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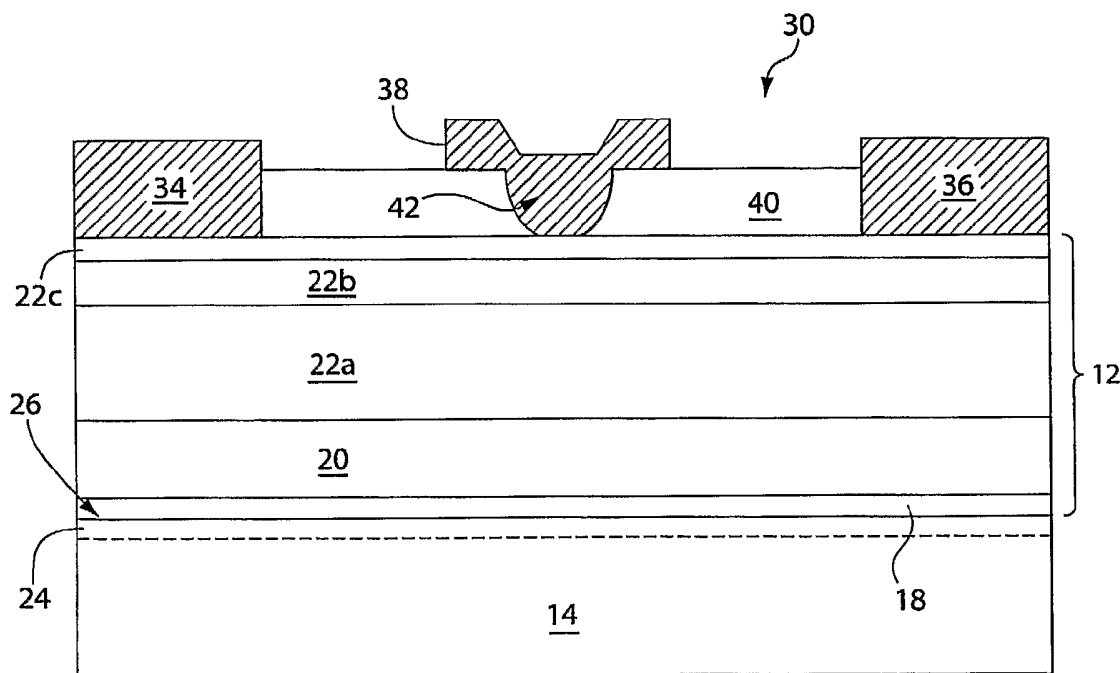
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[Continued on next page]

(54) Title: III-NITRIDE MATERIAL STRUCTURES INCLUDING SILICON SUBSTRATES



(57) Abstract: III-nitride material structures including silicon substrates, as well as methods associated with the same, are described. Parasitic losses in the structures may be significantly reduced which is reflected in performance improvements. Devices (such as RF devices) formed of structures of the invention may have higher output power, power gain and efficiency, amongst other advantages.

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— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2005/043810

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01L29/20 H01L29/778 H01L29/02 H01L29/267

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>CORDIER Y ET AL: "MBE growth of high quality aigan/gan hemts on resistive Si[111] substrate with RF small signal and power performances"</p> <p>MOLECULAR BEAN EPITAXY, 2002 INTERNATIONAL CONFERENCE ON 15-20 SEPT. 2002, PISCATAWAY, NJ, USA, IEEE, 15 September 2002 (2002-09-15), pages 99-100, XP010605709 ISBN: 0-7803-7581-5</p>	<p>1-3,7,8, 12,13, 15-18</p>
Y	<p>the whole document</p> <p style="text-align: center;">----- -/--</p>	<p>10,11,14</p>

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

22 May 2006

Date of mailing of the international search report

28 AUG. 2006

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2005/043810

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HOËL V ET AL: "High-power AlGaIn/GaIn HEMTs on resistive silicon substrate" ELECTRONICS LETTERS, IEE STEVENAGE, GB, vol. 38, no. 14, 4 July 2002 (2002-07-04), pages 750-752, XP006018528 ISSN: 0013-5194 the whole document	1-3,7,8, 13,15-18
Y	----- NAKADA YOSHINOBU ET AL: "GaIn heteroepitaxial growth on silicon nitride buffer layers formed on Si (111) surfaces by plasma-assisted molecular beam epitaxy" APPLIED PHYSICS LETTERS, AIP, AMERICAN INSTITUTE OF PHYSICS, MELVILLE, NY, US, vol. 73, no. 6, 10 August 1998 (1998-08-10), pages 827-829, XP012021928 ISSN: 0003-6951 the whole document	10,11
Y	----- US 6 649 287 B2 (WEEKS T. WARREN ET AL) 18 November 2003 (2003-11-18) cited in the application	14
A	the whole document	1-13, 15-18
A	----- HAGEMAN P R ET AL: "Growth of GaIn epilayers on Si(111) substrates using multiple buffer layers" GAN AND RELATED ALLOYS - 2001. SYMPOSIUM (MATERIALS RESEARCH SOCIETY SYMPOSIUM PROCEEDINGS VOL.693) MATER. RES. SOC WARRENDALE, PA, USA, 2002, pages 105-110, XP008064336 the whole document	1-18
A	----- S.M. SZE: "Physics of semiconductor devices" 1981, WILEY & SONS , NEW YORK US , XP002381942 page 32; figure 21 -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2005/043810

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6649287	B2	18-11-2003	
		AU 3086802 A	24-06-2002
		EP 1343927 A2	17-09-2003
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		US 2004119067 A1	24-06-2004
		US 2002074552 A1	20-06-2002

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2005/043810

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-18

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-18

Semiconductor structure comprising a silicon substrate with a resistivity greater than $10E2$ ohms-cm and a top surface region having a peak free carrier concentration of less than $10E17$ cm⁻³ and a III-nitride material formed over the substrate.

2. claims: 19-33

Semiconductor structure comprising a silicon substrate, a III-nitride material formed on the substrate, the structure having a conducting line loss of less than 1 dB/mm over a frequency range between 0 and 5 GHz.
