding from the isolation structure (30_2) is lower than a height of the second fin-shaped structure (138, H_{fin1}) protruding from the isolation structure (30_1, ¶0018).

The modification of Lee with Kim, as shown above, makes obvious the device wherein the ladder-shaped cross-sectional profile part (modified top of 138) is higher than a top surface of the isolation structure (30_1) (*claim 3*).

5. **Claims 6 is** rejected under 35 U.S.C. 103 as being obvious over Wahl in view of Kim, as applied to claims 1-5 above, and in further view of Wahl *et al.* (US 2012/0313169 A1, hereafter "Wahl").

Regarding claim 6, the combination of Lee and Kim teaches the device as recited in claim 1.

This combination fails to teach a device wherein a height of the first fin-shaped structure protruding from the substrate is higher than a height of the second fin-shaped structure protruding from the substrate.

However, Fig. 5 of Wahl teaches a structure for overcoming channel width limitations in FinFET transistors (¶0003-0007). Wahl teaches that fins of a single FinFET transistor should have different heights than the fins of a different device in order to avoid channel width quantization problems (¶0029). Wahl further shows that changing the heights of fins for

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different devices allows for the design of devices with different power properties (§0025-0026). Thus, the benefit to changing the heights of fins in a FinFET structure is to allow greater control over the power and resistance properties of the individual devices.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee, as modified by Kim, with the structure of Wahl for the benefit of allowing greater control over the power properties of the individual devices of Lee.

6. **Claims 7 and 8** are rejected under 35 U.S.C. 103 as being obvious over Lee in view of Kim, as applied to claims 1-5 above, and in further view of Chang *et al.* (US 8,669,167 B1, hereafter “Chang”).

Regarding claims 7 and 8, the combination of Lee and Kim teaches the device as recited in claim 1. Lee further teaches a device further comprising a plurality of first fin-shaped structures (238) and a plurality of second fin-shaped structures (138).

This combination fails to teach a device wherein the pitch between each top part of the first fin-shaped structures is less than the pitch between each top part of the second fin-shaped structures (*claim 7*); and wherein the first area comprises a high voltage threshold (HVT) area and the second area comprises a low voltage threshold (LVT) area (*claim 8*).

However, Chang teaches a method for adjusting the pitch of the fins in a FinFET device in order to control the threshold voltage (V_t) for the device by varying the amount of gate metal and work function material provided in between the fins (see ABS). Specifically, Chang shows that as the pitch increases between fins, the threshold voltage (V_t) decreases (see e.g. Fig. 5). Thus, the obvious benefit of this structure is to allow one to control the threshold voltages of FinFET devices by changing the pitches of the fins in different devices on the same substrate.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee, as modified by Kim, with the structure of Chang for the benefit of allowing greater control over the voltage properties of the individual devices of Lee.

Conclusion

7. The examiner has pointed out particular references contained in the prior art of record within the body of this action for the convenience of the Applicant. Although the specified citations are representative of the teachings in the art and are applied to the specific limitations within the individual claim, other passages and figures may apply. Applicant, in preparing the response, should consider fully the entire reference as potentially teaching all or part of the claimed invention, as well as the context of the passage as taught by the prior art or disclosed by the examiner.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tyler Drye, whose telephone number is (571)270-0635. The examiner can normally be reached on Monday-Thursday: 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ha Nguyen can be reached on (571) 272-1678. 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.

/Tyler Drye/

Examiner, Art Unit 2829

/Michelle Mandala/
Primary Examiner, Art Unit 2829

Notice of References Cited	Application/Control No. 14/512,475	Applicant(s)/Patent Under Reexamination SHEN ET AL.	
	Examiner Tyler Drye	Art Unit 2829	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-2012/0313169 A1	12-2012	Wahl; Jeremy	H01L21/823431	257/347
*	B	US-2013/0149826 A1	06-2013	Lee; Tsung-Lin	H01L21/823431	438/270
*	C	US-8,669,167 B1	03-2014	Chang; Josephine B.	H01L27/1211	257/347
*	D	US-2014/0335673 A1	11-2014	Kim; Sungmin	H01L29/66795	438/283
	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	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.



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BIB DATA SHEET

CONFIRMATION NO. 5891

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/512,475	10/13/2014	438	2829	NAUP2310USA		
APPLICANTS UNITED MICROELECTRONICS CORP., Hsin-Chu City, TAIWAN; INVENTORS Wen-Jiun Shen, Yunlin County, TAIWAN; Ssu-I Fu, Kaohsiung City, TAIWAN; Yen-Liang Wu, Taipei City, TAIWAN; Chia-Jong Liu, Ping-Tung County, TAIWAN; Yu-Hsiang Hung, Tainan City, TAIWAN; Chung-Fu Chang, Tainan City, TAIWAN; Man-Ling Lu, Taoyuan County, TAIWAN; Yi-Wei Chen, Taichung City, TAIWAN; ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** CHINA 201410454915.X 09/09/2014 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 10/16/2014						
Foreign Priority claimed ☒ Yes ☐ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/Tyler Drye/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY TAIWAN	SHEETS DRAWINGS 5	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116 UNITED STATES						
TITLE FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF						
FILING FEE RECEIVED 1600	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		

<p align="center"><i>Index of Claims</i></p> 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner TYLER DRYE	Art Unit 2829

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

☒ Claims renumbered in the same order as presented by applicant				☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE							
Final	Original	08/11/2015	09/14/2015						
	1	÷	✓						
	2	÷	✓						
	3	÷	✓						
	4	÷	✓						
	5	÷	✓						
	6	÷	✓						
	7	÷	✓						
	8	÷	✓						
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	14	÷	N						
	15	÷	N						
	16	÷	N						
	17	÷	N						
	18	÷	N						
	19	÷	N						
	20	÷	N						

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Wen-Jiun Shen
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA

U.S. PATENTS							
Examiner Initial*	Cite No	Patent Number	Kind Code	Issue Date	Name	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1	8669615		2014-03-11	Chang		
	2	8373238		2013-02-12	Lee		
U.S. PATENT APPLICATION PUBLICATIONS							
Examiner Initial*	Cite No	Publication Number	Kind Code	Publication Date	Name	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear	
	1	20080157225		2008-07-03	Datta		
FOREIGN PATENT DOCUMENTS							
Examiner Initial*	Cite No	Foreign Document Number	Country Code	Kind Code	Publication Date	Name	Pages, Columns, Lines where Relevant Passages or Relevant Figures Appear
	1						
NON-PATENT LITERATURE DOCUMENTS							

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Wen-Jiun Shen
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA

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.	
	1		
EXAMINER SIGNATURE			
Examiner Signature	/TYLER DRYE/		Date Considered 09/14/2015
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.			

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Application Number	
	Filing Date	
	First Named Inventor	Wen-Jiun Shen
	Art Unit	N/A
	Examiner Name	N/A
	Attorney Docket Number	NAUP2310USA

CERTIFICATION STATEMENT

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

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

OR

- ☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

- ☐ See attached certification statement.
- ☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.
- ☒ None

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	/Scott Margo/	Date (YYYY-MM-DD)	2014-10-08
Name/Print	Scott Margo	Registration Number	56277

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	3	"8669615"	US-PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2015/09/14 11:25
S2	11	"8373238"	US-PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2015/09/14 11:26
S3	2	"20080157225"	US-PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2015/09/14 11:26
S4	4	"13596687"	US-PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2015/09/14 11:32
S5	6	"13764549"	US-PGPUB; USPAT; USOCR; DERWENT	ADJ	ON	2015/09/14 11:35
S6	18	("20020074612" "20050019993" "20050051812" "20070052037" "20070075351" "20070196961" "20070292996" "20080093699" "20090084181" "20090309167" "20110053361" "20110111596" "20110298018" "20130134486" "6444512" "7807525" "7879669" "7923337").PN. OR ("8669167").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2015/09/14 11:38
S7	42	"8207027" "7655989" "20100041198" "20080128796" EP adj "1620891" EP adj "1620891"	US-PGPUB; USPAT; USOCR; DERWENT	OR	ON	2015/09/14 11:48
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		another or greater or smaller or larger or bigger or less\$2) near3 (pitch\$3 or yaw\$3 or spac\$3)	DERWENT; IBM_TDB			
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		"20140231872").PN.					
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9/ 14/ 2015 4:21:21 PM

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Search Notes 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner TYLER DRYE	Art Unit 2829

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST search history attached.	9/14/2015	TD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No. : 14/512,475 Confirmation No. 5891
First Named Inventor : Wen-Jiun Shen
Filed : October 13, 2014
TC/A.U. : 2829
Examiner : DRYE, TYLER B
Docket No. : NAUP2310USA
Customer No. : 27765

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

AMENDMENT

In response to the Office action of September 22, 2015, please amend the above-identified application as follows:

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

Remarks/Arguments begin on page 7 of this paper.

Amendments to the Claims:

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

Listing of Claims:

- 5 Claim 1 (currently amended): A fin-shaped structure, comprising:
 a substrate having a first fin-shaped structure located in a first area and a
 second fin-shaped structure located in a second area, wherein the
 second fin-shaped structure comprises a ladder-shaped cross-sectional
 profile part, wherein the width of a top part of the ladder-shaped
10 cross-sectional profile is smaller than the width of a lower part of the
 ladder-shaped cross-sectional profile, wherein the change of width
 from the lower part to the top part is step-like; and
 two gates directly disposed over the first fin-shaped structure and the second
 fin-shaped structure respectively.
- 15 Claim 2 (original): The fin-shaped structure according to claim 1, wherein the width
 of a top part of the first fin-shaped structure is larger than the width of the
 top part of the second fin-shaped structure.
- 20 Claim 3 (original): The fin-shaped structure according to claim 1, further comprising:
 an isolation structure disposed beside the first fin-shaped structure of the first
 area and beside the second fin-shaped structure of the second area
 respectively, and the ladder-shaped cross-sectional profile part is
 higher than a top surface of the isolation structure.
- 25 Claim 4 (original): The fin-shaped structure according to claim 1, wherein a top
 surface of the isolation structure of the first area is higher than a top surface
 of the isolation structure of the second area.
- 30 Claim 5 (original): The fin-shaped structure according to claim 1, wherein a height of

the first fin-shaped structure protruding from the isolation structure is lower than a height of the second fin-shaped structure protruding from the isolation structure.

- 5 Claim 6 (original): The fin-shaped structure according to claim 1, wherein a height of the first fin-shaped structure protruding from the substrate is higher than a height of the second fin-shaped structure protruding from the substrate.

- 10 Claim 7 (original): The fin-shaped structure according to claim 1, further comprising:
a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the pitch between each top part of the first fin-shaped structures is less than the pitch between each top part of the second fin-shaped structures.

- 15 Claim 8 (original): The fin-shaped structure according to claim 1, wherein the first area comprises a high voltage threshold (HVT) area and the second area comprises a low voltage threshold (LVT) area.

- 20 Claim 9 (withdrawn): A method of forming a fin-shaped structure, comprising:
providing a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area;
filling an isolation structure beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area respectively;
25 forming a patterned mask covering the first area but exposing the second area ;
removing a top part of the isolation structure of the second area, thereby exposing a first top part of the second fin-shaped structure;
performing a treatment process to modify an external surface of the first top
30 part of the second fin-shaped structure, thereby forming a modified

- part covering the first top part of the second fin-shaped structure;
removing the patterned mask; and
performing a removing process to remove a part of the isolation structure
and the modified part by the high removing selectivity to the first
5 fin-shaped structure and the second fin-shaped structure, and the
modified part and the isolation structure, thereby exposing a top part
of the first fin-shaped structure and a second top part of the second
fin-shaped structure.
- 10 Claim 10 (withdrawn): The method of forming a fin-shaped structure according to
claim 9, wherein the isolation structure comprises oxide and the modified
part comprises oxide.
- Claim 11 (withdrawn): The method of forming a fin-shaped structure according to
15 claim 9, wherein the treatment process comprises an oxidation process.
- Claim 12 (withdrawn): The method of forming a fin-shaped structure according to
claim 11, wherein the treatment process comprises an oxygen
gas-containing process or an in-situ steam generated (ISSG) process.
20
- Claim 13 (withdrawn): The method of forming a fin-shaped structure according to
claim 9, wherein the removing process comprises an ammonia and nitrogen
trifluoride containing etching process.
- 25 Claim 14 (withdrawn): A method of forming a fin-shaped structure, comprising:
providing a substrate having a first fin-shaped structure located in a first
area and a second fin-shaped structure located in a second area;
forming a first gate across the first fin-shaped structure and a second gate
across the second fin-shaped structure, wherein the first gate
30 sequentially comprises a first dielectric layer and a first sacrificial

gate covering the first fin-shaped structure, and the second gate sequentially comprises a second dielectric layer and a second sacrificial gate covering the second fin-shaped structure; removing the first sacrificial gate and the second sacrificial gate, thereby
5 exposing the first dielectric layer and the second dielectric layer; covering a mask in the first area but exposing the second area; performing a removing process to remove an external surface of a top part of the second fin-shaped structure; and removing the mask.

10

Claim 15 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
forming a dielectric layer covering the first fin-shaped structure and the second fin-shaped structure after the mask is removed.

15

Claim 16 (withdrawn): The method of forming a fin-shaped structure according to claim 14, wherein the external surface of the top part of the second fin-shaped structure and the whole second dielectric layer are removed by the removing process.

20

Claim 17 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer completely after the mask is removed.

25 Claim 18 (withdrawn): The method of forming a fin-shaped structure according to claim 14, further comprising:
removing the first dielectric layer and the second dielectric layer completely before covering the mask.

30 Claim 19 (withdrawn): The method of forming a fin-shaped structure according to

claim 14, further comprising:

forming an isolation structure beside the first fin-shaped structure of the
first area and beside the second fin-shaped structure of the second
area respectively after the substrate is provided, wherein a top part of
the isolation structure of the second area is also removed while the
removing process is performed.

5

Claim 20 (withdrawn): The method of forming a fin-shaped structure according to
claim 14, wherein the removing process has no removing selectivity to the
isolation structure and the second fin-shaped structure.

10

Electronic Acknowledgement Receipt

EFS ID:	24114313
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Winston Hsu/Lydia Wei
Filer Authorized By:	Winston Hsu
Attorney Docket Number:	NAUP2310USA
Receipt Date:	18-NOV-2015
Filing Date:	13-OCT-2014
Time Stamp:	03:40:15
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	2410947.PDF	658189 d61b852a42fca093f06daf193050eacabe66b35	no	5

Warnings:

Information:

2	Amendment/Req. Reconsideration-After Non-Final Reject	2410946.PDF	81647 <small>c428df59f89e3ecbb57a06fa1f59d5a5b827900e</small>	no	1
Warnings:					
Information:					
3	Claims	2410945.PDF	120446 <small>99c5717d900516e7c4ea313eb6803b66590b217</small>	no	5
Warnings:					
Information:					
Total Files Size (in bytes):			860282		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

REMARKS/ARGUMENTS

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record
5 in the application file.

Reconsideration of the present application is politely requested. Claims 1 – 20 remain pending in the case. In order to more particularly point out and distinctly claim that which the applicant regards as his invention, Claim 1 has been amended. No new
10 matter is introduced by this amendment. Acceptance of this amendment is respectfully requested.

Amendments to the claims

Claim 1 has been amended to include the features “the width of a top part of the
15 ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like” and “two gates directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively”. No new matter is introduced by these amendments. Acceptance of the amended claim is respectfully
20 solicited.

Claim Rejections – 35 USC §112

Claim 1 was rejected under 35 U.S.C. 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor
25 regards as the invention. Specifically, the phrase “ladder-shaped cross-sectional profile” failed to fully and explicitly describe the relationship between the top portion and the lower portion of the second fin-shaped structure. This limitation was understood by the examiner to mean “a top portion with a width smaller than the width of a lower portion, wherein the change of width from the lower portion to the
30 top portion is step-like.”

Response

Claim 1 has been amended to include the feature “the width of a top part of the ladder-shaped cross-sectional profile with a width smaller than the width of a lower
5 part of the ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like” in accordance with the Examiner’s statement.

Claim Rejections – 35 USC §103

Claims 1 – 5 were rejected under 35 U.S.C. 103 as being obvious over Lee et al.
10 (US 2013/0259823 A1, hereafter “Lee”) in view of Kim et al. (US 2014/0335673 A1, hereafter “Kim”).

Claim 6 was rejected under 35 U.S.C. 103 as being obvious over Wahl in view of Kim, as applied to claims 1 – 5 above, and in further view of Wahl et al. (US 2012/0313169 A1, hereafter “Wahl”).

15 Claims 7 and 8 were rejected under 35 U.S.C. 103 as being obvious over Lee in view of Kim, as applied to claims 1-5 above, and in further view of Chang et al. (US 8,669,167 B1, hereafter “Chang”).

Response

20 Claim 1

Amended Claim 1 now includes the feature “two gates directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively”. As detailed in the specification of the instant application, after the modified parts 120 on the second fin-shaped structures 112b are removed (shown in FIGs.4 – 5), gates are
25 directly disposed over the first fin-shaped structures and the second fin-shaped structures respectively. This is described in Para [0023]: “Thereafter, processes such as forming gates or transistors may be performed. For instance, **a gate may be formed across the first fin-shaped structures 112a of the first area A and the second fin-shaped structures 112b of the second area B** respectively; a source/drain
30 may be formed in the first fin-shaped structures 112a and the second fin-shaped

structures 112b beside the gates respectively; and an interdielectric layer may be formed to cover the gates, the first fin-shaped structures 112a and the second fin-shaped structures 112b” (*emphasis added*).

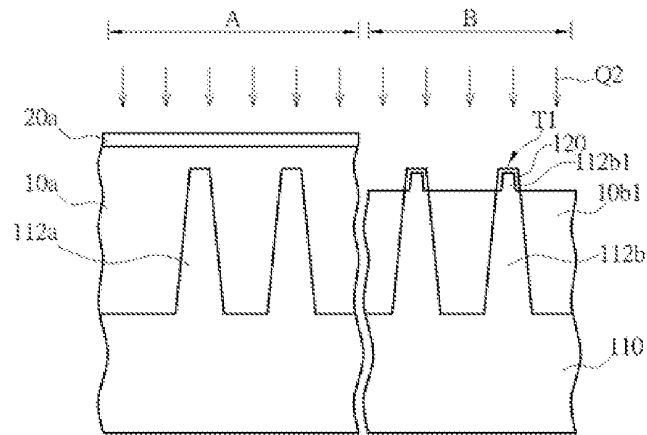


FIG. 4

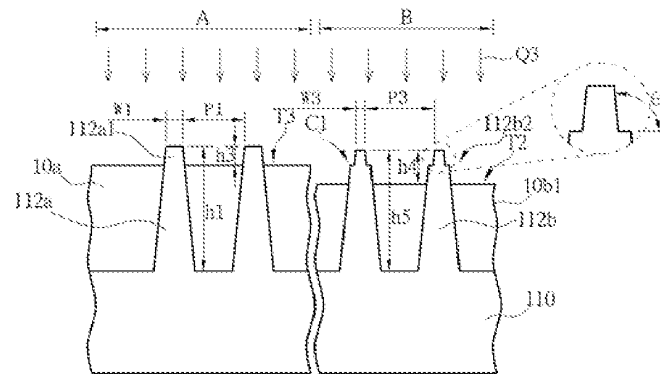
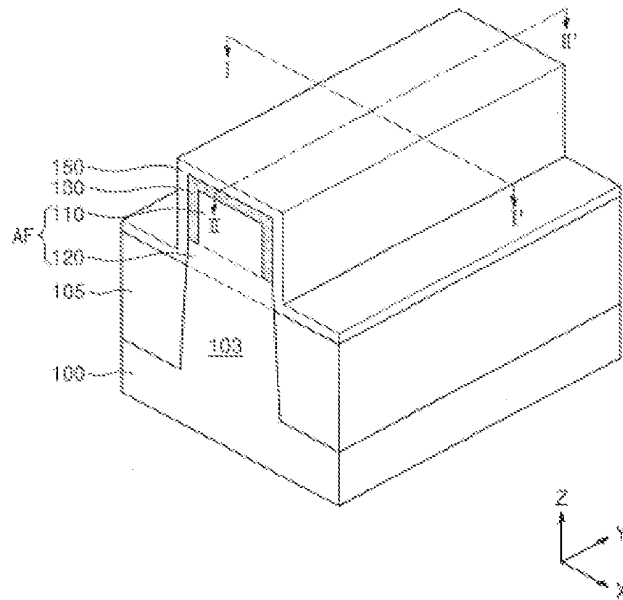


FIG. 5

5

In FIG.5A of Kim, the capping pattern 130 (equated to the modified parts of the current application) is not removed, and the etching stop layer 150 is directly disposed on the capping pattern 130. In other words, there is no gate directly disposed on a fin-shaped structure. Therefore, Kim fails to disclose “two gates directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively” as recited in Claim 1.

