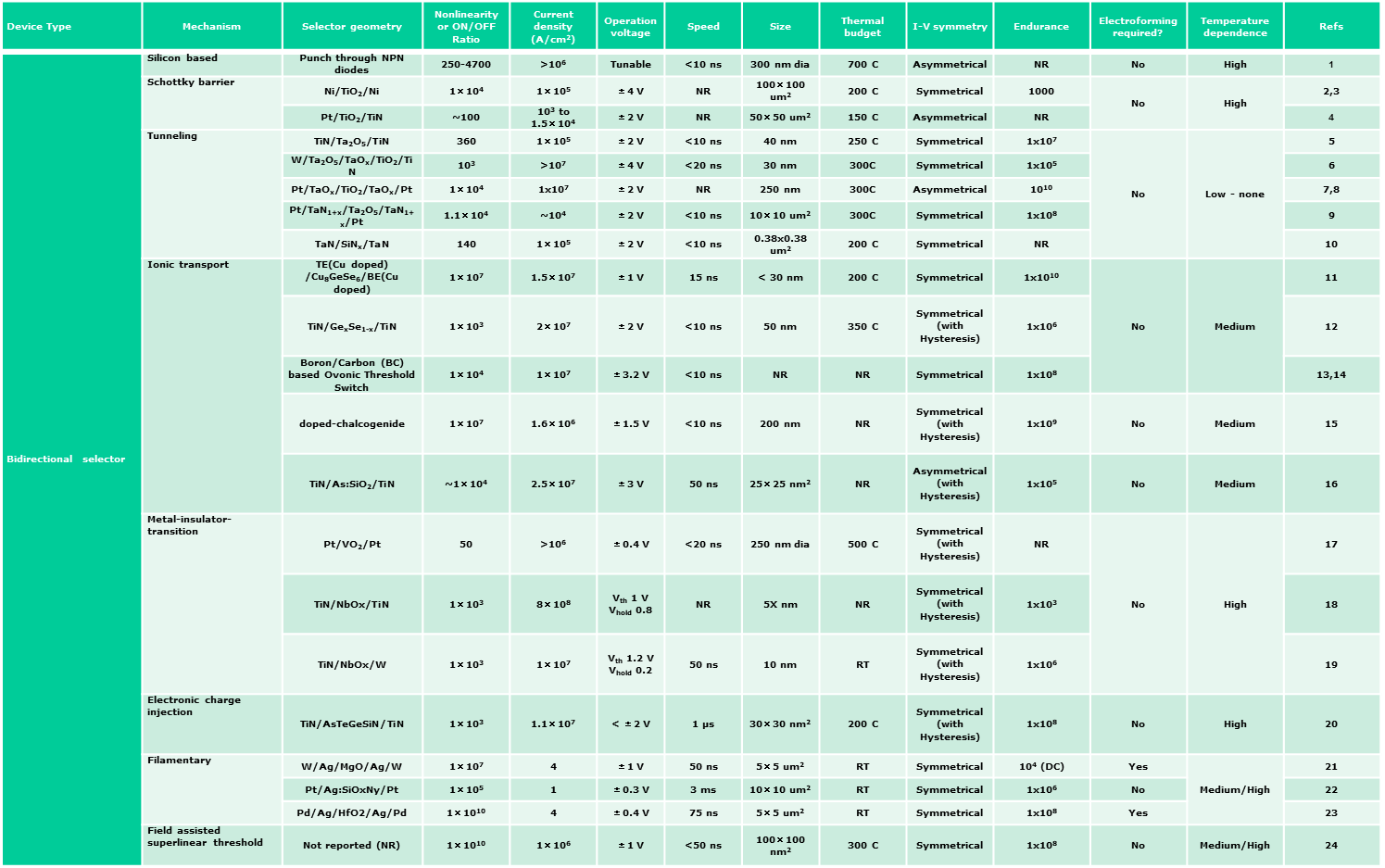
Supporting Information

Engineering Tunneling Selector to Achieve High Nonlinearity for 1S1R Integration

**Supporting information 1**



(Srinivasan et al. 2012)

(Huang et al. 2011)

(Shin et al. 2011)

(Bogdan Govoreanu et al. 2014)

(Woo et al. 2014)

(W. Lee et al. 2012)

(Choi et al. 2016)

(Kawahara et al. 2013)

(Sengupta, Shim, and Roy 2016)

(B. Govoreanu et al. 2017)

(Yasuda et al. 2017)

