

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
30 March 2006 (30.03.2006)

PCT

(10) International Publication Number
WO 2006/033717 A3

(51) International Patent Classification:
H01L 29/788 (2006.01) G11C 16/04 (2006.01)
H01L 21/336 (2006.01)

MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(21) International Application Number:
PCT/US2005/028212

(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, 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).

(22) International Filing Date: 9 August 2005 (09.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10/946,727 21 September 2004 (21.09.2004) US

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

(71) Applicant (for all designated States except US): **ATMEL CORPORATION** [US/US]; 2325 Orchard Parkway, San Jose, CA 95131 (US).

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

(72) Inventor: **LOJEK, Bohumil**; 4830 Langdale Way, Colorado Springs, CO 80906 (US).

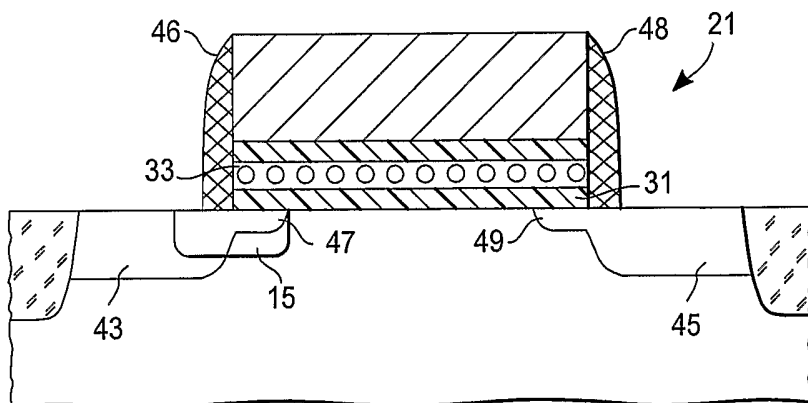
(74) Agent: **SCHNECK, Thomas**; Schneck & Schneck, P.O. Box 2-E, San Jose, CA 95109-0005 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA,

(88) Date of publication of the international search report:
26 May 2006

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.

(54) Title: NON-VOLATILE NANOCRYSTAL MEMORY TRANSISTORS USING LOW VOLTAGE IMPACT IONIZATION



(57) Abstract: A low voltage non-volatile charge storage transistor (21) has a nanocrystal layer (33) for permanently storing charge until erased. A subsurface charge injector (15, 151, 152) generates secondary carriers by stimulating electron-hole current flowing toward the substrate (10), with some carriers impacting charge in nanocrystals. The charge injector is a p-n junction diode (15, 43, 47) where one polarity is source and drain electrodes (43 & 47, 45 & 49) and the other polarity is two split doped regions (151, 152) in

the substrate partially overlapping the active area (11) on opposite sides of the active area. Any misalignment of masks for making the injected doped portions is inconsequential because a misalignment on one side of the active area offsets the corresponding misalignment on the other side. The injector implanted portions with overlap in the active area always have the same total area in the active area. This leads to programming reliability.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/28212

<p>A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : H01L 29/788, 21/336; G11C 16/04 US CL : 257/322, 900; 365/185.01, 185.18; 438/257 According to International Patent Classification (IPC) or to both national classification and IPC.</p>														
<p>B. FIELDS SEARCHED</p> <p>Minimum documentation searched (classification system followed by classification symbols) U.S. : 257/322, 900; 365/185.01, 185.18; 438/257</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)</p>														
<p>C. DOCUMENTS CONSIDERED TO BE RELEVANT</p> <table border="1"> <thead> <tr> <th>Category *</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>US 3,868,187 A (MASUOKA) 25 February 1975 (25.02.1975), column 1, line 1, through column 4, line 32.</td> <td>1-4, 6-10</td> </tr> <tr> <td>Y</td> <td>US 4,016,588 A (OHYA et al) 5 April 1977 (05.04.1977), column 4, lines 21-55, and column 6, lines 39-68.</td> <td>1-12</td> </tr> <tr> <td>Y</td> <td>US 6,580,124 B1 (CLEEVES et al) 17 June 2003 (17.06.2003), column 2, lines 58-65.</td> <td>1-12</td> </tr> </tbody> </table>			Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	US 3,868,187 A (MASUOKA) 25 February 1975 (25.02.1975), column 1, line 1, through column 4, line 32.	1-4, 6-10	Y	US 4,016,588 A (OHYA et al) 5 April 1977 (05.04.1977), column 4, lines 21-55, and column 6, lines 39-68.	1-12	Y	US 6,580,124 B1 (CLEEVES et al) 17 June 2003 (17.06.2003), column 2, lines 58-65.	1-12
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"P" document published prior to the international filing date but later than the priority date claimed														
<p>Date of the actual completion of the international search</p> <p>07 January 2006 (07.01.2006)</p>		<p>Date of mailing of the international search report</p> <p>04 APR 2006</p>												
<p>Name and mailing address of the ISA/US</p> <p>Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450</p> <p>Facsimile No. (571) 273-3201</p>		<p>Authorized officer</p> <p>MARK PRENTY <i>Mark Prenty</i></p> <p>Telephone No. 571 272-1843</p>												