Fig. 5A



Since amended Claim 1 of the present application defines “two gates directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively”, the applicant firmly believes that Claim 1 is different from and cannot be anticipated by Kim in combination with the other prior arts such as Lee.

Claims 2 – 8

Claims 2 – 8 are dependent upon Claim 1 and should therefore be found allowable if Claim 1 is found allowable.

Conclusion

It is respectfully suggested that, in light of the above, none of the cited references,

alone or in combination, teaches or makes obvious all of the limitations of amended Claim 1. Reconsideration of Claim 1 is therefore politely requested. As claims 2 – 8 are dependent upon Claim 1, they should be allowable if Claim 1 is allowed. Reconsideration of claims 2 – 8 is therefore politely requested.

5

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

Sincerely yours,

10

/Scott Margo/

Date: 11/17/2015

Scott Margo, Patent Agent No. 56,277

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

Voice Mail: 302-729-1562

15

Facsimile: 806-498-6673

e-mail : ScottMargo@naipo.com

Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C. is 13 hours behind the Taiwan time, i.e. 9 AM in D.C. = 10 PM in Taiwan.)

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/512,475	Filing Date 10/13/2014	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

(Column 1) (Column 2)

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

APPLICATION AS AMENDED – PART II

(Column 1) (Column 2) (Column 3)

	11/18/2015	CLAIMS REMAINING AFTER AMENDMENT	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

(Column 1) (Column 2) (Column 3)

		CLAIMS REMAINING AFTER AMENDMENT	Minus	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

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

** 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.

LIE
/ANGELA s. WHITE/

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

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 12/17/2015 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER DRYE, TYLER B	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			12/17/2015	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com

Office Action Summary	Application No. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner Tyler Drye	Art Unit 2829	AIA (First Inventor to File) Status Yes

-- 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 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☒ Responsive to communication(s) filed on 18 Nov. 2015.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-20 is/are pending in the application.
5a) Of the above claim(s) 9-20 is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-8 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 13 Oct. 2014 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).

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).

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)).

** 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) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. This application is being examined under the first inventor to file provisions of the AIA.

Response to Arguments

2. Applicant's amendments filed 11/18/2015 are sufficient to overcome the previous grounds of rejection. New grounds of rejection in light of the amended claims are provided. These grounds of rejection are made **FINAL** below.

Claim Rejections - 35 USC § 103

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

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

3. **Claims 1-5** are rejected under 35 U.S.C. 103 as being obvious over Lee *et al.* (US 2013/0259823 A1, hereafter "Lee") in view of Kim *et al.* (US 2014/0335673 A1, hereafter "Kim").

Regarding claim 1, Figs. 5-7 of Lee disclose a fin-shaped structure (a FinFET device), comprising: a substrate (20) having a first fin-shaped structure (238) located in a first area (200) and a second fin-shaped structure (138) located in a second area (100), and two gates (see Fig. 7, 150 and 152 and 250 and 252) directly disposed over the first fin-shaped structure (250 and 252) and the second fin-shaped structure (150 and 152), respectively. 150 and 250 represent respective gate dielectric layers, while 152 and 252 represent gate electrodes formed over the separate section of fin-shaped structures (§0020). Lee specifically discloses that the two regions are used to form different device regions (§0014), thus, it would be essential that the two regions have different electronic properties.

Lee fails to disclose a structure wherein the second fin-shaped structure comprises a ladder-shaped cross-sectional profile part, wherein a width of a top part of the ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped cross-sectional profile, wherein the change in width from the lower part to the top part is step-like.

However, Fig. 4 of Kim teaches a FinFET device comprising an upper portion (110) and a lower portion (120 and 103) with a ladder-shaped cross-sectional profile such that the width of the top part (W1) is smaller than the width of the lower portion (W2) (see ¶0039). A capping layer (130) is disposed over the top and sides of the top portion (110) to act as an etch resist etching the substrate (100) to form the lower fin (120 and 103) before forming an insulation region (105). Kim teaches that the benefit of this structure is to prevent a short-channel effect in the fin structure (¶0003).

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee with the structure of Kim for the benefit of reducing short channel effects in a FinFET device. As mentioned above, only one fin region of Lee (e.g. 100, ¶0014) is to be used as a transistor region, so that the modification would obviously not need to be made on both regions.

Regarding claim 2, the combination of Lee and Kim teaches the device as recited in claim 1. The modification of Lee with Kim, as shown above, makes obvious the device wherein the width of a top part of the first fin-shaped structure (200 of Lee, unmodified by Kim per argument to claim 1) is larger than the width of the top part of the second fin-shaped structure (100 of Lee, modified by Kim to reduce the short channel effect of the transistor).

Regarding claims 3-5, the combination of Lee and Kim teaches the device as recited in claim 1. Lee further discloses a structure further comprising: an isolation structure (30_1 and 30_2) disposed beside the first fin-shaped structure 238) of the first area (200) and beside the second fin-shaped structure (138) of the second area (100) respectively (*claim 3*); wherein a top surface of the isolation structure of the first area (30_2) is higher than a top surface of the isolation structure of the second area (30_1, see Fig. 5 and ¶0018) (*claim 4*); and wherein a height of the first fin-shaped structure (238, H_{fin2}) protruding from the isolation structure (30_2) is lower than a height of the second fin-shaped structure (138, H_{fin1}) protruding from the isolation structure (30_1, ¶0018).

The modification of Lee with Kim, as shown above, makes obvious the device wherein the ladder-shaped cross-sectional profile part (modified top of 138) is higher than a top surface of the isolation structure (30_1) (*claim 3*).

4. **Claims 6 is** rejected under 35 U.S.C. 103 as being obvious over Wahl in view of Kim, as applied to claims 1-5 above, and in further view of Wahl *et al.* (US 2012/0313169 A1, hereafter "Wahl").

Regarding claim 6, the combination of Lee and Kim teaches the device as recited in claim 1.

This combination fails to teach a device wherein a height of the first fin-shaped structure protruding from the substrate is higher than a height of the second fin-shaped structure protruding from the substrate.

However, Fig. 5 of Wahl teaches a structure for overcoming channel width limitations in FinFET transistors (§0003-0007). Wahl teaches that fins of a single FinFET transistor should have different heights than the fins of a different device in order to avoid channel width quantization problems (§0029). Wahl further shows that changing the heights of fins for different devices allows for the design of devices with different power properties (§0025-0026). Thus, the benefit to changing the heights of fins in a FinFET structure is to allow greater control over the power and resistance properties of the individual devices.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee, as modified by Kim, with the structure of Wahl for the benefit of allowing greater control over the power properties of the individual devices of Lee.

5. **Claims 7 and 8** are rejected under 35 U.S.C. 103 as being obvious over Lee in view of Kim, as applied to claims 1-5 above, and in further view of Chang *et al.* (US 8,669,167 B1, hereafter "Chang").

Regarding claims 7 and 8, the combination of Lee and Kim teaches the device as recited in claim 1. Lee further teaches a device further comprising a plurality of first fin-shaped structures (238) and a plurality of second fin-shaped structures (138).

This combination fails to teach a device wherein the pitch between each top part of the first fin-shaped structures is less than the pitch between each top part of the second fin-shaped structures (*claim 7*); and wherein the first area comprises a high voltage threshold (HVT) area and the second area comprises a low voltage threshold (LVT) area (*claim 8*).

However, Chang teaches a method for adjusting the pitch of the fins in a FinFET device in order to control the threshold voltage (V_t) for the device by varying the amount of gate metal and work function material provided in between the fins (see ABS). Specifically, Chang shows that as the pitch increases between fins, the threshold voltage (V_t) decreases (see e.g. Fig. 5). Thus, the obvious benefit of this structure is to allow one to control the threshold voltages of FinFET devices by changing the pitches of the fins in different devices on the same substrate.

It would have been obvious to one of ordinary skill in the art before the effective filing date of the claimed invention to modify the structure of Lee, as modified by Kim, with the structure of Chang for the benefit of allowing greater control over the voltage properties of the individual devices of Lee.

Conclusion

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

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

Art Unit: 2829

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tyler Drye, whose telephone number is (571)270-0635. The examiner can normally be reached on Monday-Thursday: 9AM-5PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ha Nguyen can be reached on (571) 272-1678. 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.

/Tyler Drye/
Examiner, Art Unit 2829

/Michelle Mandala/
Primary Examiner, Art Unit 2829

Search Notes 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner TYLER DRYE	Art Unit 2829

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST search history attached.	9/14/2015	TD

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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<p align="center"><i>Index of Claims</i></p> 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner TYLER DRYE	Art Unit 2829

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

☒ Claims renumbered in the same order as presented by applicant					☐ CPA		☐ T.D.		☐ R.1.47	
CLAIM		DATE								
Final	Original	08/11/2015	09/14/2015	12/08/2015						
	1	÷	✓	✓						
	2	÷	✓	✓						
	3	÷	✓	✓						
	4	÷	✓	✓						
	5	÷	✓	✓						
	6	÷	✓	✓						
	7	÷	✓	✓						
	8	÷	✓	✓						
	9	÷	N	N						
	10	÷	N	N						
	11	÷	N	N						
	12	÷	N	N						
	13	÷	N	N						
	14	÷	N	N						
	15	÷	N	N						
	16	÷	N	N						
	17	÷	N	N						
	18	÷	N	N						
	19	÷	N	N						
	20	÷	N	N						

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (09-08)

Approved for use through 10/31/2008. OMB 0651-0031

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

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

Application Number	14/512,475	Filing Date	2014-10-13	Docket Number (if applicable)	NAUP2310USA	Art Unit	2829
First Named Inventor	Wen-Jiun Shen			Examiner Name	CHI, SUBERR L		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

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

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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

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

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

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☐ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

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

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to
Deposit Account No 503105

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Doc code: RCEX

Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (09-08)

Approved for use through 10/31/2008. OMB 0651-0031

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

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Signature of Registered U.S. Patent Practitioner			
Signature	/Scott Margo/	Date (YYYY-MM-DD)	2016-02-18
Name	Scott Margo	Registration Number	56277

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

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

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3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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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)).
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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:		14512475		
Filing Date:		13-Oct-2014		
Title of Invention:		FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		
First Named Inventor/Applicant Name:		Wen-Jiun Shen		
Filer:		Winston Hsu/Jessie Su		
Attorney Docket Number:		NAUP2310USA		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
Total in USD (\$)				1200

Electronic Acknowledgement Receipt

EFS ID:	24958192
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Winston Hsu/Jessie Su
Filer Authorized By:	Winston Hsu
Attorney Docket Number:	NAUP2310USA
Receipt Date:	19-FEB-2016
Filing Date:	13-OCT-2014
Time Stamp:	03:50:25
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$1200
RAM confirmation Number	7311
Deposit Account	503105
Authorized User	HSU, WINSTON
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 CFR 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	2487182.PDF	663987	no	6
			3f919a867599b714ec8b64506611a22d2fd57a29		
Warnings:					
Information:					
2	Amendment Submitted/Entered with Filing of CPA/RCE	2487181.PDF	81864	no	1
			cafd87d7a8d6f78f1a89f61451b2829e39c98119		
Warnings:					
Information:					
3	Claims	2487180.PDF	94913	no	5
			1fcb3bc6b321f340c959a6fb822db06c91ed8998		
Warnings:					
Information:					
4	Request for Continued Examination (RCE)	2486594.pdf	324828	no	3
			54dbaf1f05cba0d3fed41d8c9a9bf87b1f8b7582		
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30420	no	2
			8f87942523a60a8f834df9f7ef58435d7db95661		
Warnings:					
Information:					
Total Files Size (in bytes):			1196012		

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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.

REMARKS/ARGUMENTS

Request for Continued Examination:

The applicant respectfully requests continued examination of the above-indicated
5 application as per 37 CFR 1.114.

Recognizing that Internet communications are not secure, I hereby authorize the
USPTO to communicate with me concerning any subject matter of this application by
10 electronic mail. I understand that a copy of these communications will be made of record
in the application file.

Reconsideration of the present application is politely requested. Claims 1 – 20
remain pending in the case. In order to more particularly point out and distinctly claim
15 that which the applicant regards as his invention, Claim 1 has been amended. Claims
2 – 3 and 5 – 6 have been amended in accordance with the amendments to Claim 1.
Claim 7 has been canceled. No new matter is introduced by this amendment.
Acceptance of this amendment is respectfully requested.

20 **Amendments to the claims**

Claim 7 has been cancelled and its limitations incorporated into Claim 1, which
has been further amended to include the feature “a substrate having a plurality of first
fin-shaped structures located in a first area and a plurality of second fin-shaped
structures located in a second area, wherein the second fin-shaped structures
25 [[comprises]] comprise ladder-shaped cross-sectional profile parts, the pitch between
each top part of the first fin-shaped structures is less than the pitch between each top
part of the second fin-shaped structures, while the pitch between each lower part
below the top part of the first fin-shaped structures is the same as the pitch between
each lower part below the top part of the second fin-shaped structures, and the width
30 of each top part of the ~~ladder-shaped cross-sectional profile~~ second fin-shaped

structures is smaller than the width of each lower part of the second fin-shaped structures ~~ladder-shaped cross-sectional profile~~, wherein the change of width from the lower part to the top part is step-like”. No new matter is introduced by these amendments. Acceptance of the amended claims is respectfully solicited.

5

Claim Rejections – 35 USC §103

Claims 1 – 5 were rejected under 35 U.S.C. 103 as being obvious over Lee et al. (US2013/0259823 A1, hereafter “Lee”) in view of Kim et al. (US 2014/0335673 A1 hereafter “Kim”).

10 Claim 6 was rejected under 35 U.S.C. 103 as being obvious over Wahl in view of Kim, as applied to claims 1 – 5 above, and in further view of Wahl et al. (US 2012/0313169 A1, hereafter “Wahl”).

 Claims 7 and 8 were rejected under 35 U.S.C. 103 as being obvious over Lee in view of Kim, as applied to claims 1 – 5 above, and in further view of Chang et al. (US 15 8,669,167 B1, hereafter “Chang”).

Response

Claim 1

 Amended Claim 1 now includes the feature “a substrate having a plurality of first
20 fin-shaped structures located in a first area and a plurality of second fin-shaped
 structures located in a second area, wherein the second fin-shaped structures
 [[comprises]] comprise ladder-shaped cross-sectional profile parts, the pitch between
 each top part of the first fin-shaped structures is less than the pitch between each top
 part of the second fin-shaped structures, while the pitch between each lower part
25 below the top part of the first fin-shaped structures is the same as the pitch between
 each lower part below the top part of the second fin-shaped structures, and the width
 of each top part of the ~~ladder-shaped cross-sectional profile~~ second fin-shaped
 structures is smaller than the width of each lower part of the second fin-shaped
 structures ~~ladder-shaped cross-sectional profile~~, wherein the change of width from the
30 lower part to the top part is step-like”. The feature is supported by the illustrations of

FIGs.1 and 4 – 5. FIG.1 is shown below. The amendments are further supported by the specification, Para [0013]: “In this embodiment, the first fin-shaped structures 112a and the second fin-shaped structures 112b have the **same structure**. A height h1 of each of the first fin-shaped structures 112a is common to a height h2 of each of the second fin-shaped structures 112b; a width w1 of a top part of each of the first fin-shaped structures 112a is the same as a width w2 of a top part of each of second fin-shaped structures 112b; and a pitch p1 between a top part of each of the first fin-shaped structures 112a is the same as a pitch p2 between a top part of each of the second fin-shaped structures 112b”.

10 The above quoted section details that **a pitch p1 between each of the first fin-shaped structures 112a is the same as a pitch p2 between each of the second fin-shaped structures 112b.**

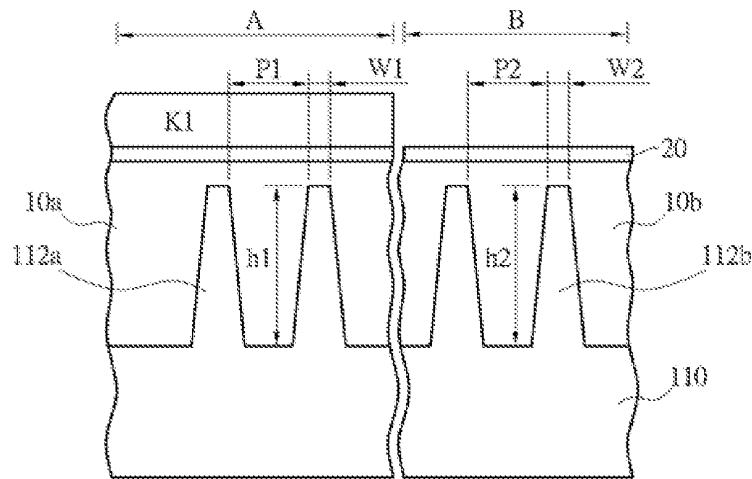


FIG. 1

15 Therefore, as the top part 112b1 of each of the second fin-shaped structures 112b is removed (shown in FIGs.4 – 5), only the pitch P1 between each top part 112a1 of the first fin-shaped structures 112a will be **less than** the pitch P3 between each top part 112b2 of the second fin-shaped structures 112b, while the pitch between each lower part below the top part of the first fin-shaped structures is **the same** as the pitch between each lower part below the top part of the second fin-shaped structures.

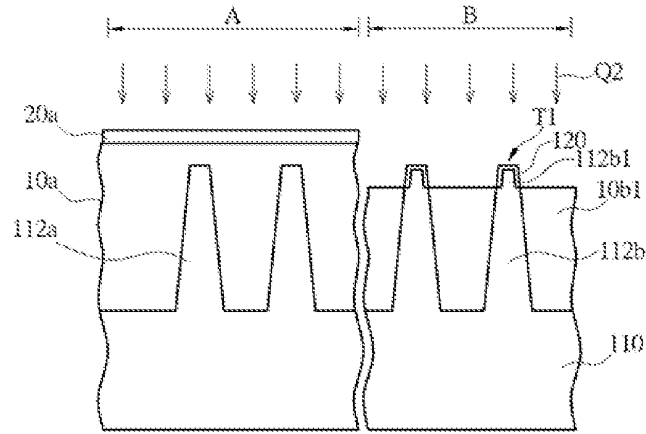


FIG. 4

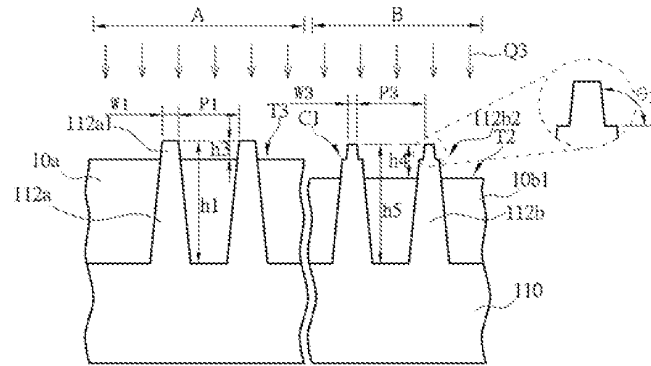


FIG. 5

In FIG. 5 of Chang, all of the fins comprising top parts and lower parts have
 5 different pitches.