(Yang et al. 2015)

(S. G. Kim et al. 2018)

(Son et al. 2011)

(Kim et al. 2014)

(Cha et al. 2013)

(M. J. Lee et al. 2012)

(Sun et al. 2018)

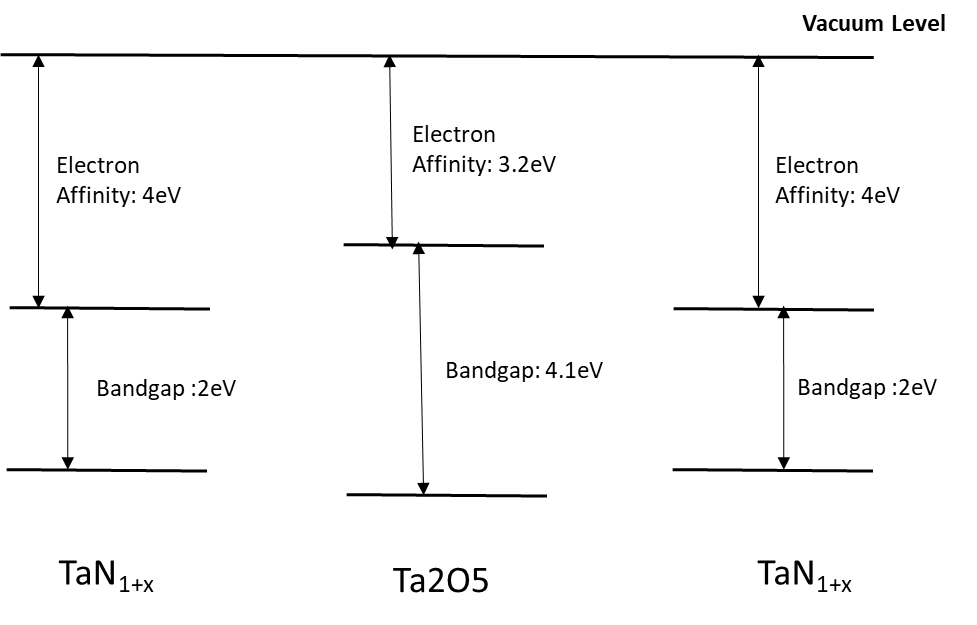
(Wang et al. 2017)

(Midya et al. 2017)

(Jo et al. 2015)

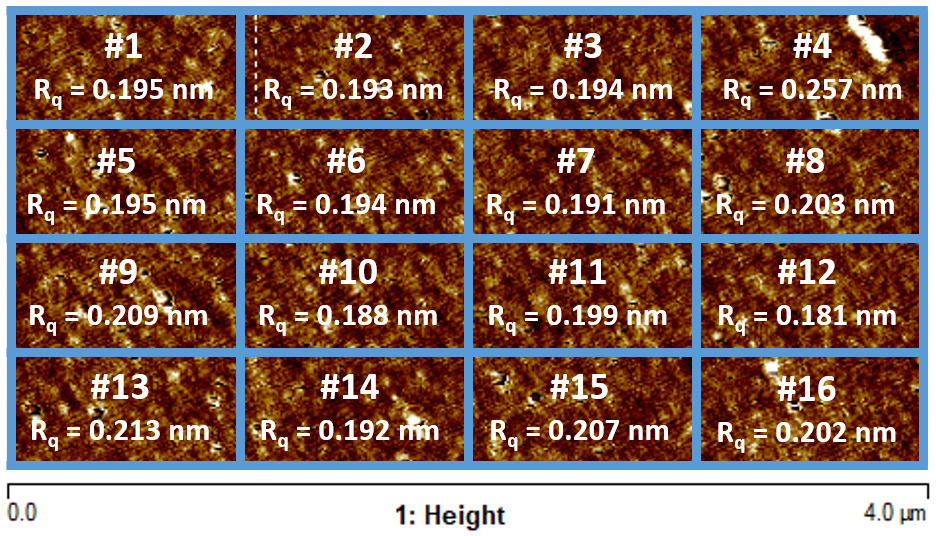
**Supplementary Figure S1.** Summary of different types of bipolar selectors proposed so far.

