

## Self-Rectification Resistance Switching Memory Device with Bipolar Operation Mode

Geng-Wei Chang <sup>(a)</sup>, Ting-Chang Chang <sup>(b,\*)</sup>, Yong-En Syu <sup>(b)</sup>, Kuan-Chang Chang <sup>(c)</sup>, Tsung-Ming Tsai <sup>(c)</sup> and Ya-Hsiang Tai <sup>(a)</sup>,

- a. Department of Photonics & Institute of Electro-Optical Engineering, National Chiao Tung University, Hsin-Chu, 300, Taiwan, R. O.C.
- b. Department of Physics and Institute of Electro-Optical Engineering, & Center for Nanoscience and Nanotechnology, National Sun Yat-Sen University, Kaohsiung, 804, Taiwan, R.O.C.
- c. Institute of Materials Science and Engineering, National Sun Yat-Sen University, Kaohsiung, 70 Lien-hai Road, Kaohsiung, 804, Taiwan R. O. C.

Address: No. 70, Lienhai Rd., Kaohsiung 80424 Taiwan, R.O.C.

Transistor with the electrical characteristics of resistance random access memory (RRAM) is investigated to avoid memory state misjudgment. In general, when determining the memory state from a selected cell for RRAM device, the memory array needs to be collocated with a transistor (1T1R structure) or diode (1D1R structure) to avoid incorrect judgment. In this research, the transistor has the RRAM characteristic after special forming process. Forming process destroyed the gate oxide layer and produced  $O_2^-$ .  $O_2^-$  combines with  $Si_3N_4$  to form  $SiON_x$  resistance switching layer. Therefore, the device not only has the self-rectification function of the transistor but also has the resistance switching behavior of RRAM.