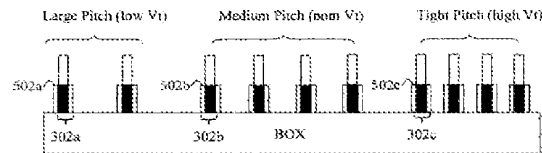


FIG. 5

Since amended Claim 1 of the present application defines “a substrate having a

plurality of first fin-shaped structures located in a first area and a plurality of second fin-shaped structures located in a second area, wherein the second fin-shaped structures [[comprises]] comprise ladder-shaped cross-sectional profile parts, the pitch between each top part of the first fin-shaped structures is less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures, and the width of each top part of the ladder-shaped cross-sectional profile second fin-shaped structures is smaller than the width of each lower part of the second fin-shaped structures ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like”, the applicant firmly believes that Claim 1 is distinctively different from and cannot be anticipated by Lee in view of Kim.

15 Claims 2 – 6 and 8

Claims 2 – 6 and 8 are dependent upon Claim 1 and should therefore be found allowable if Claim 1 is found allowable.

Claim 7

Claim 7 has been cancelled.

20

Conclusion

It is respectfully suggested that, in light of the above, none of the cited references, alone or in combination, teaches or makes obvious all of the limitations of amended Claim 1. Reconsideration of Claim 1 is therefore politely requested. As claims 2 – 6 and 8 are dependent upon Claim 1, they should be allowable if Claim 1 is allowed. Reconsideration of claims 2 – 6 and 8 is therefore politely requested.

25

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

30

Appl. No. 14/512,475
Reply to Office action of December 17, 2015

Sincerely yours,

/Scott Margo/

Date: 02/18/2016

Scott Margo, Patent Agent No. 56,277

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

Voice Mail: 302-729-1562

Facsimile: 806-498-6673

e-mail : ScottMargo@naipo.com

- 10 Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C. is 13 hours behind the Taiwan time, i.e. 9 AM in D.C. = 10 PM in Taiwan.)

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No. : 14/512,475 Confirmation No. : 5891
First Named Inventor : Wen-Jiun Shen
Filed : October 13, 2014
TC/A.U. : 2829
Examiner : CHI, SUBERR L
Docket No. : NAUP2310USA
Customer No. : 27765

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

AMENDMENT AND REQUEST FOR CONTINUED EXAMINATION

In response to the Office action of December 17, 2015, 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 7 of this paper.

Amendments to the Claims:

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

5 **Listing of Claims:**

Claim 1 (currently amended): A fin-shaped structure, comprising:

10 a substrate having a plurality of first fin-shaped structures located in a first area and a plurality of second fin-shaped structures located in a second area, wherein the second fin-shaped structures [[comprises]] comprise [[a]] ladder-shaped cross-sectional profile parts, the pitch between
15 each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first
 fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures, and wherein the
 width of [[a]] each top part of the second fin-shaped structures
 ladder-shaped cross-sectional profile is smaller than the width of [[a]]
20 each lower part of the second fin-shaped structures ladder-shaped
 cross-sectional profile, wherein the change of width from the lower part to the top part is step-like; and
 two gates directly disposed over the first fin-shaped structures and the second fin-shaped structures respectively.

25 Claim 2 (currently amended): The fin-shaped structure according to claim 1, wherein the width of [[a]] each top part of the first fin-shaped structures is larger than the width of the each top part of the second fin-shaped structures.

30 Claim 3 (currently amended): The fin-shaped structure according to claim 1, further comprising:

an isolation structure disposed beside the first fin-shaped structures of the first area and beside the second fin-shaped structures of the second area respectively, and the ladder-shaped cross-sectional profile part is higher than a top surface of the isolation structure.

5

Claim 4 (original): The fin-shaped structure according to claim 1, wherein a top surface of the isolation structure of the first area is higher than a top surface of the isolation structure of the second area.

10 Claim 5 (currently amended): The fin-shaped structure according to claim 1, wherein a height of the first fin-shaped structures protruding from the isolation structure is lower than a height of the second fin-shaped structures protruding from the isolation structure.

15 Claim 6 (currently amended): The fin-shaped structure according to claim 1, wherein a height of the first fin-shaped structures protruding from the substrate is higher than a height of the second fin-shaped structures protruding from the substrate.

20 Claim 7 (canceled)

Claim 8 (original): The fin-shaped structure according to claim 1, wherein the first area comprises a high voltage threshold (HVT) area and the second area comprises a low voltage threshold (LVT) area.

25

Claim 9 (withdrawn): A method of forming a fin-shaped structure, comprising:
providing a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area;
filling an isolation structure beside the first fin-shaped structure of the first area and beside the second fin-shaped structure of the second area

30

respectively;
forming a patterned mask covering the first area but exposing the second
area;
removing a top part of the isolation structure of the second area, thereby
5 exposing a first top part of the second fin-shaped structure;
performing a treatment process to modify an external surface of the first top
part of the second fin-shaped structure, thereby forming a modified
part covering the first top part of the second fin-shaped structure;
removing the patterned mask; and
10 performing a removing process to remove a part of the isolation structure
and the modified part by the high removing selectivity to the first
fin-shaped structure and the second fin-shaped structure, and the
modified part and the isolation structure, thereby exposing a top part
of the first fin-shaped structure and a second top part of the second
15 fin-shaped structure.

Claim 10 (withdrawn): The method of forming a fin-shaped structure according to
claim 9, wherein the isolation structure comprises oxide and the modified
part comprises oxide.

20

Claim 11 (withdrawn): The method of forming a fin-shaped structure according to
claim 9, wherein the treatment process comprises an oxidation process.

Claim 12 (withdrawn): The method of forming a fin-shaped structure according to
25 claim 11, wherein the treatment process comprises an oxygen
gas-containing process or an in-situ steam generated (ISSG) process.

Claim 13 (withdrawn): The method of forming a fin-shaped structure according to
claim 9, wherein the removing process comprises an ammonia and nitrogen
30 trifluoride containing etching process.

Claim 14 (withdrawn): A method of forming a fin-shaped structure, comprising:
providing a substrate having a first fin-shaped structure located in a first
area and a second fin-shaped structure located in a second area;
5 forming a first gate across the first fin-shaped structure and a second gate
across the second fin-shaped structure, wherein the first gate
sequentially comprises a first dielectric layer and a first sacrificial
gate covering the first fin-shaped structure, and the second gate
sequentially comprises a second dielectric layer and a second
10 sacrificial gate covering the second fin-shaped structure;
removing the first sacrificial gate and the second sacrificial gate, thereby
exposing the first dielectric layer and the second dielectric layer;
covering a mask in the first area but exposing the second area;
performing a removing process to remove an external surface of a top part
15 of the second fin-shaped structure; and
removing the mask.

Claim 15 (withdrawn): The method of forming a fin-shaped structure according to
claim 14, further comprising:
20 forming a dielectric layer covering the first fin-shaped structure and the
second fin-shaped structure after the mask is removed.

Claim 16 (withdrawn): The method of forming a fin-shaped structure according to
claim 14, wherein the external surface of the top part of the second
25 fin-shaped structure and the whole second dielectric layer are removed by
the removing process.

Claim 17 (withdrawn): The method of forming a fin-shaped structure according to
claim 14, further comprising:
30 removing the first dielectric layer completely after the mask is removed.

- 5 Claim 18 (withdrawn): The method of forming a fin-shaped structure according to
 claim 14, further comprising:
 removing the first dielectric layer and the second dielectric layer completely
 before covering the mask.
- 10 Claim 19 (withdrawn): The method of forming a fin-shaped structure according to
 claim 14, further comprising:
 forming an isolation structure beside the first fin-shaped structure of the
 first area and beside the second fin-shaped structure of the second
 area respectively after the substrate is provided, wherein a top part of
 the isolation structure of the second area is also removed while the
 removing process is performed.
- 15 Claim 20 (withdrawn): The method of forming a fin-shaped structure according to
 claim 14, wherein the removing process has no removing selectivity to the
 isolation structure and the second fin-shaped structure.

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/512,475	Filing Date 10/13/2014	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

(Column 1)

(Column 2)

FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (j), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	* 0	x \$80 =	0
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	* 0	x \$420 =	0
☐ 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).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	0

APPLICATION AS AMENDED – PART II

(Column 1)

(Column 2)

(Column 3)

AMENDMENT	02/19/2016	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	x \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	x \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
TOTAL ADD'L FEE						0	

(Column 1)

(Column 2)

(Column 3)

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
TOTAL ADD'L FEE							

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

** 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.

LIE
/GERALDINE STANLEY/

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA

CONFIRMATION NO. 5891

27765
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
P.O. BOX 506
MERRIFIELD, VA 22116

PUBLICATION NOTICE



0000000081317154

Title:FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Publication No.US-2016-0071844-A1

Publication Date:03/10/2016

NOTICE OF PUBLICATION OF APPLICATION

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

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

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

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

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



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 09/30/2016 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER CHI, SUBERR L	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			09/30/2016	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com

Office Action Summary	Application No. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner SUBERR CHI	Art Unit 2829	AIA (First Inventor to File) Status Yes

-- 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 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☒ Responsive to communication(s) filed on 02/19/2016.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-6 and 8-20 is/are pending in the application.
5a) Of the above claim(s) 9-20 is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 1-6 and 8 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

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

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).

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)).

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

Attachment(s)

- | | |
|--|---|
| 1) ☐ Notice of References Cited (PTO-892) | 3) ☐ Interview Summary (PTO-413) |
| | Paper No(s)/Mail Date. ____. |
| 2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) | 4) ☐ Other: ____. |
| Paper No(s)/Mail Date ____. | |

DETAILED ACTION

Notice of AIA Status

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

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 02/19/2016 has been entered.

Response to Arguments

3. The Applicant's arguments with respect to claims #1-6 and 8 in the reply filed on 02/19/2016 have been carefully considered, but are moot in view of the new grounds of rejection.
4. The Examiner was unable to find the claim limitations in the prior art, therefore no prior art rejection has been applied.

Claim Rejections – 35 USC § 112(b)

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

Claims 1-6 and 8 are rejected under 35 U.S.C. 112(b) as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant, regards as the invention.

5. As to claim 1, there is a lack of antecedent basis for “**the** pitch between each top part of the first fin-shaped structures” (emphasis added), “**the** pitch between each top part of the second fin-shaped structures” (emphasis added), “**the** pitch between each lower part below the top part of the first fin-shaped structures” (emphasis added), and “**the** pitch between each lower part below the top part of the second fin-shaped structures” (emphasis added).
6. Furthermore as to claim 1, the term “pitch” appears to be incorrectly used. First, Applicant’s Specification does not define the term. Second, the manner in which the Applicant is using it is contrary to the definition accorded by one of ordinary skill in the art. According to the Semiconductor Glossary¹ the definition of “pitch” is “the center-to-center distance between features of an integrated circuit”. Applicant’s pitch “P1” and “P3” are not center-to-center distances. Moreover, it appears that the *actual* pitch of the Applicant’s

¹ www.semi1source.com/glossary

device is constant between first and second fin-shaped structures because the center-to-center distance does not change.

Where applicant acts as his or her own lexicographer to specifically define a term of a claim contrary to its ordinary meaning, the written description must clearly redefine the claim term and set forth the uncommon definition so as to put one reasonably skilled in the art on notice that the applicant intended to so redefine that claim term. *Process Control Corp. v. HydReclaim Corp.*, 190 F.3d 1350, 1357, 52 USPQ2d 1029, 1033 (Fed. Cir. 1999). The term “pitch” in claim 1 is used by the claim to mean “a distance between non-corresponding points,” while the accepted meaning is “a center-to-center distance between corresponding points”. The term is indefinite because the specification does not clearly redefine the term.

7. Claims 2-6 and 8 remained rejected under 35 U.S.C. 112(b) by virtue of their dependence on claim 1.

Specification Objection

8. The Specification is objected to because it lacks antecedent basis for the term “pitch”.
See Examiner’s discussion, *supra*.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SUBERR CHI whose telephone number is (571)270-3955. The examiner can normally be reached on 9-5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ha Nguyen can be reached on (571)272-1678. 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.

/SUBERR CHI/
Examiner, Art Unit 2829

/HA TRAN T NGUYEN/
Supervisory Patent Examiner, Art Unit 2829

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	8371	(fin\$7 same (width or distance) same (step\$3)) and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/23 15:36
L2	669	((fin\$1 or "fin-shaped") with (width or distance) with (step\$3)) and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/23 15:37
S1	5	"14512475"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 15:12
S2	8	("20120313169" "20130149826" "20140335673" "8669167").PN.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 16:54
S3	737	H01L21/8234.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:00
S4	9953	H01L27/088.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:00
S5	0	("2015/0318215").URPN.	USPAT	ADJ	ON	2016/09/20 17:02
S6	1	(US-20150318215-\$).did.	US-PGPUB	ADJ	ON	2016/09/20 17:02
S7	94	(S3 or S4) and fin and pitch and width	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:04
S8	3280	(fin\$7 same pitch same width) and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:20
S9	1	(US-20150311085-\$).did.	US-PGPUB	ADJ	ON	2016/09/20 17:22
S10	122	(fin\$7 same pitch same width).clm. and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	ADJ	ON	2016/09/20 17:23

			DERWENT; IBM_TDB			
S11	1	(US-20150097220-\$).did.	US-PGPUB	ADJ	ON	2016/09/20 17:25
S12	1	(US-20130221448-\$).did.	US-PGPUB	ADJ	ON	2016/09/20 17:28
S13	1	(US-20100093173-\$).did.	US-PGPUB	ADJ	ON	2016/09/20 17:32
S14	13	(wen near2 jiun near2 shen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:42
S15	89	(ssu near2 fu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:42
S16	38	(yen near2 liang near2 wu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:42
S17	24	(chia near2 jong near2 liu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:43
S18	0	(yu near2 hsiang near2 hong).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:43
S19	76	(yu near2 hsiang near2 hung).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:43
S20	90	(chung near2 fu near2 chang).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:43
S21	18	(man near2 ling near2 lu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:44
S22	172	(yi near2 wei near2 chen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:44
S23	3	(S14 or S15 or S16 or S17 or S19 or S20 or S21 or S22) and (fin\$7 and pitch and width).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2016/09/20 17:45

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S24	768	(fin or fins or fin\$1shaped) and pitch and width and top and lower and (step or ladder).clm.	USPAT	ADJ	ON	2016/09/20 17:50
S25	7	((fin or fins or fin\$1shaped) and pitch and width and top and lower and (step or ladder)).clm.	USPAT	ADJ	ON	2016/09/20 17:50

9/ 23/ 2016 3:53:12 PM**C:\ Users\ schi\ Documents\ EAST\ Workspaces\ Suberr 14-512475, RCE, NF.wsp**

Search Notes 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner SUBERR CHI	Art Unit 2829

CPC- SEARCHED		
Symbol	Date	Examiner
H01L 21/8234, H01L 27/088	9/20/2016	SC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST search history attached.	9/14/2015	TD
EAST	9/20/2016	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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AUTHORIZATION TO ACT IN A REPRESENTATIVE CAPACITY

In re Application of: WEN-JIUN SHEN, Fu, Ssu-I, Yen-Liang Wu, Chia-Jong Liu, Hung, Yu-Hsiang, Chang, Chung-Fu, MAN-LING LU, Chen, Yi-Wei

Application No: 14/512,475

Filed: 2014/10/13

Title: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Attorney Docket No. : NAUP2310USA

Art Unit: 2829

The practitioner named below is authorized to conduct interviews and has the authority to bind the principal concerned. (Note: pursuant to 37 CFR 10.57(c), a practitioner cannot authorize other registered practitioners to conduct interviews without consent of the client after full disclosure.) Furthermore, the practitioner is authorized to file correspondence in the above-identified application pursuant to 37 CFR 1.34:

Name:
Ding Yu TanRegistration No.
58812

SIGNATURE of the assignee of the entire right, title, and interest

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Date: 2016/11/04

Name:
JINSHENG YANGTitle:
UMC Patent Prosecution Dept./
Intellectual Property & Legal Affairs
Division Manager

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Approved for use through 01/31/2013. OMB 0651-0031

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WEN-JIUN SHEN, Fu, Sgu-I, Yen-Liang Wu, Chia-Jong Liu, Hung, Yu-Hsiang, Chang, Chung-Fu, MAN-LING LU, Chien, Yi-WaiApplication No./Patent No.: 14/512,475 Filed/Issue Date: 2014/10/13Titled: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

UNITED MICROELECTRONICS CORP., 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 633934 Frame 0391 or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

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.

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☐ 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.

Jinsheng Yang
Signature

JINSHENG YANG

Printed or Typed Name

2016/11/04

Date

U.S. Patent Prosecution Dept. / Intellectual Property & Legal Affairs Division Unit

Title or Registration Number

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AUTHORIZATION TO ACT IN A REPRESENTATIVE CAPACITY

In re Application of: WEN-JIUN SHEN, Fu, Ssu-I, Yen-Liang Wu, Chia-Jong Liu, Hung, Yu-Hsiang, Chang, Chung-Fu, MAN-LING LU, Chen, Yi-Wei

Application No: 14/512,475

Filed: 2014/10/13

Title: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Attorney Docket No.: NAUP2310USA

Art Unit: 2829

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Name:
Ding Yu TanRegistration No.
58812

SIGNATURE of the assignee of the entire right, title, and interest

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Date: 2016/11/04

Name:
JINSHENG YANGTitle:
UMC Patent Prosecution Dept./
Intellectual Property & Legal Affairs
Division Manager

Jinsheng Yang

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AUTHORIZATION TO ACT IN A REPRESENTATIVE CAPACITY

In re Application of: WEN-JIUN SHEN, Fu, Ssu-I, Yen-Liang Wu, Chia-Jong Liu, Hung, Yu-Hsiang, Chang, Chung-Fu, MAN-LING LU, Chen, Yi-Wei

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Name:
Ding Yu TanRegistration No.
58812

SIGNATURE of the assignee of the entire right, title, and interest

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature

Date: 2016/11/04

Name:
JINSHENG YANGTitle:
UMC Patent Prosecution Dept./
Intellectual Property & Legal Affairs
Division Manager

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To: Suberr Chi Page 2 of 3

2016-11-05 02:20:20 (GMT)

886266021291 From: DEAN TAN

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PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: WEN-JUN SHEN, Fu, Szu-I, Yen-Liang Wu, Chia-Jong Liu, Hung, Yu-Hsiang, Chang, Chung-Fu, MAN-LING LU, Chien, Yi-Wei

Application No./Patent No.: 14/512,475 Filed/Issue Date: 2014/10/13

Titled: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

UNITED MICROELECTRONICS CORP., 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 033934 Frame 0391 or for which a copy thereof is attached.

- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

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.

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To: Suberr Chi Page 3 of 3

2016-11-05 02:20:20 (GMT)

886266021291 From: DEAN TAN

PTO/AIA/86 (08-12)

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STATEMENT UNDER 37 CFR 3.73(c)

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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.

