

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
26 August 2021 (26.08.2021)



(10) International Publication Number
WO 2021/165836 A1

(51) International Patent Classification:
GIIC 11/00 (2006.01) *GIIC 7/00* (2006.01)

(21) International Application Number:
PCT/IB2021/051313

(22) International Filing Date:
17 February 2021 (17.02.2021)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
16/797,626 21 February 2020 (21.02.2020) 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]; PO Box 41, North Harbour, Portsmouth Hampshire PO6 3AU (GB). **IBM (CHINA) INVESTMENT COMPANY LIMITED** [CN/CN]; 25/

F, Pangu Plaza, No. 27, Cental North 4th Ring Road, Chaoyang District, Beijing 100101 (CN).

(72) Inventors: **LI, Ning**; IBM Corporation, PO Box 218, 1101 Kitchawan Road, Yorktown Heights, New York, 10598 (US). **KIM, Wanki**; IBM Corporation, PO Box 218, 1101 Kitchawan Road, Yorktown Heights, New York, 10598 (US). **BEDELL, Stephen**; IBM Corporation, PO Box 218, 1101 Kitchawan Road, Yorktown Heights, New York, 10598 (US). **SADANA, Devendra**; IBM Corporation, Intellectual Property Law, PO Box 218, 1101 Kitchawan Road, Yorktown Heights New York (US).

(74) Agent: **GRAHAM, Timothy**; 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,

(54) Title: COMPENSATING PCM DRIFT FOR NEUROMORPHIC APPLICATIONS

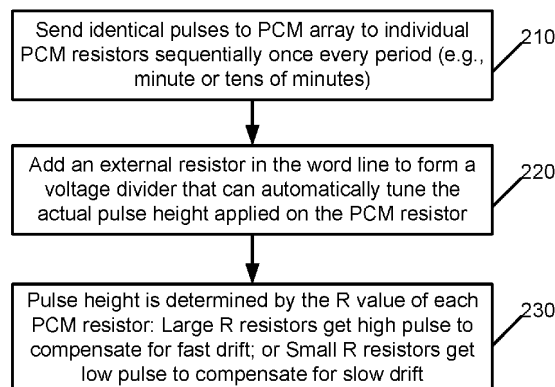


FIG. 2

(57) Abstract: An apparatus includes an analog phase change memory array, including an array of cells addressable and accessible through first lines and second lines. The apparatus includes device(s) coupled to one or more of the first lines. The device(s) is/are able to be coupled to or decoupled from the one or more first lines to compensate for phase change memory resistance drift in resistance of at least one of the cells in the one or more first lines. The apparatus may also include control circuitry configured to send, using the first lines and second lines, a same set pulse through the device(s) to multiple individual phase change memory resistors in the phase change memory array sequentially once every period.

[Continued on next page]

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, 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))
- in black and white; the international application as filed contained color or greyscale and is available for download from PATENTSCOPE