

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 2014002559	FOR FURTHER ACTION		See item 4 below
International application No. PCT/JP2015/054710	International filing date (<i>day/month/year</i>) 20 February 2015 (20.02.2015)	Priority date (<i>day/month/year</i>) 11 March 2014 (11.03.2014)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																								
<p>3. This report contains indications relating to the following items:</p> <table border="0"> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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<p align="center">The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No. +41 22 338 82 70</p>	<p>Date of issuance of this report 13 September 2016 (13.09.2016)</p>
	<p>Authorized officer</p> <p align="center">Yukari Nakamura</p> <p>e-mail: pt07.pct@wipo.int</p>

PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing (day/month/year)	21.04.2015
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Applicant's or agent's file reference 2014002559	FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/JP2015/054710	International filing date (day/month/year) 20.02.2015	Priority date (day/month/year) 11.03.2014
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International Patent Classification (IPC) or both national classification and IPC
**H01L21/8234 (2006.01) i, H01L21/28 (2006.01) i, H01L21/336 (2006.01) i,
H01L27/088 (2006.01) i, H01L29/41 (2006.01) i, H01L29/417 (2006.01) i, H01L29/66 (2006.01) i,
H01L29/786 (2006.01) i**

Applicant
NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/JP	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.

PCT/JP2015/054710

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - the international application in the language in which it was filed
 - a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
 - a. (means)
 - on paper
 - in electronic form
 - b. (time)
 - in the international application as filed
 - together with the international application in electronic form
 - subsequently to this Authority for the purposes of search
4. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No. PCT/JP2015/054710
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Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement																											
1. Statement	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; vertical-align: top;">Novelty (N)</td> <td style="width: 60%;"> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">1-6</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;"> </td> <td style="text-align: right;">NO</td> </tr> </table> </td> <td style="width: 10%;"></td> </tr> <tr> <td style="vertical-align: top;">Inventive step (IS)</td> <td> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">2, 5</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;">1, 3, 4, 6</td> <td style="text-align: right;">NO</td> </tr> </table> </td> <td></td> </tr> <tr> <td style="vertical-align: top;">Industrial applicability (IA)</td> <td> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">1-6</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;"> </td> <td style="text-align: right;">NO</td> </tr> </table> </td> <td></td> </tr> </table>	Novelty (N)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">1-6</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;"> </td> <td style="text-align: right;">NO</td> </tr> </table>	Claims	1-6	YES	Claims		NO		Inventive step (IS)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">2, 5</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;">1, 3, 4, 6</td> <td style="text-align: right;">NO</td> </tr> </table>	Claims	2, 5	YES	Claims	1, 3, 4, 6	NO		Industrial applicability (IA)	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">Claims</td> <td style="border-bottom: 1px solid black;">1-6</td> <td style="width: 10%; text-align: right;">YES</td> </tr> <tr> <td>Claims</td> <td style="border-bottom: 1px solid black;"> </td> <td style="text-align: right;">NO</td> </tr> </table>	Claims	1-6	YES	Claims		NO	
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2. Citations and explanations:	<p>Document 1: JP 2013-74288 A (TOSHIBA CORP.) 22 April 2013, paragraphs [0008]-[0042], fig. 1-5 (Family: none)</p> <p>Document 2: JP 2002-231951 A (SONY CORP.) 16 August 2002, paragraphs [0045]-[0071], fig. 1-9 & JP 2005-523002 A & US 2002/0177260 A1 & US 2004/0002068 A1 & US 2004/0005561 A1 & US 2007/0238182 A1 & US 8920776 B & US 2006/0084055 A1 & US 2006/0269912 A1 & WO 2003/062401 A2 & WO 2003/077836 A2 & EP 1474510 A2 & EP 1975231 A1 & EP 1578347 A2 & CA 2473746 A & CN 1643143 A & NZ 561297 A & AU 2003210670 B & AT 519844 T & DK 1975231 T & ES 2370737 T & PT 1975231 E & SI 1975231 T & KR 10-2004-0075949 A & HK 1078327 A & CA 2463659 A & CN 1635988 A & KR 10-2004-0072626 A & AU 2002367594 A</p> <p>Document 3: JP 2009-164453 A (RENESAS TECHNOLOGY CORP.) 23 July 2009, entire text, all drawings (Family: none)</p>																											

WRITTEN OPINION OF THE
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International application No.

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The invention as in claims 1, 3, 4, and 6 does not involve an inventive step with respect to document 1 and document 2 cited in the ISR.

Document 1 describes a semiconductor device provided with, on a semiconductor substrate, two N-type tunnel transistors each having a P-type source region and an N-type drain region, wherein the source region of one tunnel transistor and the drain region of the other tunnel transistor are electrically connected by wiring, as well as a method of fabricating this semiconductor device.

Document 2 describes a semiconductor device in which, when electrically connecting a p-type region and an n-type region of two transistors on a semiconductor substrate, in order to reduce the layout area and decrease the wiring capacitance, the p-type region and the n-type region are formed adjacent to each other, a metal is deposited on the top surface, and by heating this structure, silicide is formed on the top surface of the p-type region and the n-type region, so that the p-type region and the n-type region are electrically connected, as well as a method of fabricating this semiconductor device.

Therefore, a person skilled in the art could easily conceive of using the silicide described in document 2, instead of wiring, as the means of connecting the P-type source region and the N-type drain region in document 1.

The invention as in claims 2 and 5 is not disclosed in any of the documents cited in the ISR and is thus novel and involves an inventive step.

In particular, in an integrated circuit formed of

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International application No.

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

the tunnel field-effect transistor according to the present application, the feature wherein a metal-semiconductor alloy layer is formed so as to bridge a first P-type region and a second N-type region that are disposed facing each other, and is formed from the surface position of the semiconductor layer to a depth that is the same as or greater than the formation depth of the first P-type region and the second N-type region is not described in any of the documents cited in the ISR and would not be easily conceivable by a person skilled in the art.