Jinsheng Yang
Signature
JINSHENG YANG
Printed or Typed Name

2016/11/04
Date
U.S. Patent Prosecution Dept. / Intellectual Property & Legal Affairs Division Mail
Title or Registration Number

[Page 2 of 2]



UNITED STATES PATENT AND TRADEMARK OFFICE
USPTO Automated Interview Request (AIR)

Nov 9 2016

This paper requesting to schedule and/or conduct an interview is appropriate because:

This submission is requested to be accepted as an authorization for this interview to communicate via the internet. Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned concerning scheduling of the interview via video conference, instant messaging, or electronic mail, and to conduct the interview in accordance with office practice including video conferencing.

Name(s):
Ding Yu Tan

S-signature:
/Ding Yu Tan/

Registration Number:
58812

U.S. Application Number:
14512475

Confirmation Number:
5891

E-mail Address:
dean.foresight@gmail.com

Phone Number:
2816688988

Proposed Time of Interview:
11-17-2016 10:00 AM ET

Preferred Interview Type:
Telephonic

I am the applicant or applicant's representative for this application.



UNITED STATES
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 11/25/2016 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER CHI, SUBERR L	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			11/25/2016	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

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

Paragraph (b)

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

37 CFR §1.2 Business to be transacted in writing.

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

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

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

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

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

The Form provides for recordation of the following information:

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

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

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

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

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

Examiner to Check for Accuracy

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

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Examiner Chi and Mr. Tan discussed Items #1-#4 on the Examiner Interview Agenda.

As to Item #1, Examiner Chi does not disagree with the MPEP citation, but would like to caution the Applicant that drawings must be drawn to scale in order to extrapolate certain dimensional limitations.

As to Item #2, Examiner Chi agrees that this proposed amendment appears to overcome the previous prior art of Kim and Lee.

As to Item #3, the Examiner objects to the language proposed because the wording creates an ambiguity in the first and second distances. Furthermore, claim scope cannot be limited by reference characters from the drawings. MPEP 608.01(m).

Applicant submitted further changes to Item #3 which appear to overcome these objections. See attached documents.

As to Item #4, the Examiner objects for similar reasons to Item #3.

Applicant submitted further changes to Item #4 which appear to overcome these objections. See attached documents.

Chi, Suberr

From: 談定宇 <dean.foresight@gmail.com>
Sent: Thursday, November 17, 2016 8:14 PM
To: Chi, Suberr
Subject: proposed amendment

Dear Examiner Chi:

I made slight changes to our amendment as follow:

“a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures”

“while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin”

do you think it is ok?

best regards

Ding Tan

Examiner Interview Agenda

Application No. 14/512475

Claims to be discussed: Claim 1

Interview Requestor: Ding Tan

Interview Requestor Telephone No: 281-668-8988

References to be discussed :

1. Kim (US2014/0335673);
2. Lee (US2013/0149826)
3. Chang (US 8669167)

Items to be discussed during interview

Item # 1

Applicant rep. would like to discuss with Examiner concerning definitions for P1, P2, and P3 taken from instant application based on the following:

Please refer to MPEP 2163 on the importance of the drawings serving as written description of an invention, which recites in part:

An applicant **may show possession of an invention by disclosure of drawings** or structural chemical formulas **that are sufficiently detailed** to show that applicant was in possession of the claimed invention as a whole. See, e.g., *Vas-Cath*, 935 F.2d at 1565, 19 USPQ2d at 1118 (“**drawings alone may provide a ‘written description’ of an invention** as required by Sec. 112”); *In re Wolfensperger*, 302 F.2d 950, 133 USPQ 537 (CCPA 1962) (**the drawings of applicant’s specification provided sufficient written descriptive support for the claim limitation at issue**); *Autogiro Co. of Am. v. United States*, 384 F.2d 391, 398, 155 USPQ 697, 703 (Ct. Cl. 1967) (“In those instances **where a visual representation can flesh out words, drawings may be used in the same manner and with the same limitations as the specification.**”);

Please see Figs 1 and 5 of instant application, as reproduced below:

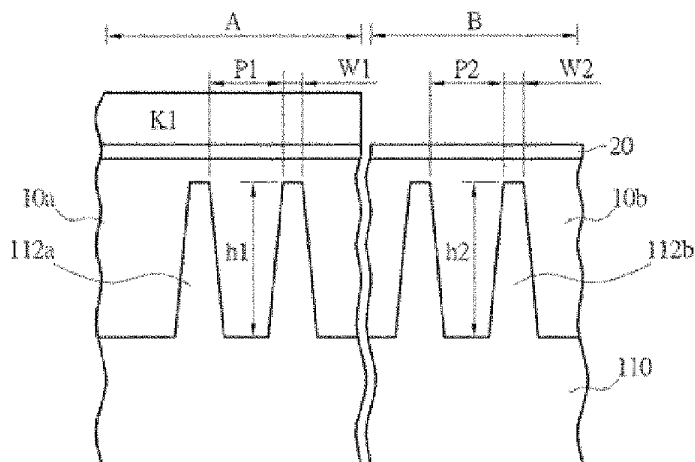


FIG. 1

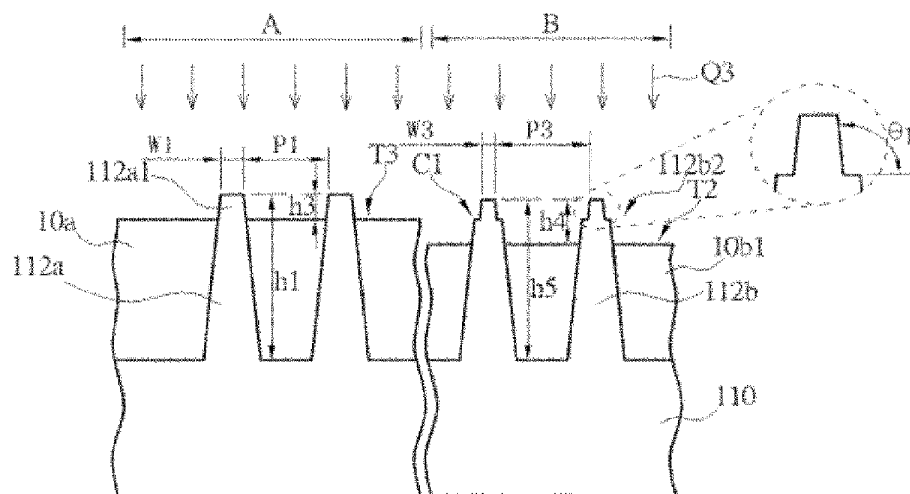


FIG. 5

Please refer to the structural features or elements identified as P1, P2, and P3 in the above drawings, along with their respective arrowed dimension lines, projection lines, etc..., and based on the **totality of support from instant disclosure as a whole, including the above drawings**, P1, P2, P3 can be at least **ascertained** as being “distance segment having dimension nomenclature and markings thereof”, respectively.

Please see under the Principles of Dimensioning as described in the following two publically available online literature:

<https://mech.iitm.ac.in/part1.pdf>

http://homepages.cae.wisc.edu/~me231/online_notes/dimensioning/principals_dim.pdf

Please note that at the very least, P1 can be interpreted as being a distance segment having a length dimension value.

Item # 2

Applicant rep. would like to propose a possible amendment to claim 1, by deleting the features

~~“the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures”~~ from claim 1, as well as amending claim 1 further to read as follow:

Claim 1 (currently amended): A fin-shaped structure, comprising:

a substrate having a first fin-shaped structure located in a first area and a second fin-shaped structure located in a second area, wherein the second fin-shaped structure comprises a ladder-shaped cross-sectional profile part, wherein the width of a top part of the ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like; and

two gates **conformally and** directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively.

Applicant rep. further submit the following comparison analysis:

<p>Present Application</p>

Please see also [0023] – [0024] of the specification of instant application for support of above proposed amendment for claim 1.

Item # 3

Applicant rep. would like to propose a possible amendment to claim 1, by deleting the features

~~“the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures”~~ from claim 1, as well as amending claim 1 further to read as follow:

“a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and a first distance between each adjacent top corner of the first fin-shaped structures is less than a second distance between each adjacent top corner of the second fin-shaped structures.”

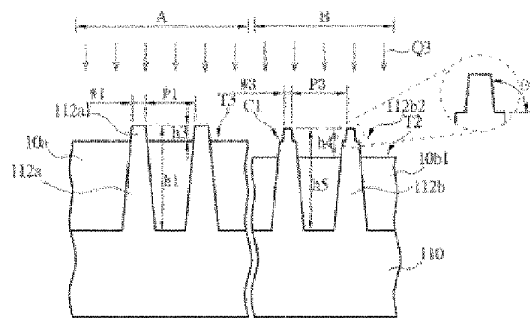


FIG. 5

Please note that the “a first distance” and “a second distance” belong to the type of length dimension values of length segments as previously discussed under item # 1 above.

Item # 4

Pending the results of discussion for Item # 3 above, Applicant rep. may also discuss about a possible amendment to claim 1 in combination with Item # 3 to further read as follow:

“while ~~the pitch~~ a third distance between each lower part below the top part of the first fin-shaped structures is the same as ~~the pitch~~ a fourth distance between each lower part below the top part of the second fin-shaped structures”

Please note that Chang does not teach of **varying** distances between each adjacent top corner of fin-shaped structures **while** the distances between adjacent lower parts of the fin-shaped structures are **maintained to be the same**. In other words, Chang teaches of having the **same** adjacent top corner distances for fin-shaped structures **of the same pitch**, while having **different** adjacent top corner distances for fin-shaped structures **of different pitches**. Please refer to the distances between adjacent top corners and the

distances between adjacent lower parts for each of the fins 302a, 302b, and 302c as taught by Chang as shown in reproduced Fig. 5 of Chang below for further comparison:

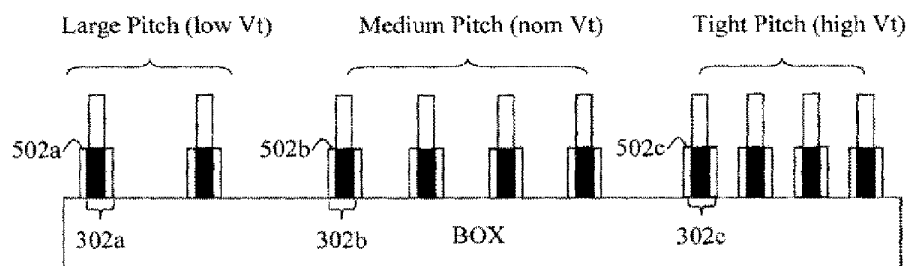


FIG. 5

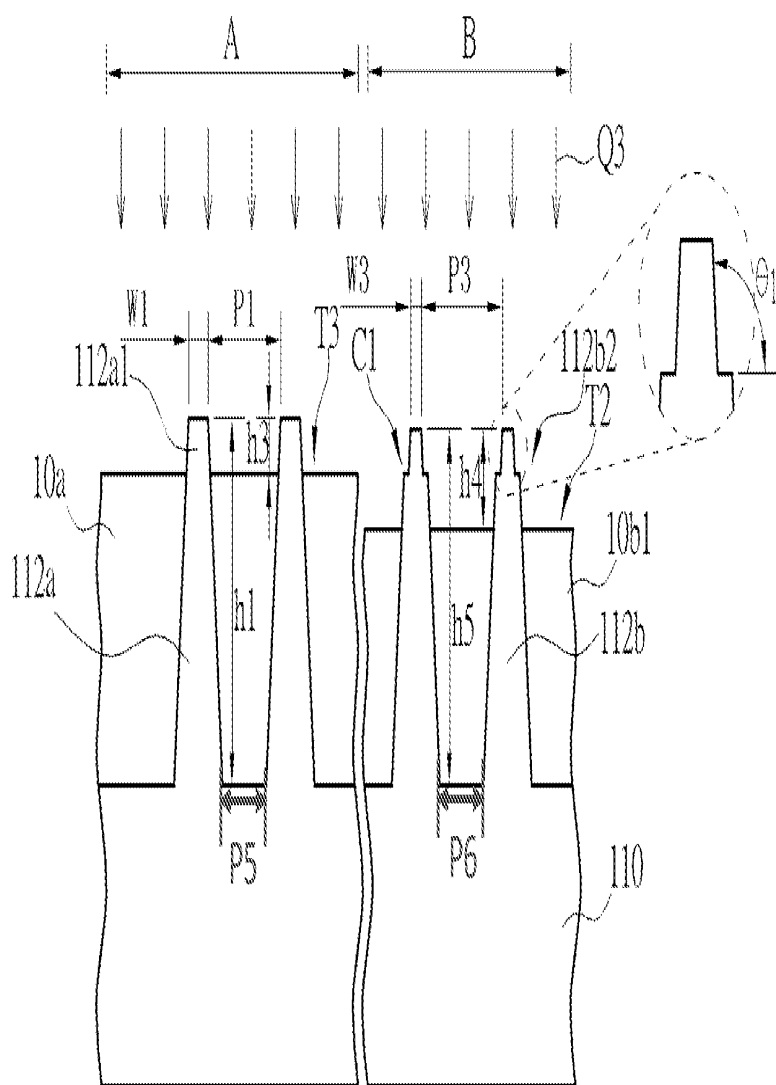


FIG. 5

“while a third distance P5
between each lower part below the
top part of the first fin-shaped
structures is the same as
a fourth distance P6 between each
lower part below the top part of the
second fin-shaped structures”

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No. : 14/512,475 Confirmation No. 5891
First Named Inventor : Wen-Jiun Shen
Filed : October 13, 2014
TC/A.U. : 2829
Examiner : CHI, SUBERR L
Docket No. : NAUP2310USA
Customer No. : 27765

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

AMENDMENT

In response to the Office action of September 30, 2016, please amend the above-identified application as follows:

- 5 **Amendments to the Specification** begin on page 2 of this paper.
Amendments to the Claims are reflected in the listing of claims which begins on page 4 of this paper.
Amendments to the Drawings begin on page 9 of this paper.
Remarks/Arguments begin on page 10 of this paper.
- 10 An **Appendix** including amended drawing figures is attached following page 20 of this paper.

REPLACEMENT SHEET

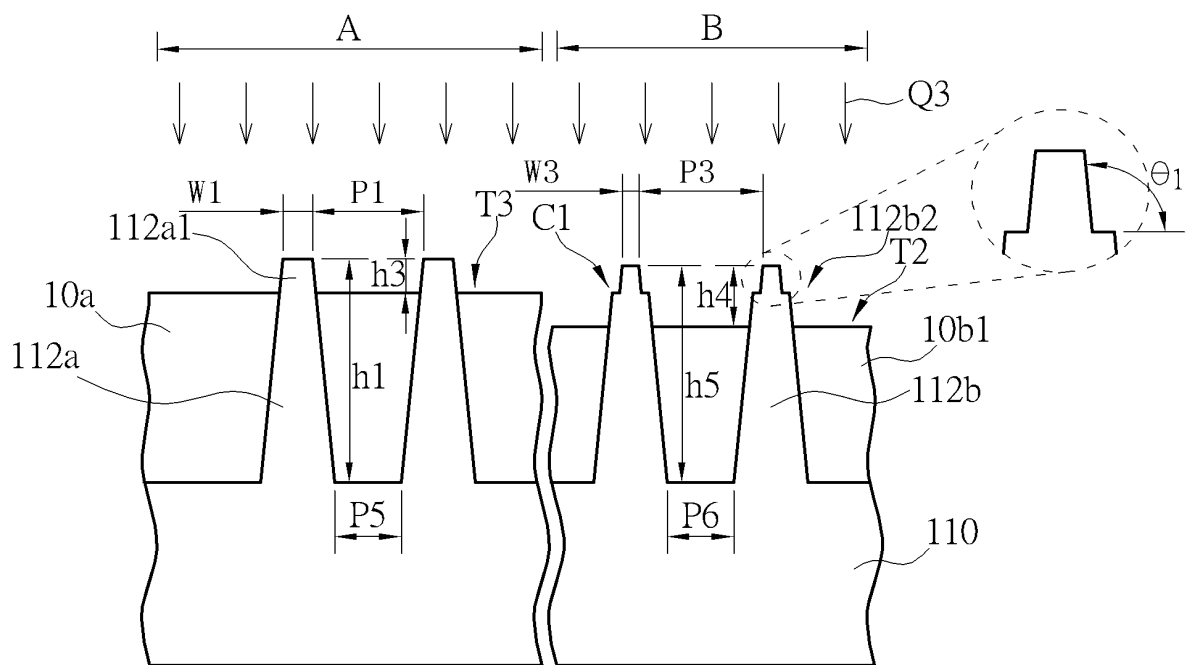


FIG. 5

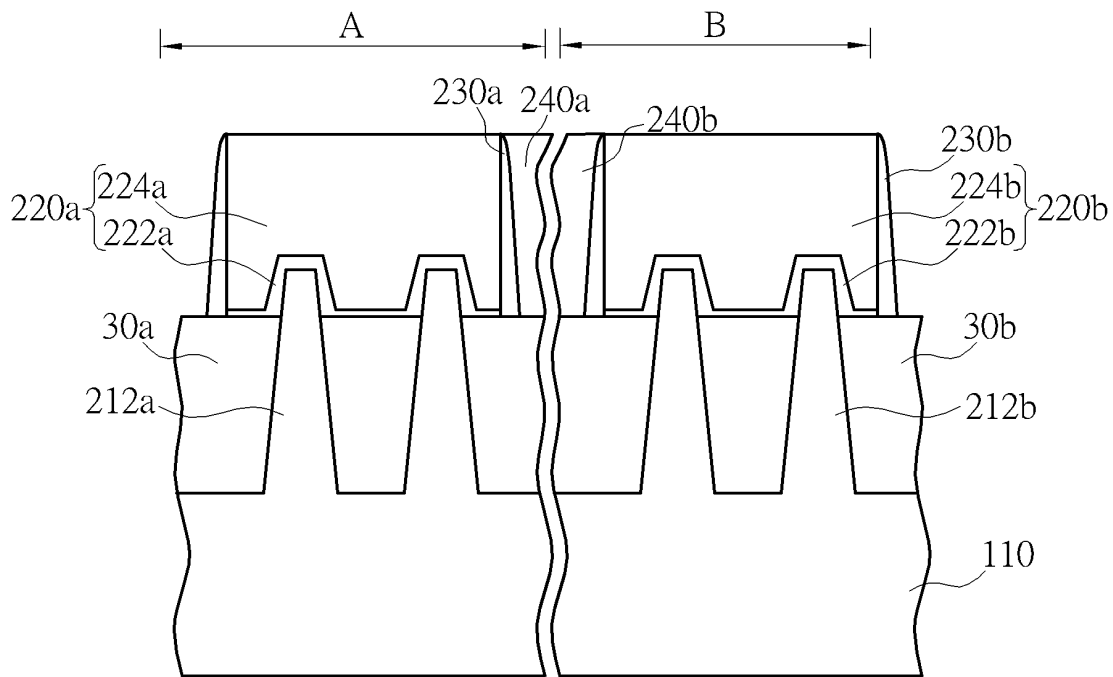


FIG. 6

Amendments to the Claims:

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

Listing of Claims:

- 5 Claim 1 (currently amended): A fin-shaped structure, comprising:
a substrate having a ~~plurality of~~ first fin-shaped ~~structure~~ structures located
in a first area and a ~~plurality of~~ second fin-shaped ~~structure~~ structures
located in a second area, wherein the second fin-shaped ~~structure~~
~~structures~~ comprises ~~comprise~~ a ladder-shaped cross-sectional profile
10 ~~parts~~ part, the pitch between each top part of the first fin-shaped
structures being less than the pitch between each top part of the
second fin-shaped structures, while the pitch between each lower part
below the top part of the first fin-shaped structures is the same as the
pitch between each lower part below the top part of the second
15 ~~fin-shaped structures, and wherein~~ the width of ~~[[each]]~~ a top part of
the ladder-shaped cross-sectional profile ~~second fin-shaped structures~~
is smaller than the width of ~~[[each]]~~ a lower part of the ladder-shaped
cross-sectional profile ~~second fin-shaped structures~~, wherein the
change of width from the lower part to the top part is step-like; and
20 two gates conformally and directly disposed over the first fin-shaped
~~structure~~ structures and the second fin-shaped ~~structure~~ structures
respectively.

