

A Memristive Device with Intrinsic Rectification Behavior and Performace of Crossbar Arrays

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Abstract : Passive crossbar arrays is in principle the simplest functional electrical circuit, together with memristive device in cross-point, holding great promise in future high-density, non-volatile memories. However, the greatest problem of crossbar array is the sneak path current. In this paper, we investigate one type of memristive device with intrinsic rectification behavior to address the sneak path currents. Firstly, a SPICE behavior model written in Verilog-A language of the memristive device is presented to fit experimental data published in literature. Next, systematic performance simulations including read margin and power consumption of crossbar array, which uses the self-rectifying memristive device as storage element at cross-point, with respect to different crossbar sizes, interconnect resistance, ratio of HRS/LRS (High Resistance State/ Low Resistance State), rectification ratio and different read schemes are conducted. Subsequently, Trade-offs among reading margin, power consumption, and reading schemes are analyzed to provide guidelines for circuit design. Finally, performance comparison between the memristive device with/without intrinsic rectification behavior is given to show the worthiness of this intrinsic rectification behavior.

Keywords : memristive device, memristor, crossbar, RRAM, read margin, power consumption

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