

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
12 June 2008 (12.06.2008)

PCT

(10) International Publication Number
WO 2008/070034 A3

- (51) **International Patent Classification:**
H01L 31/111 (2006.01)
- (21) **International Application Number:**
PCT/US2007/024761
- (22) **International Filing Date:**
1 December 2007 (01.12.2007)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
11/607,583 1 December 2006 (01.12.2006) US
- (71) **Applicant (for all designated States except US):** AL-
PHA & OMEGA SEMICONDUCTOR, LTD. [—/US];
Canon's Court, 22 Victoria Street, Hamilton, HM12 (BM).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** PAN, Ji [CN/US];
510 Mansion Court, Santa Clara, CA 95054 (US).
BHALLA, Anup [IN/US]; 1406 Block Drive, Santa
Clara, CA 95050 (US).
- (74) **Agent:** LIN, Bo-in; 13445 Mandoli Drive, Los Altos Hills,
CA 94022 (US).

- (81) **Designated States (unless otherwise indicated, for every kind of national protection available):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW
- (84) **Designated States (unless otherwise indicated, for every kind of regional protection available):** ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

- Published:**
 - with international search report
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments
- (88) **Date of publication of the international search report:**
24 July 2008

(54) **Title:** JUNCTION BARRIER SCHOTTKY (JBS) WITH FLOATING ISLANDS

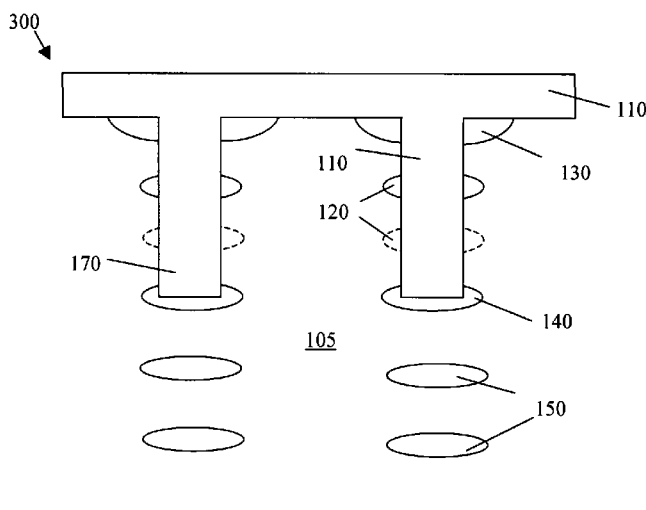


Fig. 3

(57) **Abstract:** A Schottky diode includes a Schottky barrier and a plurality of dopant regions disposed near the Schottky barrier as floating islands to function as PN junctions for preventing a leakage current generated from a reverse voltage. At least a trench opened in a semiconductor substrate with a Schottky barrier material disposed therein constitutes the Schottky barrier. The Schottky barrier material may also be disposed on sidewalls of the trench for constituting the Schottky barrier. The trench may be filled with the Schottky barrier material composed of Ti/TiN or a tungsten metal disposed therein for constituting the Schottky barrier. The trench is opened in a N-type semiconductor substrate and the dopant regions includes P-doped regions disposed under the trench constitute the floating islands. The P-doped floating islands may be formed as vertical arrays under the bottom of the trench.

WO 2008/070034 A3

INTERNATIONALSEARCH REPORT

International application No

PCT/US2007/024761

A CLASSIFICATION OF SUBJECT MATTER IPC(8) - H01L 31/1 11 (2008.04) USPC - 257/109 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) IPC(8) - H01L 31/1 11 (2008 04) USPC - 257/109 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 practicable, search terms used) PatBase		
C DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	US 2006/0138450 A 1 (LANOIS et al) 29 June 2006 (29 06 2006) entire document	1-2, 4-12, 16-17 and 21
Y		3,13-15,18-20
Y	US 6,977,208 B2 (CHIOLA) 20 December 2005 (20 12 2005) entire document	3 and19
Y	US 2005/0029585 A 1 (HE et al) 10 February 2005 (10 02 2005) entire document	13-15
Y	US 6,825,105 B2 (GROVER et al) 30 November 2004 (30 11 2004) entire document	18-20
<input type="checkbox"/> Further documents are listed in the continuation of Box C <input type="checkbox"/>		
* 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 application or patent but published on or after the international filing date "L" document which may throw doubts <i>on</i> 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		Date of mailing of the international search report
13 May 2008		11 JUN 2008
Name and mailing address of the ISAAJS Mail Stop PCT, Attn ISA/US, Commissioner for Patents P O Box 1450, Alexandria, Virginia 22313-1450 Facsimile No 571-273-3201		Authorized officer Blame R Copenheaver PCT Helpdesk 571-272-4300 PCTOSP 571-272-7774