- Claim 2 (currently amended): The fin-shaped structure according to claim 1, wherein
25 the width of ~~[[each]]~~ a top part of the first fin-shaped structure ~~structures~~ is
larger than the width of ~~[[each]]~~ a top part of the second fin-shaped structure
~~structures~~.

- Claim 3 (currently amended): The fin-shaped structure according to claim 1, further
30 comprising:

an isolation structure disposed beside the first fin-shaped ~~structure~~ ~~structures~~
of the first area and beside the second fin-shaped ~~structure~~ ~~structures~~
of the second area respectively, and the ladder-shaped cross-sectional
profile part is higher than a top surface of the isolation structure.

5

Claim 4 (original): The fin-shaped structure according to claim 1, wherein a top
surface of the isolation structure of the first area is higher than a top surface
of the isolation structure of the second area.

10 Claim 5 (currently amended): The fin-shaped structure according to claim 1, wherein a
height of the first fin-shaped ~~structure~~ ~~structures~~ protruding from the
isolation structure is lower than a height of the second fin-shaped ~~structure~~
~~structures~~ protruding from the isolation structure.

15 Claim 6 (currently amended): The fin-shaped structure according to claim 1, wherein a
height of the first fin-shaped ~~structure~~ ~~structures~~ protruding from the
substrate is higher than a height of the second fin-shaped ~~structure~~ ~~structures~~
protruding from the substrate.

20 Claim 7 (canceled)

Claim 8 (original): The fin-shaped structure according to claim 1, wherein the first
area comprises a high voltage threshold (HVT) area and the second area
comprises a low voltage threshold (LVT) area.

25

Claim 9 (withdrawn-currently amended): A method of forming a fin-shaped structure,
comprising:

providing a substrate having a first fin-shaped structure located in a first area
and a second fin-shaped structure located in a second area;

30 filling an isolation structure beside the first fin-shaped structure of the first

area and beside the second fin-shaped structure of the second area respectively;
forming a patterned mask covering the first area but exposing the second area;
5 removing a top part of the isolation structure of the second area, thereby exposing a first top part of the second fin-shaped structure;
performing a treatment process to modify an external surface of the first top part of the second fin-shaped structure, thereby forming a modified part covering the first top part of the second fin-shaped structure;
10 removing the patterned mask; and
performing a removing process to remove a part of the isolation structure and the modified part by the high removing selectivity to the first fin-shaped structure and the second fin-shaped structure, and the modified part and the isolation structure, thereby exposing a top part
15 of the first fin-shaped structure and a second top part of the second fin-shaped structure, wherein the second fin-shaped structure comprises a ladder-shaped cross-sectional profile part, wherein the width of a top part of the ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped
20 cross-sectional profile, wherein the change of width from the lower part to the top part is step-like.

Claim 10 (withdrawn): The method of forming a fin-shaped structure according to claim 9, wherein the isolation structure comprises oxide and the modified
25 part comprises oxide.

Claim 11 (withdrawn): The method of forming a fin-shaped structure according to claim 9, wherein the treatment process comprises an oxidation process.

30 Claim 12 (withdrawn): The method of forming a fin-shaped structure according to

claim 11, wherein the treatment process comprises an oxygen gas-containing process or an in-situ steam generated (ISSG) process.

5 Claim 13 (withdrawn): The method of forming a fin-shaped structure according to claim 9, wherein the removing process comprises an ammonia and nitrogen trifluoride containing etching process.

Claims 14-20 (canceled)

10 Claim 21 (new): A fin-shaped structure, comprising:
 a substrate having a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first
15 distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth
20 distance between adjacent lower parts of the third fin and the fourth fin.

 Claim 22 (new): The fin-shaped structure according to claim 21, wherein the width of each top part of the first fin-shaped structures is larger than the width of each
25 top part of the second fin-shaped structures.

 Claim 23 (new): The fin-shaped structure according to claim 21, further comprising:
 an isolation structure disposed beside the first fin-shaped structures and beside the second fin-shaped structures respectively, and
30 ladder-shaped cross-sectional profile parts of the second fin-shaped

structures are higher than a top surface of the isolation structure.

5 Claim 24 (new): The fin-shaped structure according to claim 21, wherein a top surface
of the isolation structure of the first area is higher than a top surface of the
isolation structure of the second area.

10 Claim 25 (new): The fin-shaped structure according to claim 21, wherein a height of
the first fin-shaped structures protruding from the isolation structure is lower
than a height of the second fin-shaped structures protruding from the
isolation structure.

15 Claim 26 (new): The fin-shaped structure according to claim 21, wherein a height of
the first fin-shaped structures protruding from the substrate is higher than a
height of the second fin-shaped structures protruding from the substrate.

Amendments to the Specification:

Please replace paragraph [0013] with the following amended paragraph:

[0013] The substrate 110 has two first fin-shaped structures 112a in the first area A and two second fin-shaped structures 112b in the second area B. In this embodiment, two first fin-shaped structures 112a are formed in the first area A and two second fin-shaped structures 112b are formed in the second area B, but the number of the first fin-shaped structures 112a or the second fin-shaped structures 112b is not restricted thereto. In this embodiment, the first fin-shaped structures 112a and the second fin-shaped structures 112b have the same structure. A height h1 of each of the first fin-shaped structures 112a is common to a height h2 of each of the second fin-shaped structures 112b; a width w1 of a top part of each of the first fin-shaped structures 112a is the same as a width w2 of a top part of each of second fin-shaped structures 112b; and a first distance ~~pitch~~-p1 between a top part of each of the first fin-shaped structures 112a is the same as a distance ~~pitch~~-p2 between a top part of each of the second fin-shaped structures 112b. Therefore, when a selective treatment process is performed on one single area or on a plurality of areas, symmetric structures in these areas will receive the same influence and uniform structures can be formed. The first distance ~~pitch~~-p1 between a top part of each of the first fin-shaped structures 112a may also be different from the distance ~~pitch~~-p2 between a top part of each of the second fin-shaped structures 112b.

Please replace paragraph [0022] with the following amended paragraph:

[0022] Each of the second fin-shaped structures 112b having a ladder-shaped cross-sectional profile part C1 can be formed while reserving the original first fin-shaped structures 112a. The ladder-shaped cross-sectional profile part C1 has a bending angle θ_1 , which is preferably larger than or equal to 90° . It is emphasized that a specific following structure is formed by applying the method of forming a fin-shaped structure of the present invention. The width w1 of the top part of each of the first fin-shaped structures 112a comprising a first fin and a second fin is larger than a width w3 of a top part of each of the second fin-shaped structures 112b

comprising a third fin and a fourth fin. The ~~pitch~~ first distance $p1$ ~~of the top part~~
between each of the first fin-shaped structures 112a ~~between adjacent top corners of~~
the first fin and the second fin of the first fin-shaped structures 112a is less than a
~~second distance~~ ~~pitch~~ $p3$ ~~of a top part between each of the second fin-shaped~~
5 ~~structures 112b~~ between adjacent top corners of the third fin and the fourth fin of the
second fin-shaped structures 112b while a third distance $p5$ between adjacent lower
parts of the first fin and the second fin is the same as a fourth distance $p6$ between
adjacent lower parts of the third fin and the fourth fin. The ladder-shaped
cross-sectional profile part C1 of each of the second fin-shaped structures 112b is
10 higher than a top surface T2 of the isolation structure 10b1. A top surface T3 of the
isolation structure 10a in the first area A is higher than the top surface T2 of the
isolation structure 10b1 in the second area B. A height $h3$ of each of the first
fin-shaped structures 112a protruding from the isolation structure 10a is lower than a
height $h4$ of each of the second fin-shaped structures 112b protruding from the
15 isolation structure 10b1. The height $h1$ of each of the first fin-shaped structures 112a
protruding from the substrate 110 is higher than a height $h5$ of each of the second
fin-shaped structures 112b protruding from the substrate 110.

Doc Code: ECOMM.AUTH/ECOMM.WTDW

Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

**AUTHORIZATION FOR INTERNET
COMMUNICATIONS IN A PATENT
APPLICATION OR REQUEST TO
WITHDRAW AUTHORIZATION FOR
INTERNET COMMUNICATIONS**

Application No.	14/512,475
Filing Date	10/13/2014
First Named Inventor	Wen-Jiun Shen
Art Unit	2829
Examiner Name	CHI, SUBERR L
Practitioner Docket No.	NAUP2310USA

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

I. To authorize permission for Internet Communications.

☒ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☒ attorney or agent of record. Registration number 56277.

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

/Scott Margo/
Signature

12/27/2016
Date

Scott Margo
Typed or printed name

3027291562
Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☐ * Total of _____ forms are submitted.

Privacy Act Statement

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

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

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
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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.

Electronic Acknowledgement Receipt

EFS ID:	27911454
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Scott Hunter Margo/Eve Hsieh
Filer Authorized By:	Scott Hunter Margo
Attorney Docket Number:	NAUP2310USA
Receipt Date:	29-DEC-2016
Filing Date:	13-OCT-2014
Time Stamp:	04:19:51
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	2746250.PDF	987094	no	16
			6cb1102ebcd47f2688398178ad25ddb16bafb4a7		

Warnings:

Information:					
2	Amendment/Req. Reconsideration-After Non-Final Reject	2746249.PDF	83614	no	1
			6f56ac8fdc98551ba7342eb6f690c3a2f3e6d357		
Warnings:					
Information:					
3	Drawings-only black and white line drawings	2746248.PDF	68142	no	1
			d097c54cc620da5a4f8ecb5f503313eb9711869f1		
Warnings:					
Information:					
4	Claims	2746247.PDF	96617	no	5
			cfdb6b14b505d1a42c17d6aa05770cc53b0c4420e		
Warnings:					
Information:					
5	Specification	2746246.PDF	101159	no	2
			c0a0e411dee3d924507233898b71bf927b6c6cc4		
Warnings:					
Information:					
6	Internet Communications Authorized	2746202.PDF	250381	no	2
			8b98c8784d29c4bcca71f7a102f37c3fdb379630		
Warnings:					
Information:					
Total Files Size (in bytes):			1587007		

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New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

Appl. No. 14/512,475
Reply to Office action of September 30, 2016

Amendments to the Drawings:

Attachment: Replacement Sheet

1 page

REMARKS/ARGUMENTS

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record
5 in the application file.

Reconsideration of the present application is politely requested. Claims 1-6 and 8-20 remain pending in the case. In order to more particularly point out and distinctly claim what the applicants regard as their invention, claims 1-3, 5-6 and 9 have been
10 amended. Claims 14-20 have been canceled. Claims 21-26 have been newly added. FIG.5 and the corresponding specification have been amended. No new matter is introduced by this amendment.

1. Interview Summary

15 A telephone interview was conducted between the Applicant rep., US Patent Agent Ding Tan, and Examiner Subber Chi on November 17, 2016. Some issues in the aforesaid Office action were extensively discussed. The following agreements were reached between the Examiner and the Applicant rep.:

By amending claim 1 to include the proposed amendments discussed under Items
20 # 2, #3, and #4:

Option #1 : two gates **conformally and** directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively.

Option #2 : a plurality of first fin-shaped structures and a plurality of second
25 fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures.

30

Option #3 : while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin.

5 In addition, FIG. 5 along with the corresponding passage in the specification should be amended (by filing replacement sheet for Fig. 5 and amendment to specification) to reflect the addition of “third distance (P5)” and “ fourth distance (P6)” into claim 1 (see item # 4 for more details).

10 Furthermore, all of the features directing/relating to the “pitch” in existing claim 1 should be deleted: ~~“the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the~~
15 ~~second fin-shaped structures”~~ .

Examiner then agreed that the 35 USC 112(b) rejection would be overcome, as well as making amended claim 1 being patentable over Kim, Lee, Chang.

20 In addition, arguments and amendments discussed during the interview are as follows:

Item #1) Applicant rep. discussed with the Examiner concerning definitions for P1, P2, and P3 taken from instant application based on the following:

25 Please refer to MPEP 2163 on the importance of the drawings serving as written description of an invention, which recites in part:

30 An applicant may show possession of an invention by disclosure of drawings or structural chemical formulas that are sufficiently detailed to show that applicant was in possession of the claimed invention as a whole. See, e.g., Vas-Cath, 935 F.2d at 1565, 19 USPQ2d at 1118 (“drawings alone may provide a ‘written description’ of an invention as required by Sec. 112”); In re Wolfensperger, 302 F.2d 950, 133 USPQ

537 (CCPA 1962) (the drawings of applicant's specification provided sufficient written descriptive support for the claim limitation at issue); *Autogiro Co. of Am. v. United States*, 384 F.2d 391, 398, 155 USPQ 697, 703 (Ct. Cl. 1967) ("In those instances where a visual representation can flesh out words, drawings may be used in the same manner and with the same limitations as the specification.");

Please see Figs 1 and 5 of instant application, as reproduced below:

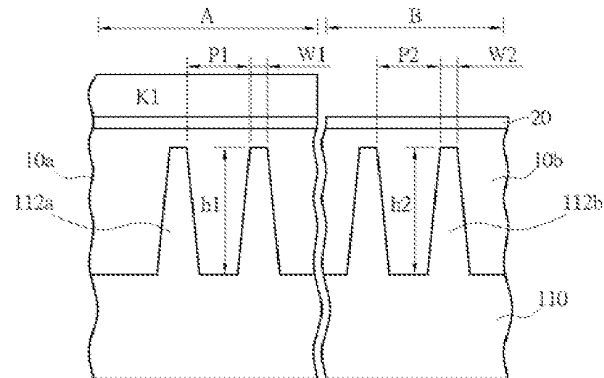


FIG. 1

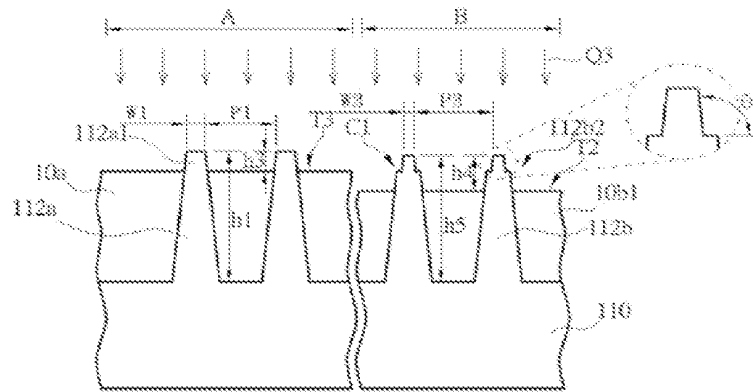


FIG. 5

10 Please refer to the structural features or elements identified as P1, P2, and P3 in the above drawings, along with their respective arrowed dimension lines, projection lines, etc..., and based on the totality of support from instant disclosure as a whole, including the above drawings, P1, P2, P3 can be at least ascertained as being "distance

segment having dimension nomenclature and markings thereof”, respectively.

Please see under the Principles of Dimensioning as described in the following two publicly available online literature:

<https://mech.iitm.ac.in/part1.pdf>

5 [http://homepages.cae.wisc.edu/~me231/online_notes/dimensioning/principals dim.pdf](http://homepages.cae.wisc.edu/~me231/online_notes/dimensioning/principals_dim.pdf)

Please note that at the very least, P1, P2, P3 each can be interpreted as being a distance segment having a length dimension value.

10 **Examiner agreed** that by deleting all of the features directing/relating to the
“pitch” in existing claim 1 (~~“the pitch between each top part of the first fin-shaped
structures being less than the pitch between each top part of the second fin-shaped
structures, while the pitch between each lower part below the top part of the first
fin-shaped structures is the same as the pitch between each lower part below the top
15 part of the second fin-shaped structures)~~ and adding new features as discussed below
under items # 3-4, then the 35 USC 112(b) rejection would be overcome.

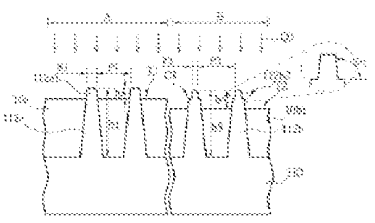
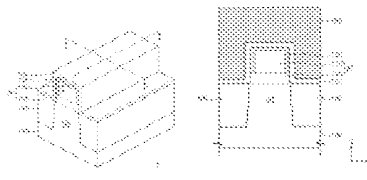
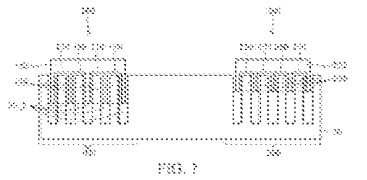
Item #2) Applicant rep. discussed a possible amendment to Claim 1, by
deleting the features ~~“the pitch between each top part of the first fin-shaped structures
20 being less than the pitch between each top part of the second fin-shaped structures,
while the pitch between each lower part below the top part of the first fin-shaped
structures is the same as the pitch between each lower part below the top part of the
second fin-shaped structures”~~ from Claim 1, as well as amending Claim 1 further to
read as follow:

25 Claim 1 (currently amended): A fin-shaped structure, comprising:
a substrate having a first fin-shaped structure located in a first area and a
second fin-shaped structure located in a second area, wherein the
second fin-shaped structure comprises a ladder-shaped cross-sectional
profile part, wherein the width of a top part of the ladder-shaped
30 cross-sectional profile is smaller than the width of a lower part of the

ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like; and
two gates **conformally and** directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively.

5

Applicant rep. further submits the following comparison analysis:

Present Application	Prior art
 <p>FIG. 5</p>	<p>Kim (US2014/0335673):</p>  <p>130 capping pattern (SIN) 150 etch stop layer</p> <p>Lee (US2013/0149826)</p>  <p>FIG. 7</p>
gates <u>conformally and</u> directly disposed over the ladder-shaped fin	<p>Kim: Gates disposed on etch stop layer Lee: not ladder-shaped fin</p>

Please see also [0023] – [0024] of the specification of instant application for
10 support of above proposed amendment for Claim 1.

Examiner agreed that the above amendment would be beneficial.

Item #3) Applicant rep. suggested another possible amendment to Claim 1, by
15 deleting the features “~~the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures,~~

while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures” and amending Claim 1 further to read as follow:

5 “a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and a first distance between each adjacent top corner of the first fin-shaped structures is less than a second distance between each adjacent top corner of the second fin-shaped structures.”

10 Applicant rep. pointed out that “a first distance” and “a second distance” belong to the type of length dimension values of length segments as previously discussed under item # 1 above.

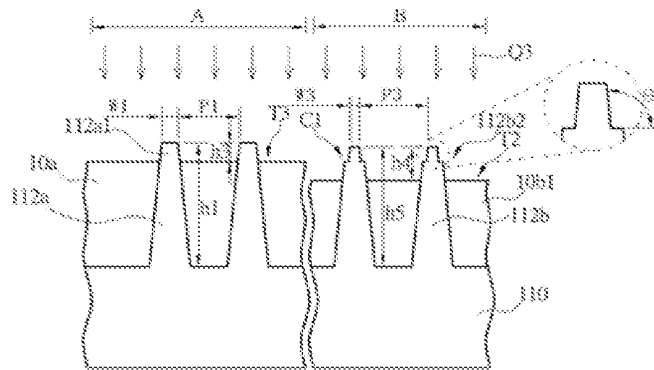


FIG. 5

15 However, Examiner disagreed to the proposed claim language, and explained that the “first distance” and “second distance” are not sufficiently defined enough, and thus can be interpreted in different ways.

