

(43) International Publication Date  
29 December 2011 (29.12.2011)(10) International Publication Number  
**WO 2011/163429 A3**

PCT

## (51) International Patent Classification:

*H01L 21/02* (2006.01) *H01L 21/8247* (2006.01)  
*H01L 27/115* (2006.01)

## (21) International Application Number:

PCT/US2011/041546

## (22) International Filing Date:

23 June 2011 (23.06.2011)

## (25) Filing Language:

English

## (26) Publication Language:

English

## (30) Priority Data:

12/823,728 25 June 2010 (25.06.2010) US

(71) Applicant (for all designated States except US): **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, NY 10504 (US).

## (72) Inventors; and

(75) Inventors/Applicants (for US only): **GAMBINO, Jeffrey, P.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **MOON, Matthew, D.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **MURPHY, William, J.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **NAKOS, James, S.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **PASTEL, Paul, W.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US). **PHILIPS, Brett, A.** [US/US]; 1000 River Street, Essex Junction, VT 05452 (US).(74) Agent: **LESTRANGE, Michael, J.**; International Business Machines Corporation, Intellectual Property Law 972E, 1000 River Street, Essex Junction, VT 05452 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, 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, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

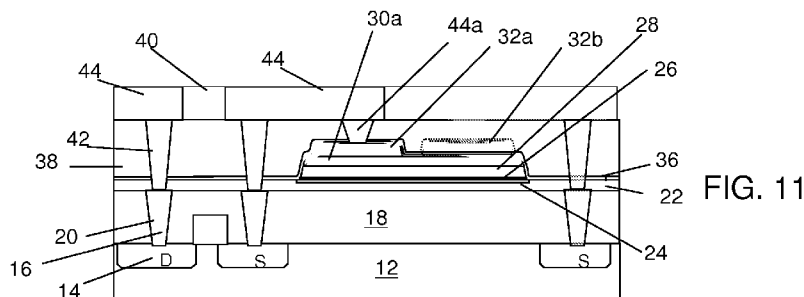
## Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

## (88) Date of publication of the international search report:

23 February 2012

(54) Title: FERRO-ELECTRIC CAPACITOR MODULES, METHODS OF MANUFACTURE AND DESIGN STRUCTURES



(57) Abstract: Ferro-electric capacitor modules, methods of manufacture and design structures. The method of manufacturing the ferro-electric capacitor includes forming a barrier layer on an insulator (18) layer of a CMOS structure (10). The method further includes forming a top plate (32) and a bottom plate (28) over the barrier layer. The method further includes forming a ferro-electric material (30) between the top plate (32) and the bottom plate (28). The method further includes encapsulating the barrier layer, top plate (32), bottom plate (28) and ferro-electric material (30) with an encapsulating material (36). The method further includes forming contacts (20, 44a) to the top plate (32) and bottom plate (28), through the encapsulating material (36). At least the contact (44a) to the top plate (32) and a contact (20) to a diffusion of the CMOS structure are in electrical connection through a common wire.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2011/041546

## A. CLASSIFICATION OF SUBJECT MATTER

INV. H01L21/02 H01L27/115 H01L21/8247  
ADD.

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)

EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	EP 1 887 624 A1 (FUJITSU LTD [JP] FUJITSU SEMICONDUCTOR LTD [JP]) 13 February 2008 (2008-02-13) paragraphs [0022] - [0047], [0106] - [0117]; figures 2,11 -----	1,2, 8-10,13, 14,16-25 3-7,11, 12,15
X	US 2004/084701 A1 (KANAYA HIROYUKI [JP] ET AL) 6 May 2004 (2004-05-06) paragraphs [0020], [0103] - [0112]; figures 1-5 paragraphs [0141] - [0143]; figure 20B paragraphs [0148] - [0149]; figures 23B,23C -----	1-25
X A	US 2009/020797 A1 (WANG WENSHENG [JP]) 22 January 2009 (2009-01-22) paragraphs [0082] - [0144]; figures 1-5 -----	1-14, 16-25 15



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

1 December 2011

Date of mailing of the international search report

23/12/2011

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer

Neumann, Andreas

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2011/041546

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1887624	A1	13-02-2008	EP 1887624 A1 13-02-2008
			EP 2267758 A2 29-12-2010
			US 2008073685 A1 27-03-2008
			US 2011210424 A1 01-09-2011
			WO 2006129366 A1 07-12-2006
-----			
US 2004084701	A1	06-05-2004	NONE
-----			
US 2009020797	A1	22-01-2009	US 2009020797 A1 22-01-2009
			US 2011217792 A1 08-09-2011
			WO 2007116442 A1 18-10-2007
-----			