

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
16 September 2021 (16.09.2021)



(10) International Publication Number
WO 2021/181172 A1

(51) International Patent Classification:

H01L 43/02 (2006.01) G11C 11/16 (2006.01)
H01L 43/12 (2006.01) G11C 11/15 (2006.01)

(21) International Application Number:

PCT/IB2021/050787

(22) International Filing Date:

01 February 2021 (01.02.2021)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

16/817,744 13 March 2020 (13.03.2020) US

(71) Applicant: **INTERNATIONAL BUSINESS MACHINES CORPORATION** [US/US]; New Orchard Road, Armonk, New York 10504 (US).

(71) Applicants (for MG only): **IBM UNITED KINGDOM LIMITED** [GB/GB]; P.O. Box 41, North Harbour, Portsmouth, Hampshire PO6 3AU (GB). **IBM (CHINA) INVESTMENT COMPANY LIMITED** [CN/CN]; 25/F, Pangu Plaza, No.27, Central North 4th Ring Road, Chaoyang District, Beijing 100101 (CN).

(72) Inventors: **HASHEMI, Pouya**; IBM Corporation, 1101 Kitchawan Road, Yorktown Heights, New York 10598

(US). **DORIS, Bruce**; IBM Corporation, 1101 Kitchawan Road, Yorktown Heights, New York 10598 (US). **NOWAK, Janusz, Jozef**; IBM Corporation, 1101 Kitchawan Road, Yorktown Heights, New York 10598 (US). **SUN, Jonathan, Zanhong**; IBM Corporation, 1101 Kitchawan Road, Yorktown Heights, New York 10598 (US).

(74) Agent: **WILLIAMS, Julian**; IBM United Kingdom Limited, Intellectual Property Law, Hursley Park, Hursley, Winchester, Hampshire SO21 2JN (GB).

(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, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, IT, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, 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, ST, SZ, TZ,

(54) Title: INVERTED WIDE BASE DOUBLE MAGNETIC TUNNEL JUNCTION DEVICE

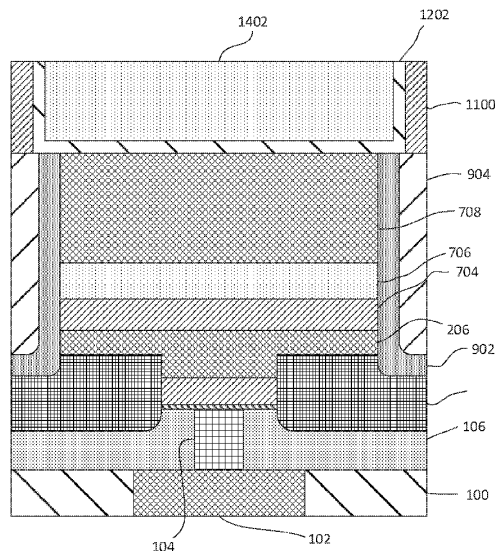


FIG. 14

(57) Abstract: A method of manufacturing a double magnetic tunnel junction device is provided. The method includes forming a first magnetic tunnel junction stack (204), forming a spin conducting layer (206) on the first magnetic tunnel junction stack (204), and forming a second magnetic tunnel junction stack (704) on the spin conducting layer (206). The second magnetic tunnel junction stack (704) has a width that is greater than a width of the first magnetic tunnel junction stack (204). The double magnetic tunnel junction device can achieve an increase in the switching efficiency relative to related single magnetic tunnel junction device, and may achieve an increased magnetoresistance ratio which potentially reducing the switching current.

WO 2021/181172 A1

[Continued on next page]

UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, 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, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*