Upon further discussions during the interview, Claim 1 is further suggested to be amended to express the first fin-shaped structures and the second fin-shaped structures in terms of more precisely defined fins, i.e. first fin, second fin, such as for example:

20 “a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first

distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures”

5 Item #4) Applicant rep. also discussed another possible amendment to Claim 1 in combination with Item # 3 to further read as follow:

“while ~~the pitch~~ a third distance P5 between each lower part below the top part of the first fin-shaped structures is the same as ~~the pitch~~ a fourth distance P6 between each lower part below the top part of the second fin-shaped structures”

10

However, Examiner has the same concerns similar for item # 3 above.

Therefore, upon further discussion, it was agreed that it would be better to combine the amendment proposals under item # 3 and item # 4, and amendment proposal for item # 4 should read:

15 “while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin”

20 During the discussion, Applicant rep. proposed the following definitions for the third distance P5 and the fourth distance P6 based on annotated FIG. 5:

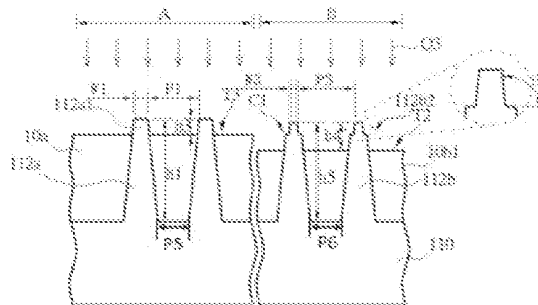


FIG. 5

Please note that **Chang does not teach** of **varying distances** between each adjacent

top corner of fin-shaped structures **while** the distances between adjacent lower parts of the fin-shaped structures are **maintained to be the same**. In other words, Chang teaches of having the **same** adjacent top corner distances for fin-shaped structures **of the same pitch**, while having **different** adjacent top corner distances for fin-shaped structures **of different**
5 **pitches**. Please refer to the distances between adjacent top corners and the distances between adjacent lower parts for each of the fins 302a, 302b, and 302c as taught by Chang as shown in reproduced Fig. 5 of Chang below for further comparison:

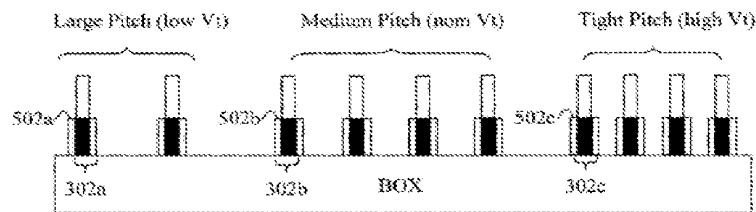


FIG. 5

10 Meanwhile, Applicant rep. pointed to the specification in [0013] which recites “In this embodiment, the first fin-shaped structures 112a and the second fin-shaped structures 112b have the same structure.” for support of amendment above under item # 4.

It was also discussed during the interview that FIG. 5 along with the corresponding passage in the specification should be amended alongside the proposed amendment to
15 claim 1 in item # 4 to reflect the addition of “third distance P5” and “fourth distance P6” into claim 1 (i.e. “while a third distance P5 between adjacent lower parts of the first fin and the second fin is the same as a fourth distance P6 between adjacent lower parts of the third fin and the fourth fin”) based on support at least in [0013] of the specification as originally filed, thus no new matter is introduced by the amendment.

20

This response which includes amendments to the claims and the corresponding arguments is accordingly made based on the mutual understanding reached in this telephone interview.

2. Amendments to the claims and the specification

Claim 1 has been amended to include the features “the width of a top part of the ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like” and “two gates conformally and directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively” and cancel the feature “the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures” according to Item 2 discussed during above telephone interview. The dependency of claims 2-3 and 5-6 has been accordingly amended. Withdrawn Claim 9 has been amended according to amended Claim 1. Claims 14-20 have been canceled.

FIG5 has been amended to add “p5” and “p6”, and the corresponding Para [0013] and Para [0022] of the specification has been amended accordingly to include the terms “third distance p5” and “fourth distance p6”, and their relations as shown in FIG.5.

No new matter is introduced by these amendments. Acceptance of the amendments is respectfully requested.

3. Claim Rejections – 35 USC §112(b)

The Examiner stated “As to claim 1, there is a lack of antecedent basis for “the pitch between each top part of the first fin-shaped structures” (emphasis added), “the pitch between each top part of the second fin-shaped structures” (emphasis added), “the pitch between each lower part below the top part of the first fin-shaped structures” (emphasis added), and “the pitch between each lower part below the top part of the second fin-shaped structures” (emphasis added). Furthermore as to claim 1, the term “pitch” appears to be incorrectly used. First, Applicant’s Specification does not define the term. Second, the manner in which the Applicant is using it is contrary to the definition accorded by one of ordinary skill in the art. According to the Semiconductor Glossary¹ the definition of “pitch” is “the center-to-center distance between features of an integrated

circuit”. Applicant’s pitch “P1” and “P3” are not center-to-center distances. Moreover, it appears that the actual pitch of the Applicant’s device is constant between first and second fin-shaped structures because the center-to-center distance does not change.”

5 Response

 The term “pitch” in Claim 1 has been canceled. Claim 1 should overcome the 35 USC 112(b) rejection. The dependent claims 2-6 and 8 of Claim 1 should overcome as well.

10 **4. Specification Objection**

 The Examiner stated that “The Specification is objected to because it lacks antecedent basis for the term “pitch”. See Examiner’s discussion, *supra*.”.

Response

15 The term “pitch” in the Specification has been replaced by the terms “first distance”, “distance” and “second distance” according to the agreements achieved during the telephone interview.

5. Introduction of New Claims

20 Claim 21 is added according to Item #3 and item #4.

 Claim 21 includes the feature “a substrate having a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a
25 second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin”. The dependency of claims 22-26 have been newly
30 added as well according to claims 2-6.

No new matter is introduced. Acceptance of the new claims is respectfully requested.

5 It is respectfully suggested that, in light of the above, none of the cited
references, alone or in combination, teaches or makes obvious all of the limitations of
amended Claim 1 and Claim 21. Reconsideration of Claim 1 and Claim 21 is therefore
politely requested. As claims 2 – 6 and 8 are dependent upon Claim 1, they should be
allowable if Claim 1 is allowed. Reconsideration of claims 2 – 6 and 8 is therefore
politely requested. As claims 22 – 26 are dependent upon Claim 21, they should be
10 allowable if Claim 1 is allowed. Reconsideration of claims 22 – 26 is therefore
politely requested.

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

15

Sincerely yours,

/Scott Margo/

Date: 12/27/2016

Scott Margo, Patent Agent No. 56,277

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

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25 Note: Please leave a message in my voice mail if you need to talk to me. (The time in
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 11/25/2016 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			EXAMINER CHI, SUBERR L	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
			11/25/2016	ELECTRONIC

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

The time period for reply, if any, is set in the attached communication.

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mis.ap.uspto@naipo.com

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record

A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

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

Paragraph (b)

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

37 CFR §1.2 Business to be transacted in writing.

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

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

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

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

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

The Form provides for recordation of the following information:

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

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

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

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

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

Examiner to Check for Accuracy

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

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Examiner Chi and Mr. Tan discussed Items #1-#4 on the Examiner Interview Agenda.

As to Item #1, Examiner Chi does not disagree with the MPEP citation, but would like to caution the Applicant that drawings must be drawn to scale in order to extrapolate certain dimensional limitations.

As to Item #2, Examiner Chi agrees that this proposed amendment appears to overcome the previous prior art of Kim and Lee.

As to Item #3, the Examiner objects to the language proposed because the wording creates an ambiguity in the first and second distances. Furthermore, claim scope cannot be limited by reference characters from the drawings. MPEP 608.01(m).

Applicant submitted further changes to Item #3 which appear to overcome these objections. See attached documents.

As to Item #4, the Examiner objects for similar reasons to Item #3.

Applicant submitted further changes to Item #4 which appear to overcome these objections. See attached documents.

Appl. No. 14/512,475
Reply to Office action of September 30, 2016

Amendments to the Drawings:

Attachment: Replacement Sheet

1 page

REMARKS/ARGUMENTS

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record
5 in the application file.

Reconsideration of the present application is politely requested. Claims 1-6 and 8-20 remain pending in the case. In order to more particularly point out and distinctly claim what the applicants regard as their invention, claims 1-3, 5-6 and 9 have been
10 amended. Claims 14-20 have been canceled. Claims 21-26 have been newly added. FIG.5 and the corresponding specification have been amended. No new matter is introduced by this amendment.

1. Interview Summary

15 A telephone interview was conducted between the Applicant rep., US Patent Agent Ding Tan, and Examiner Subber Chi on November 17, 2016. Some issues in the aforesaid Office action were extensively discussed. The following agreements were reached between the Examiner and the Applicant rep.:

By amending claim 1 to include the proposed amendments discussed under Items
20 # 2, #3, and #4:

Option #1 : two gates **conformally and** directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively.

Option #2 : a plurality of first fin-shaped structures and a plurality of second
25 fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures.

30

Option #3 : while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin.

5 In addition, FIG. 5 along with the corresponding passage in the specification should be amended (by filing replacement sheet for Fig. 5 and amendment to specification) to reflect the addition of “third distance (P5)” and “ fourth distance (P6)” into claim 1 (see item # 4 for more details).

10 Furthermore, all of the features directing/relating to the “pitch” in existing claim 1 should be deleted: ~~“the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the~~
15 ~~second fin-shaped structures”~~ .

Examiner then agreed that the 35 USC 112(b) rejection would be overcome, as well as making amended claim 1 being patentable over Kim, Lee, Chang.

20 In addition, arguments and amendments discussed during the interview are as follows:

Item #1) Applicant rep. discussed with the Examiner concerning definitions for P1, P2, and P3 taken from instant application based on the following:

25 Please refer to MPEP 2163 on the importance of the drawings serving as written description of an invention, which recites in part:

30 An applicant may show possession of an invention by disclosure of drawings or structural chemical formulas that are sufficiently detailed to show that applicant was in possession of the claimed invention as a whole. See, e.g., Vas-Cath, 935 F.2d at 1565, 19 USPQ2d at 1118 (“drawings alone may provide a ‘written description’ of an invention as required by Sec. 112”); In re Wolfensperger, 302 F.2d 950, 133 USPQ

537 (CCPA 1962) (the drawings of applicant's specification provided sufficient written descriptive support for the claim limitation at issue); *Autogiro Co. of Am. v. United States*, 384 F.2d 391, 398, 155 USPQ 697, 703 (Ct. Cl. 1967) ("In those instances where a visual representation can flesh out words, drawings may be used in the same manner and with the same limitations as the specification.");

Please see Figs 1 and 5 of instant application, as reproduced below:

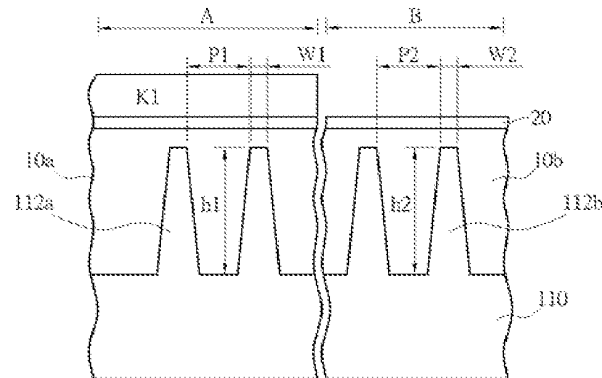


FIG. 1

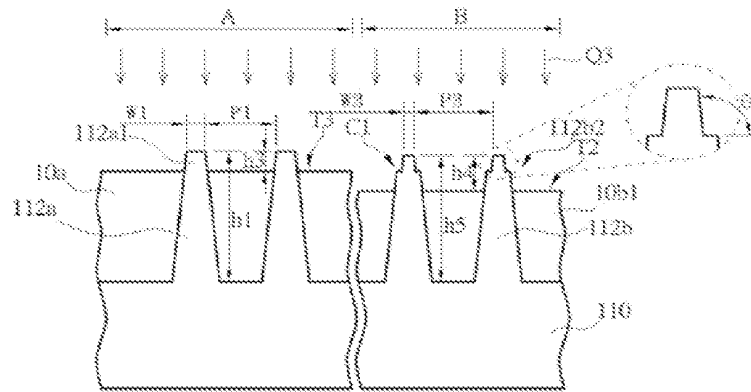


FIG. 5

10 Please refer to the structural features or elements identified as P1, P2, and P3 in the above drawings, along with their respective arrowed dimension lines, projection lines, etc..., and based on the totality of support from instant disclosure as a whole, including the above drawings, P1, P2, P3 can be at least ascertained as being "distance

segment having dimension nomenclature and markings thereof”, respectively.

Please see under the Principles of Dimensioning as described in the following two publicly available online literature:

<https://mech.iitm.ac.in/part1.pdf>

5 [http://homepages.cae.wisc.edu/~me231/online_notes/dimensioning/principals dim.pdf](http://homepages.cae.wisc.edu/~me231/online_notes/dimensioning/principals_dim.pdf)

Please note that at the very least, P1, P2, P3 each can be interpreted as being a distance segment having a length dimension value.

10 **Examiner agreed** that by deleting all of the features directing/relating to the
“pitch” in existing claim 1 (~~“the pitch between each top part of the first fin-shaped
structures being less than the pitch between each top part of the second fin-shaped
structures, while the pitch between each lower part below the top part of the first
fin-shaped structures is the same as the pitch between each lower part below the top
15 part of the second fin-shaped structures)~~ and adding new features as discussed below
under items # 3-4, then the 35 USC 112(b) rejection would be overcome.

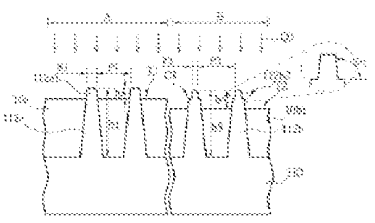
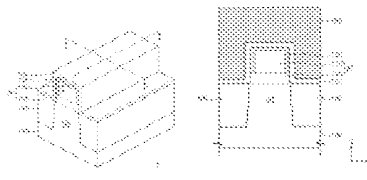
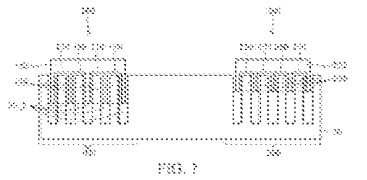
Item #2) Applicant rep. discussed a possible amendment to Claim 1, by
deleting the features ~~“the pitch between each top part of the first fin-shaped structures
20 being less than the pitch between each top part of the second fin-shaped structures,
while the pitch between each lower part below the top part of the first fin-shaped
structures is the same as the pitch between each lower part below the top part of the
second fin-shaped structures”~~ from Claim 1, as well as amending Claim 1 further to
read as follow:

25 Claim 1 (currently amended): A fin-shaped structure, comprising:
a substrate having a first fin-shaped structure located in a first area and a
second fin-shaped structure located in a second area, wherein the
second fin-shaped structure comprises a ladder-shaped cross-sectional
profile part, wherein the width of a top part of the ladder-shaped
30 cross-sectional profile is smaller than the width of a lower part of the

ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like; and
two gates **conformally and** directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively.

5

Applicant rep. further submits the following comparison analysis:

Present Application	Prior art
 <p>FIG. 5</p>	<p>Kim (US2014/0335673):</p>  <p>130 capping pattern (SiN) 150 etch stop layer</p> <p>Lee (US2013/0149826)</p>  <p>FIG. 7</p>
gates <u>conformally and</u> directly disposed over the ladder-shaped fin	<p>Kim: Gates disposed on etch stop layer</p> <p>Lee: not ladder-shaped fin</p>

Please see also [0023] – [0024] of the specification of instant application for
10 support of above proposed amendment for Claim 1.

Examiner agreed that the above amendment would be beneficial.

Item #3) Applicant rep. suggested another possible amendment to Claim 1, by
15 deleting the features “~~the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures,~~

while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures” and amending Claim 1 further to read as follow:

5 structures, and a first distance between each adjacent top corner of the first fin-shaped
structures is less than a second distance between each adjacent top corner of the
second fin-shaped structures.”

10 to the type of length dimension values of length segments as previously discussed
under item # 1 above.

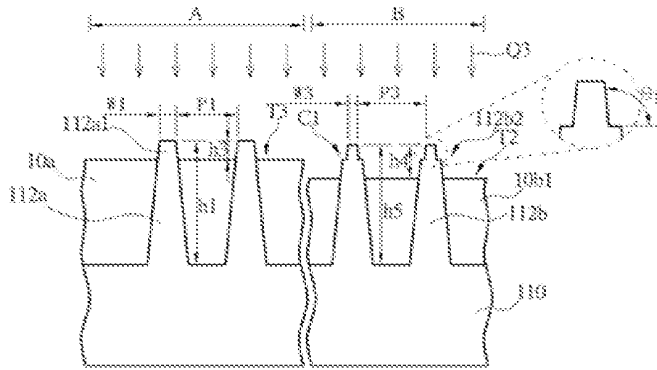


FIG. 5

15 the “first distance” and “second distance” are not sufficiently defined enough, and thus
can be interpreted in different ways.

Upon further discussions during the interview, Claim 1 is further suggested to be amended to express the first fin-shaped structures and the second fin-shaped structures in terms of more precisely defined fins, i.e. first fin, second fin, such as for example:

structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first

distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures”

5 Item #4) Applicant rep. also discussed another possible amendment to Claim 1 in
combination with Item # 3 to further read as follow:

“while the pitch a third distance P5 between each lower part below the top part of the first fin-shaped structures is the same as the pitch a fourth distance P6 between each lower part below the top part of the second fin-shaped structures”

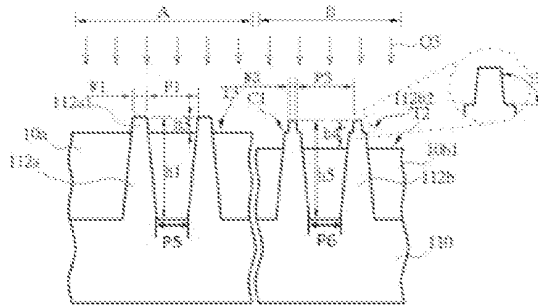
10

However, Examiner has the same concerns similar for item # 3 above.

Therefore, upon further discussion, it was agreed that it would be better to combine the amendment proposals under item # 3 and item # 4, and amendment proposal for item # 4 should read:

15 “while a third distance between adjacent lower parts of the first fin and the second
fin is the same as a fourth distance between adjacent lower parts of the third fin and the
fourth fin”

During the discussion, Applicant rep. proposed the following definitions for the third
20 distance P5 and the fourth distance P6 based on annotated FIG. 5:



W. C. C.

Please note that **Chang does not teach** of varying distances between each adjacent

top corner of fin-shaped structures **while** the distances between adjacent lower parts of the fin-shaped structures are **maintained to be the same**. In other words, Chang teaches of having the **same** adjacent top corner distances for fin-shaped structures **of the same pitch**, while having **different** adjacent top corner distances for fin-shaped structures **of different**
5 **pitches**. Please refer to the distances between adjacent top corners and the distances between adjacent lower parts for each of the fins 302a, 302b, and 302c as taught by Chang as shown in reproduced Fig. 5 of Chang below for further comparison:

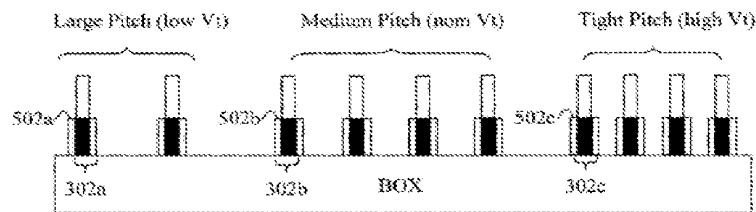


FIG. 5

10 Meanwhile, Applicant rep. pointed to the specification in [0013] which recites “In this embodiment, the first fin-shaped structures 112a and the second fin-shaped structures 112b have the same structure.” for support of amendment above under item # 4.

