(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
28 June 2012 (28.06.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/087403 A1

(51) International Patent Classification:
H01L 29/78 (2006.01) *H01L 21/336* (2006.01)

(21) International Application Number:
PCT/US2011/054198

(22) International Filing Date:
30 September 2011 (30.09.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
12/975,278 21 December 2010 (21.12.2010) US

(71) Applicant *(for all designated States except US)*: **INTEL CORPORATION** [US/US]; 2200 Mission College Boulevard, Santa Clara, CA 95052 (US).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **GLASS, Glenn, A.** [US/US]; 6220 SW Madhatter Ln., Beaverton, OR 97008 (US). **MURTHY, Anand, S.** [US/US]; 10934 NW Lucerne Ct., Portland, OR 97229 (US). **GHANI, Tahir** [US/US]; 15523 NW Andalusian Way, Portland, OR 97229 (US).

(74) Agent: **FINCH & MALONEY PLLC**; Finch & Maloney PLLC, c/o CPA Global, P.O.Box 52050, Minneapolis, MN 55402 (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, QA, RO, RS, RU, RW, 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, RW, 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).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

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))*

(54) **Title**: CONTACT RESISTANCE REDUCTION EMPLOYING GERMANIUM OVERLAYER PRE-CONTACT METALIZATION

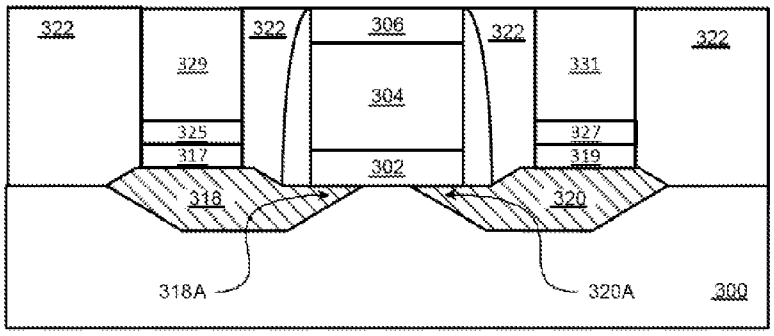


FIG. 5F

(57) **Abstract**: Techniques are disclosed for forming transistor devices having reduced parasitic contact resistance relative to conventional devices. The techniques can be implemented, for example, using a standard contact stack such as a series of metals on, for example, silicon or silicon germanium (SiGe) source/drain regions. In accordance with one example such embodiment, an intermediate boron doped germanium layer is provided between the source/drain and contact metals to significantly reduce contact resistance. Numerous transistor configurations and suitable fabrication processes will be apparent in light of this disclosure, including both planar and non-planar transistor structures (e.g., FinFETs), as well as strained and unstrained channel structures. Graded buffering can be used to reduce misfit dislocation. The techniques are particularly well-suited for implementing p-type devices, but can be used for n-type devices if so desired.

WO 2012/087403 A1