It was also discussed during the interview that FIG. 5 along with the corresponding passage in the specification should be amended alongside the proposed amendment to
15 claim 1 in item # 4 to reflect the addition of “third distance P5” and “fourth distance P6” into claim 1 (i.e. “while a third distance P5 between adjacent lower parts of the first fin and the second fin is the same as a fourth distance P6 between adjacent lower parts of the third fin and the fourth fin”) based on support at least in [0013] of the specification as originally filed, thus no new matter is introduced by the amendment.

20

This response which includes amendments to the claims and the corresponding arguments is accordingly made based on the mutual understanding reached in this telephone interview.

2. Amendments to the claims and the specification

Claim 1 has been amended to include the features “the width of a top part of the ladder-shaped cross-sectional profile is smaller than the width of a lower part of the ladder-shaped cross-sectional profile, wherein the change of width from the lower part to the top part is step-like” and “two gates conformally and directly disposed over the first fin-shaped structure and the second fin-shaped structure respectively” and cancel the feature “the pitch between each top part of the first fin-shaped structures being less than the pitch between each top part of the second fin-shaped structures, while the pitch between each lower part below the top part of the first fin-shaped structures is the same as the pitch between each lower part below the top part of the second fin-shaped structures” according to Item 2 discussed during above telephone interview. The dependency of claims 2-3 and 5-6 has been accordingly amended. Withdrawn Claim 9 has been amended according to amended Claim 1. Claims 14-20 have been canceled.

FIG5 has been amended to add “p5” and “p6”, and the corresponding Para [0013] and Para [0022] of the specification has been amended accordingly to include the terms “third distance p5” and “fourth distance p6”, and their relations as shown in FIG.5.

No new matter is introduced by these amendments. Acceptance of the amendments is respectfully requested.

3. Claim Rejections – 35 USC §112(b)

The Examiner stated “As to claim 1, there is a lack of antecedent basis for “the pitch between each top part of the first fin-shaped structures” (emphasis added), “the pitch between each top part of the second fin-shaped structures” (emphasis added), “the pitch between each lower part below the top part of the first fin-shaped structures” (emphasis added), and “the pitch between each lower part below the top part of the second fin-shaped structures” (emphasis added). Furthermore as to claim 1, the term “pitch” appears to be incorrectly used. First, Applicant’s Specification does not define the term. Second, the manner in which the Applicant is using it is contrary to the definition accorded by one of ordinary skill in the art. According to the Semiconductor Glossary¹ the definition of “pitch” is “the center-to-center distance between features of an integrated

circuit”. Applicant’s pitch “P1” and “P3” are not center-to-center distances. Moreover, it appears that the actual pitch of the Applicant’s device is constant between first and second fin-shaped structures because the center-to-center distance does not change.”

5 Response

 The term “pitch” in Claim 1 has been canceled. Claim 1 should overcome the 35 USC 112(b) rejection. The dependent claims 2-6 and 8 of Claim 1 should overcome as well.

10 **4. Specification Objection**

 The Examiner stated that “The Specification is objected to because it lacks antecedent basis for the term “pitch”. See Examiner’s discussion, *supra*.”.

Response

15 The term “pitch” in the Specification has been replaced by the terms “first distance”, “distance” and “second distance” according to the agreements achieved during the telephone interview.

5. Introduction of New Claims

20 Claim 21 is added according to Item #3 and item #4.

 Claim 21 includes the feature “a substrate having a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a
25 second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin”. The dependency of claims 22-26 have been newly
30 added as well according to claims 2-6.

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/512,475	Filing Date 10/13/2014	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

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

APPLICATION AS AMENDED – PART II

AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	12/29/2016	CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X \$80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0
		CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>							

SLIE
SONYA HILLIARD

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

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14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 04/17/2017 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION 5F., No.389, Fuhe Rd., Yonghe Dist. New Taipei City, TAIWAN			EXAMINER CHI, SUBERR L	
			ART UNIT	PAPER NUMBER
			2829	
			NOTIFICATION DATE	DELIVERY MODE
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mis.ap.uspto@naipo.com

Office Action Summary	Application No. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner SUBERR CHI	Art Unit 2829	AIA (First Inventor to File) Status Yes

-- 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 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

- 1) ☒ Responsive to communication(s) filed on 12/29/2016.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

- 5) ☒ Claim(s) 1-6,8-13 and 21-26 is/are pending in the application.
5a) Of the above claim(s) 9-13 is/are withdrawn from consideration.
- 6) ☒ Claim(s) 21-26 is/are allowed.
- 7) ☒ Claim(s) 1-6 and 8 is/are rejected.
- 8) ☐ Claim(s) ____ is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, 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.

Application Papers

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

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).

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)).

** 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) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
Paper No(s)/Mail Date ____.
- 3) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 4) ☐ Other: ____.

DETAILED ACTION

Notice of AIA Status

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

Response to Arguments

2. The previously issued Specification objection is hereby withdrawn in view of the amended claims.
3. The previously issued 112(b) or 112 (pre-AIA) 2nd paragraph rejection(s) is withdrawn in view of the amended claims.
4. The Applicant's arguments with respect to claims #1-6, 8 and 21-26 in the reply filed on 12/29/2016 have been carefully considered, but are moot in view of the new grounds of rejection.

Claim Rejections – 35 USC § 112(b)

The following is a quotation of 35 U.S.C. 112(b):

(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

Claims 1-6 and 8 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant, regards as the invention.

5. As to claim 1, there is a lack of antecedent basis for the limitations of “**the** width of a top part” (emphasis added), “**the** width of a lower part” (emphasis added), and “**the** change of width from the lower part to the top part” (emphasis added).
6. Claims 2-6 and 8 are rejected under 112(b) by virtue of their dependence on claim 1.

Claim Rejections 35 USC § 102(a)(1)

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

A person shall be entitled to a patent unless –

(a)(1) the claimed invention was patented, described in a printed publication, or in public use, on sale or otherwise available to the public before the effective filing date of the claimed invention.

Claims 1, 3, and 8 are rejected under 35 U.S.C. 102(a)(1) as being anticipated by Torek et al., (U.S. Patent Publication No. 2010/0148234), hereafter “Torek”.

7. As to claim 1, Torek teaches:
 - a. *A substrate (FIG. 4, [100]) having a first fin-shaped structure (FIG. 4, left side fin structure) located in a first area and a second fin-shaped structure (FIG. 4, right*

side fin structure) *located in a second area, wherein the second fin-shaped structure comprises a ladder shaped cross-sectional profile part.*

- b. *Wherein the width of a top part of the ladder-shaped cross section profile is smaller than the width of a lower part of the ladder-shaped cross sectional profile. Torek teaches the base of each of the first and second fin shaped structures having a larger width than that of the top parts of the fin shaped structures.*
 - c. *Wherein the change of width from the lower part to the top part is step-like. FIG. 4.*
 - d. *Two gates (FIGS. 4/5, [131+132]) conformally and directly disposed over the first fin-shaped structure and the second fin-shaped structure.*
8. As to claim 3, Torek teaches an isolation structure (**FIG. 4, [102]**) disposed besides the first and second fin-shaped structures, such that the ladder-shaped cross-sectional profile part is higher than a top surface of the isolation structure.
9. As to claim 8, the language “high voltage threshold area” and “low voltage threshold area” does not add any additional structural limitations, and is treated as intended use language. The Examiner notes that a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art structure is

capable of performing the intended use, then it meets the claim. See, e.g., *In re Pearson*, 181 USPQ 641 (CCPA); *In re Minks*, 169 USPQ 120 (Bd Appeals); *In re Casey*, 152 USPQ 235 (CCPA 1967); *In re Otto*, 136 USPQ 458, 459 (CCPA 1963). See MPEP §2114.

The intended use recitations do not distinguish the present invention over the prior art of Torek who teaches first and second areas, which could be applied to high voltage/low voltage applications.

Claim Rejections - 35 USC § 103

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

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102 of this title, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 2 is rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Kozarsky et al., (U.S. Patent Publication No. 2015/0311085), hereafter “Kozarsky”.

10. As to claim 2, Torek does not teach the width of a top part of the first fin-shaped structure is larger than the width of a top part of the second fin-shaped structure.

On the other hand, Kozarsky teaches a top surface of a first fin-shaped structure (**Kozarsky, FIG. 2D, [220-A]**) having a larger width than a top surface of a second fin-shaped structure (**Kozarsky, FIG. 2D, [220-B]**).

One of ordinary skill in the art would have recognized that a fin with a larger width yields the predictable benefit of forming more stable fin-shaped structures for high current applications. **Kozarsky, ¶ [0035].**

As such, it would have been obvious to one of ordinary skill in the art to incorporate the different width fin-shaped structures as taught by Kozarsky into the fin-shaped structures as taught by Torek.

Claims 4 and 5 are rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Bergendahl et al., (U.S. Patent Publication No. 2014/0191323), hereafter “Bergendahl”.

11. As to claims 4 and 5, Torek does not teach a top surface of the isolation structure of the first area higher than a top surface of the isolation structure of the second area.

On the other hand, Bergendahl teaches a top surface of the isolation structure (**Bergendahl, FIG. 12, [401]**) of the first area higher than a top surface of the isolation structure of the second area (**claim 4**). Bergendahl’s dielectric structure having different areas having different heights therefore also teaches a height of a first fin-shaped structure protruding from an isolation structure lower than a height of a second fin-shaped structure protruding from the isolation structure (**claim 5**).

One of ordinary skill in the art would have recognized that a dielectric layer with a different height in different regions will yield the predictable benefit of forming fin-shaped structures with variable channel widths.

As such, it would have been obvious to one of ordinary skill in the art to incorporate the variable height isolation structure as taught by Bergendahl into the overall fin-shaped device with isolation structure as taught by Torek.

Claim 6 is rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Cheng et al., (U.S. Patent Publication No. 2015/0145048), hereafter “Cheng”.

12. As to claim 6, Torek does not teach different protruding heights of the first and second fin-shaped structures.

On the other hand, Cheng teaches a height of the first fin-shaped structure (**Cheng, FIG. 17, 1722**) higher than a height of the second fin-shaped structure (**Cheng, FIG. 17, [1720]**).

One of ordinary skill in the art would have recognized that the use of different height fins yields the predictable benefit of allowing the fine tuning of device characteristics. **Cheng, ¶ [0048]**.

As such, it would have been obvious to one of ordinary skill in the art to incorporate the different height fins as taught by Cheng into the overall fin-shaped device as taught by Torek.

Indication of Allowable Subject Matter

13. The following is a statement of reasons for the indication of allowable subject matter for claims 21-26:

The Examiner was unable to find prior art teaching “wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin” (claim 21).

Conclusion

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

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SUBERR CHI whose telephone number is (571)270-3955. The examiner can normally be reached on 9-5 pm.

Art Unit: 2829

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on (571) 272-1236. 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.

/SUBERR CHI/
Examiner, Art Unit 2829

/DANIEL WHALEN/
Primary Examiner, Art Unit 2829

Notice of References Cited	Application/Control No. 14/512,475		Applicant(s)/Patent Under Reexamination SHEN ET AL.	
	Examiner SUBERR CHI		Art Unit 2829	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-2010/0148234 A1	06-2010	Torek; Kevin J.	H01L29/7851	257/296
*	B	US-2014/0191323 A1	07-2014	Bergendahl; Marc Adam	H01L21/823431	257/368
*	C	US-2015/0311085 A1	10-2015	Kozarsky; Eric S.	H01L21/3086	257/401
*	D	US-2015/0145048 A1	05-2015	Cheng; Kangguo	H01L27/1211	257/351
	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	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	835	(fin with (different height\$1 or taller or shorter)) and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/11 15:23
L8	1	(US-20150145048-\$).did.	US-PGPUB	ADJ	ON	2017/04/11 15:26
L9	1	(US-20150129980-\$).did.	US-PGPUB	ADJ	ON	2017/04/11 15:26
L10	1	(US-20140124860-\$).did.	US-PGPUB	ADJ	ON	2017/04/11 15:28
S1	5	"14512475"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 16:19
S6	13084	H01L29/785.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 16:22
S7	2425	H01L27/0886.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 18:02
S8	1	("2015/0311085").URPN.	USPAT	ADJ	ON	2017/04/10 18:11
S9	1	(US-20140227857-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 18:45
S10	1	(US-20140191323-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 18:46
S11	1	(US-20140001562-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 18:53
S12	1	(US-20130056826-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 18:54
S13	353	H01L27/0925.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 19:11
S14	1100	H01L27/10879.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 19:14
S15	2498	H01L29/7831.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2017/04/10 19:17

			EPO; JPO; DERWENT; IBM_TDB			
S16	3602	((distance or width or separation) with (fin) with (corner or edge)) and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 19:50
S17	345	S16 and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 19:51
S18	1	(US-20150206954-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 19:54
S19	1	(US-20130026571-\$).did.	US-PGPUB	ADJ	ON	2017/04/10 20:01
S20	14	(wen near2 jiun near2 shen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:04
S21	105	(ssu near2 i near2 fu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:04
S22	44	(yen near2 liang near2 wu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:05
S23	26	(chia near2 jong near2 liu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:05
S24	93	(yu near2 hsiang near2 hung).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:05
S25	104	(chung near2 fu near2 chang).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:05
S26	19	(man near2 ling near2 lu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:06
S27	202	(yi near2 wei near2 chen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:06
S28	0	(S20 or S21 or S22 or S23 or S24 or S25 or S26 or S27) and (fin	US-PGPUB; USPAT; USOCR; FPRS;	ADJ	ON	2017/04/10 20:07

EAST Search History

		same adjacent top corners).clm.	EPO; JPO; DERWENT; IBM_TDB			
S29	1	(S20 or S21 or S22 or S23 or S24 or S25 or S26 or S27) and (fin with corner\$1).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/04/10 20:07

EAST Search History (Interference)

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C:\ Users\ schi\ Documents\ EAST\ Workspaces\ Suberr's East Searches\ Suberr 14-512475,
RCE, NF, F.wsp

Search Notes 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner SUBERR CHI	Art Unit 2829

CPC- SEARCHED			
Symbol		Date	Examiner
H01L 21/8234, H01L 27/088		9/20/2016	SC
H01L 27/0886, H01L 27/0925, H01L 27/10879, H01L 29/7831		4/10/2017	SC

CPC COMBINATION SETS - SEARCHED			
Symbol		Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES			
Search Notes		Date	Examiner
EAST search history attached.		9/14/2015	TD
EAST		9/20/2016	SC
EAST (class, inventor, keyword)		4/10/2017	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No. : 14/512,475 Confirmation No. 5891
First Named Inventor : Wen-Jiun Shen
Filed : October 13, 2014
TC/A.U. : 2829
Examiner : CHI, SUBERR L
Docket No. : NAUP2310USA
Customer No. : 27765

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

AMENDMENT

In response to the Office action of April 17, 2017, please amend the above-identified application as follows:

- 5 **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.

Amendments to the Claims:

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

Listing of Claims:

5 Claims 1-20 (canceled)

Claim 21 (previously presented): A fin-shaped structure, comprising:

10 a substrate having a plurality of first fin-shaped structures and a plurality of second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin.

20 Claim 22 (previously presented): The fin-shaped structure according to claim 21, wherein the width of each top part of the first fin-shaped structures is larger than the width of each top part of the second fin-shaped structures.

25 Claim 23 (previously presented): The fin-shaped structure according to claim 21, further comprising:
an isolation structure disposed beside the first fin-shaped structures and beside the second fin-shaped structures respectively, and ladder-shaped cross-sectional profile parts of the second fin-shaped structures are higher than a top surface of the isolation structure.

30

Claim 24 (previously presented): The fin-shaped structure according to claim 21, wherein a top surface of the isolation structure of the first area is higher than a top surface of the isolation structure of the second area.

5 Claim 25 (previously presented): The fin-shaped structure according to claim 21, wherein a height of the first fin-shaped structures protruding from the isolation structure is lower than a height of the second fin-shaped structures protruding from the isolation structure.

10 Claim 26 (previously presented): The fin-shaped structure according to claim 21, wherein a height of the first fin-shaped structures protruding from the substrate is higher than a height of the second fin-shaped structures protruding from the substrate.

15

Electronic Acknowledgement Receipt

EFS ID:	29295428
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Roger Gwan-Jye Chen/Anna Lu
Filer Authorized By:	Roger Gwan-Jye Chen
Attorney Docket Number:	NAUP2310USA
Receipt Date:	24-MAY-2017
Filing Date:	13-OCT-2014
Time Stamp:	23:28:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment		no			
File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Arguments/Remarks Made in an Amendment	2865116.PDF	589444	no	3
			d51507b800017577b4b1b3993b4b7ae135bd8235		
Warnings:					

Information:					
2	Response After Final Action	2865115.PDF	79104	no	1
			1a40c8218b08f158e9cabbf2613e8a6e1c390c22		
Warnings:					
Information:					
3	Claims	2865114.PDF	80603	no	2
			dC3649f4d9f3b5827e32ad13582fc98dc7c29606		
Warnings:					
Information:					
Total Files Size (in bytes):			749151		
<p>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.</p> <p><u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.</p> <p><u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.</p> <p><u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.</p>					

REMARKS/ARGUMENTS

Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with me concerning any subject matter of this application by electronic mail. I understand that a copy of these communications will be made of record
5 in the application file.

Reconsideration of the present application is politely requested. Claims 1 – 6, 8 – 13 and 21 – 26 remain pending in the case. Claims 1 – 6 and 8 – 13 have been canceled. No new matter is introduced by this amendment. Acceptance of this
10 amendment is respectfully requested.

Amendments to the claims

Claims 1 – 6 and 8 – 13 have been canceled. No new matter is introduced by these amendments. Acceptance of the amended claims is respectfully solicited.
15

Claim Rejections – 35 USC §112(b)

The Examiner stated that “As to claim 1, there is a lack of antecedent basis for the limitations of “the width of a top part” (emphasis added), “the width of a lower part” (emphasis added), and “the change of width from the lower part to the top part”
20 (emphasis added).”

Response

Claim 1 has been canceled.

25 **Claim Rejections – 35 USC §102(a)(1)**

Claims 1, 3 and 8 were rejected under 35 U.S.C. 102(a)(1) as being anticipated by Torek et al., (U.S. Patent Publication No. 2010/0148234), hereafter “Torek”.

Response

30 Claims 1, 3 and 8 have been canceled.

Claim Rejections – 35 USC §103

Claim 2 was rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Kozarsky et al., (U.S. Patent Publication No. 2015/0311085), hereafter “Kozarsky”.

Claims 4 and 5 were rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Bergendahl et al., (U.S. Patent Publication No. 2014/0191323), hereafter “Bergendahl”.

Claim 6 was rejected under 35 U.S.C. 103 as being unpatentable over Torek as applied to claim 1, and further in view of Cheng et al., (U.S. Patent Publication No. 2015/0145048), hereafter “Cheng”.

Response

Claims 2 and 4 – 6 have been canceled.

Indication of Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter for claims 21-26:

The Examiner was unable to find prior art teaching “wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin” (claim 21).

Response

Claims 21 – 26 are deemed to be allowed. As Claims 1 – 20 have been canceled, allowance of the present application is sincerely requested.

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

Appl. No. 14/512,475
Reply to Office action of April 17, 2017

case.

Sincerely yours,

5 /Winston Hsu/ Date: 05/24/2017

Winston Hsu, Patent Agent No. 41,526

5F., No.389, Fuhe Rd., Yonghe Dist., New Taipei City, Taiwan

Voice Mail: 302-729-1562

Facsimile: 806-498-6673

10 e-mail : winstonhsu@naipo.com

Note: Please leave a message in my voice mail if you need to talk to me. (The time in D.C. is 12 hours behind the Taiwan time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)

15

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

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/512,475	Filing Date 10/13/2014	☐ To be Mailed
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ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

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

APPLICATION AS AMENDED – PART II

AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
	05/24/2017	CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	* 6	Minus	** 20	= 0	X \$80 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	X \$420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0
AMENDMENT	(Column 1)	(Column 2)	(Column 3)	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)
		CLAIMS REMAINING AFTER AMENDMENT					
	Total (37 CFR 1.16(i))	*	Minus	**	=	X \$ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X \$ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	
<p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.</p> <p>** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".</p> <p>*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".</p> <p>The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p>							
						LIE MARCUS PRIDGEN	

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

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



UNITED STATES PATENT AND TRADEMARK OFFICE

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

NOTICE OF ALLOWANCE AND FEE(S) DUE

27765 7590 06/20/2017
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
5F., No.389, Fuhe Rd., Yonghe Dist.
New Taipei City,
TAIWAN

EXAMINER

CHI, SUBERR L

ART UNIT

PAPER NUMBER

2829

DATE MAILED: 06/20/2017

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891

TITLE OF INVENTION: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	09/20/2017

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: 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
or Fax (571)-273-2885**

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

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

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

Certificate of Mailing or Transmission

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

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

27765 7590 06/20/2017
NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
5F., No.389, Fuhe Rd., Yonghe Dist.
New Taipei City,
TAIWAN

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891

TITLE OF INVENTION: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	09/20/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHI, SUBERR L	2829	438-254000

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

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

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

(A) NAME OF ASSIGNEE

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

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

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

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

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

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

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. _____



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891
27765 7590 06/20/2017 NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION 5F., No.389, Fuhe Rd., Yonghe Dist. New Taipei City, TAIWAN			EXAMINER CHI, SUBERR L	
			ART UNIT	PAPER NUMBER
			2829	

DATE MAILED: 06/20/2017

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 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.

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. 14/512,475	Applicant(s) SHEN ET AL.	
	Examiner SUBERR CHI	Art Unit 2829	AIA (First Inventor to File) 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 05/24/2017.
☐ 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 21-26. 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) | 5. ☒ Examiner's Amendment/Comment |
| 2. ☐ Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date _____ | 6. ☒ Examiner's Statement of Reasons for Allowance |
| 3. ☐ Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 7. ☐ Other _____. |
| 4. ☐ Interview Summary (PTO-413),
Paper No./Mail Date _____. | |

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DETAILED ACTION

Notice of AIA Status

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

Response to Arguments

2. The previously issued 112(b) rejection(s) is withdrawn in view of the cancelled claims.
3. The Applicant's arguments with respect to claims #21-26 in the reply filed on 05/24/2017 have been carefully considered, and are persuasive. A Notice of Allowability is forthwith issued in the present Office Action.

Examiner's Amendment

4. 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.

Authorization for this examiner's amendment was given in a telephone interview with Winston Hsu, Registration No. 41,526, on June 13, 2017.

(Claim 21: Currently Amended)

A fin-shaped structure, comprising: a substrate having a plurality of first fin-shaped structures and a plurality second fin-shaped structures, and the first fin-shaped structures comprising a first fin and a second fin, the second fin-shaped structures comprising a third fin and a fourth fin, wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures while a third distance between adjacent lower parts of the first fin and the second fin is the same as a fourth distance between adjacent lower parts of the third fin and the fourth fin; and wherein the adjacent top corners are directly opposite each other.

(Claim 24: Currently Amended)

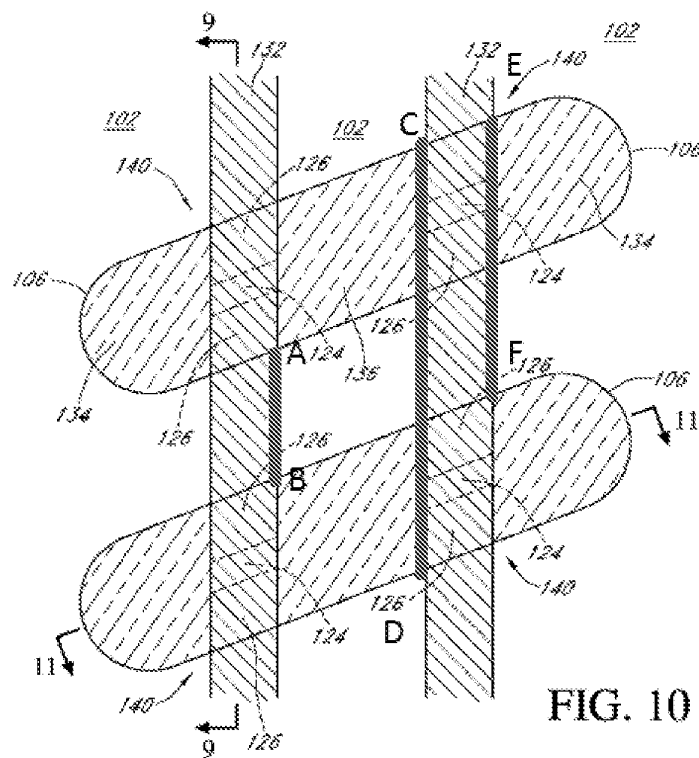
The fin-shaped structure according to claim ~~24~~, 23, wherein a top surface of the isolation structure of ~~the a~~ first area is higher a top surface of the isolation structure of ~~the a~~ second area.

Allowable Subject Matter

5. Claims #21-26 are allowed.

The following is an examiner's statement of reasons for allowance: prior art fails to teach or suggest:

“wherein a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures is less than a second distance between adjacent top corners of the third fin . . . and wherein the adjacent top corners are directly opposite each other” (claim 21).



Torek et al., (U.S. Patent Publication No. 2010/0148234), hereafter “Torek”, is the closest prior art.

Three line segments, AB, CD, and EF, are illustrated in Torek FIG. 10 above, and represent the relevant distances between top corners of the first fin and second fin, and third fin and fourth fin. Line segment AB is a first distance between adjacent top corners of the first fin and the second fin of the first fin-shaped structures. Line segment CD and EF are second and third distances between adjacent top corners of the third fin and the fourth fin of the second fin-shaped structures. Line segment AB is less than line segments CD and EF. However, line segments CD and EF are not adjacent top corners that are *directly opposite* each other, and therefore claim 21 is allowable.

No other prior art references were found.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to SUBERR CHI whose telephone number is (571)270-3955. The examiner can normally be reached on 9-5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on (571) 272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2829

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.

/SUBERR CHI/
Examiner, Art Unit 2829

/DANIEL WHALEN/
Primary Examiner, Art Unit 2829

OK to enter

/S.L.C/

06/05/2017

FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF

Appl. No.	: 14/512,475	Confirmation No.	5891
First Named Inventor	: Wen-Jiun Shen		
Filed	: October 13, 2014		
TC/A.U.	: 2829		
Examiner	: CHI, SUBERR L		
Docket No.	: NAUP2310USA		
Customer No.	: 27765		

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

AMENDMENT

In response to the Office action of April 17, 2017, please amend the above-identified application as follows:

- 5 **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.

Search Notes 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner SUBERR CHI	Art Unit 2829

CPC- SEARCHED		
Symbol	Date	Examiner
H01L 21/8234, H01L 27/088	9/20/2016	SC
H01L 27/0886, H01L 27/0925, H01L 27/10879, H01L 29/7831	4/10/2017	SC
H01L 27/0886, H01L 27/10879	6/5/2017	SC

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
EAST search history attached.	9/14/2015	TD
EAST	9/20/2016	SC
EAST (class, inventor, keyword)	4/10/2017	SC
EAST (class, keyword, inventor searches)	6/5/2017	SC

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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UNITED STATES PATENT AND TRADEMARK OFFICE

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

BIB DATA SHEET

CONFIRMATION NO. 5891

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
14/512,475	10/13/2014	438	2829	NAUP2310USA		
APPLICANTS UNITED MICROELECTRONICS CORP., Hsin-Chu City, TAIWAN; INVENTORS Wen-Jiun Shen, Yunlin County, TAIWAN; Ssu-I Fu, Kaohsiung City, TAIWAN; Yen-Liang Wu, Taipei City, TAIWAN; Chia-Jong Liu, Ping-Tung County, TAIWAN; Yu-Hsiang Hung, Tainan City, TAIWAN; Chung-Fu Chang, Tainan City, TAIWAN; Man-Ling Lu, Taoyuan County, TAIWAN; Yi-Wei Chen, Taichung City, TAIWAN; ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** CHINA 201410454915.X 09/09/2014 ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** 10/16/2014						
Foreign Priority claimed ☒ Yes ☐ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and Acknowledged <u>/SUBERR L CH/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY TAIWAN	SHEETS DRAWINGS 5	TOTAL CLAIMS 20	INDEPENDENT CLAIMS 3
ADDRESS NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION 5F., No.389, Fuhe Rd., Yonghe Dist. New Taipei City, TAIWAN						
TITLE FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF						
FILING FEE RECEIVED 1600	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees		
				☐ 1.16 Fees (Filing)		
				☐ 1.17 Fees (Processing Ext. of time)		
				☐ 1.18 Fees (Issue)		
				☐ Other _____		
				☐ Credit		

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	5	"14512475"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:14
L2	17858	(distance same corner same "adjacent") and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:35
L3	1215	(distance same corner same "adjacent") and (@ad<"20141013") and (257/\$.ccls. or 438/\$.ccls.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:35
L4	560	L3 and gate	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:37
L5	15	(wen near2 jiun near2 shen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:42
L6	110	(ssu near2 "i" near2 fu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:42
L7	46	(yen near2 liang near2 wu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:42
L8	27	(chia near2 jong near2 liu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:43
L9	97	(yu near2 hsiang near2 hung).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:43
L10	106	(chung near2 fu near2 chang).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:43
L11	20	(man near2 ling near2 lu).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:43
L12	207	(yi near2 wei near2 chen).in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:44

EAST Search History

L13	5	(L5 or L6 or L7 or L8 or L9 or L10 or L11 or L12) and corner.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:44
L14	2462	H01L27/0886.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:46
L15	1110	H01L27/10879.cpc. and (@ad<"20141013")	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	ADJ	ON	2017/06/05 19:46
L16	1	(US-20160064377-\$).did.	US-PGPUB	ADJ	ON	2017/06/05 19:54

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L17	36395	(fin or fin\$1shaped and adjacent and top corners and distance).clm.	USPAT	ADJ	ON	2017/06/05 20:41
L18	1	((fin or fin\$1shaped) and adjacent and top corners and distance).clm.	USPAT	ADJ	ON	2017/06/05 20:41

6/ 5/ 2017 8:41:34 PM

C:\Users\schi\Documents\EAST\Workspaces\Suberr's East Searches\Suberr 14-512475, RCE, NF, F, A.wsp

Issue Classification 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.	
	Examiner SUBERR CHI	Art Unit 2829	

CPC						
Symbol					Type	Version
H01L		21	/	308	F	2013-01-01
H01L		27	/	0886	I	2013-01-01
H01L		21	/	823431	I	2013-01-01
H01L		21	/	30604	I	2013-01-01
H01L		21	/	02238	A	2013-01-01
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CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

/SUBERR CHI/ Examiner.Art Unit 2829 (Assistant Examiner)	06/05/2017 (Date)	Total Claims Allowed: 6	
/DANIEL WHALEN/ Primary Examiner.Art Unit 2829 (Primary Examiner)	06/14/2017 (Date)	O.G. Print Claim(s) 21	O.G. Print Figure 5

Issue Classification 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner SUBERR CHI	Art Unit 2829

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION														
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED									
						H	O	I	L	27 / 0896										
CROSS REFERENCE(S)																				
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																			

/SUBERR CHI/ Examiner.Art Unit 2829 (Assistant Examiner)	06/05/2017 (Date)	Total Claims Allowed: 6	
/DANIEL WHALEN/ Primary Examiner.Art Unit 2829 (Primary Examiner)	06/14/2017 (Date)	O.G. Print Claim(s) 21	O.G. Print Figure 5

Issue Classification 	Application/Control No. 14512475	Applicant(s)/Patent Under Reexamination SHEN ET AL.
	Examiner SUBERR CHI	Art Unit 2829

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17												
	2		18												
	3		19												
	4		20												
	5	1	21												
	6	2	22												
	7	3	23												
	8	4	24												
	9	5	25												
	10	6	26												
	11														
	12														
	13														
	14														
	15														
	16														

/SUBERR CHI/ Examiner.Art Unit 2829 (Assistant Examiner)	06/05/2017 (Date)	Total Claims Allowed: 6	
/DANIEL WHALEN/ Primary Examiner.Art Unit 2829 (Primary Examiner)	06/14/2017 (Date)	O.G. Print Claim(s) 21	O.G. Print Figure 5

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
or Fax (571)-273-2885**

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

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

27765 7590 06/20/2017

NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
5F., No.389, Fuhe Rd., Yonghe Dist.,
New Taipei City,
Taiwan

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

Certificate of Mailing or Transmission

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

Hitomi Lin	(Depositor's name)
/Hitomi Lin/	(Signature)
09/01/2017	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/13/2014	Wen-Jiun Shen	NAUP2310USA	5891

TITLE OF INVENTION: **FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF**

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	\$960	\$0	\$0	\$960	09/20/2017

EXAMINER	ART UNIT	CLASS-SUBCLASS
CHI, SUBERR L	2829	438-254000

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 Winston Hsu

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)

UNITED MICROELECTRONICS CORP. Hsin-Chu City, Taiwan, R.O.C.

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

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

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

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 50-3105 (enclose an extra copy of this form).

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 /Winston Hsu/

Date 08/31/2017

Typed or printed name Winston Hsu

Registration No. 41526

Electronic Patent Application Fee Transmittal				
Application Number:		14512475		
Filing Date:		13-Oct-2014		
Title of Invention:		FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF		
First Named Inventor/Applicant Name:		Wen-Jiun Shen		
Filer:		Winston Hsu/Hitomi Lin		
Attorney Docket Number:		NAUP2310USA		
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				960

Electronic Acknowledgement Receipt

EFS ID:	30247016
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Winston Hsu/Hitomi Lin
Filer Authorized By:	Winston Hsu
Attorney Docket Number:	NAUP2310USA
Receipt Date:	01-SEP-2017
Filing Date:	13-OCT-2014
Time Stamp:	01:37:00
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	\$960
RAM confirmation Number	090117INTEFSW00007547503105
Deposit Account	503105
Authorized User	Hitomi Lin
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: 37 CFR 1.16 (National application filing, search, and examination fees) 37 CFR 1.17 (Patent application and reexamination processing fees)	

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	2944963.PDF	154582	no	1
			d9a38dae6a4b8ad35cd2a27c5ece12b673ad6ba0		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30504	no	2
			f32aaa15aa88ac9aac6c9d700f988c2e65eb3cd8		

Warnings:

Information:

Total Files Size (in bytes):	185086
-------------------------------------	--------

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

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/512,475	10/10/2017	9786510	NAUP2310USA	5891

27765 7590 09/20/2017

NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION
5F., No.389, Fuhe Rd., Yonghe Dist.
New Taipei City,
TAIWAN

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 103 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):

Wen-Jiun Shen, Yunlin County, TAIWAN;
UNITED MICROELECTRONICS CORP., Hsin-Chu City, TAIWAN;
Ssu-I Fu, Kaohsiung City, TAIWAN;
Yen-Liang Wu, Taipei City, TAIWAN;
Chia-Jong Liu, Ping-Tung County, TAIWAN;
Yu-Hsiang Hung, Tainan City, TAIWAN;
Chung-Fu Chang, Tainan City, TAIWAN;
Man-Ling Lu, Taoyuan County, TAIWAN;
Yi-Wei Chen, Taichung City, TAIWAN;

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Letters Patent of: Wen-Jiun Shen et al.

Patent No.: 9,786,510

5 Issued: Oct. 10, 2017

For: FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD
THEREOF

10 **REQUEST FOR CERTIFICATE OF CORRECTION**
PURSUANT TO 37 C.F.R. 1.322

Attention: Certificate of Correction Branch

Commissioner for Patents

P.O. Box 1450

Alexandria VA 22313-1450

Upon reviewing the above-identified patent, Patentee noted a printing
15 error which should be corrected.

In claim 1, at column 8, line 57, the word “comers” should be “corners”.
This term was correctly presented in Claim 21, now renumbered as Claim 1 in
the issued patent, by the applicant in the Response to an Office Action filed on
20 May 24, 2017. Thus, this error should not have appeared in the Letters Patent,
and including the error in the Letters Patent was an error by the Patent Office.
Accordingly no fee is required.

Transmitted herewith is a proposed Certificate of Correction effecting such
25 a correction. Accordingly, the applicant requests the issuance of a certificate of
correction.

Sincerely yours,

/Winston Hsu/

Date: 02/02/2023

Winston Hsu, Patent Agent No. 41,526

5 5F., No.389, Fuhe Rd., Yonghe Dist., New Taipei City, Taiwan

Voice Mail: 302-729-1562

e-mail: winstonhsu@naipo.com

Note: Please leave a message in my voice mail if you need to talk to me. (The time in
10 D.C. is 13 hours behind the Taiwan time and DST 12 hours behind.)

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.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

Page 1 of 1

PATENT NO. : 9,786,510
APPLICATION NO.: 14/512,475
ISSUE DATE : Oct.10, 2017
INVENTOR(S) : Wen-Jiun Shen et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE CLAIMS:

Please correct at column 8, claim number 1, line numebr 57:

"comer" should be

--corner--.

MAILING ADDRESS OF SENDER (Please do not use Customer Number below):

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, 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:	47467590
Application Number:	14512475
International Application Number:	
Confirmation Number:	5891
Title of Invention:	FIN-SHAPED STRUCTURE AND MANUFACTURING METHOD THEREOF
First Named Inventor/Applicant Name:	Wen-Jiun Shen
Customer Number:	27765
Filer:	Winston Hsu/connie chen
Filer Authorized By:	Winston Hsu
Attorney Docket Number:	NAUP2310USA
Receipt Date:	03-FEB-2023
Filing Date:	13-OCT-2014
Time Stamp:	21:50:13
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	Request for Certificate of Correction	NAUP2310USA0_AS_1_NP072. PDF	277769 7cd4fef9d3d990cb415a9c2c14dead1fe13e c2e7	no	3

Warnings:

Information:	
Total Files Size (in bytes):	277769
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 9,786,510 B2
APPLICATION NO. : 14/512475
DATED : October 10, 2017
INVENTOR(S) : Shen et al.

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

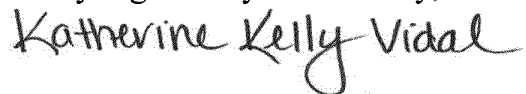
At Column 8, Claim number 1, Line number 57:

“comers”

Should be:

--corner--.

Signed and Sealed this
Twenty-eighth Day of February, 2023



Katherine Kelly Vidal
Director of the United States Patent and Trademark Office