**Supporting information 2**

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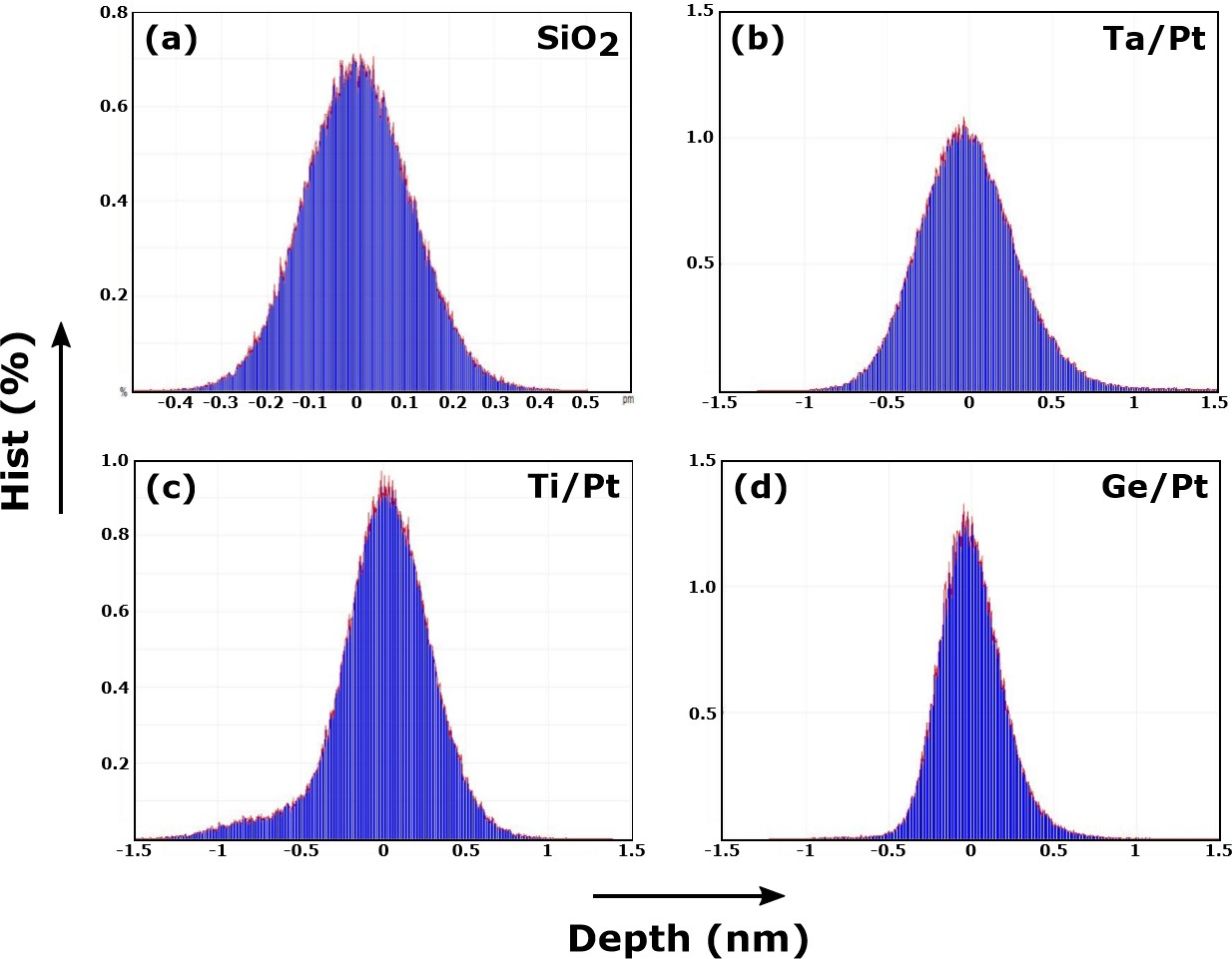
**Supplementary Figure S2.** Energy band diagram of TLTB (TaN1+x/Ta2O5/TaN1+x) layer.

**Supporting information 3**

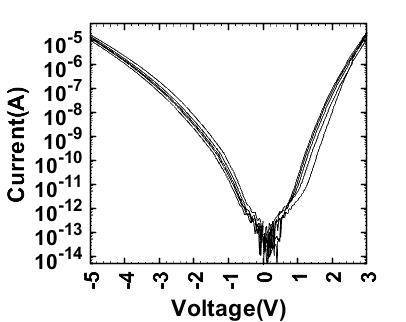


**Supplementary Figure S3.** rms roughness value for 16 (4x4) equally divided sub regions of the total scanned surface area of the Ge/Pt layer. The measured Rq values are indicated in the respective boxes. For these 16 boxes, the value of Rq varies between 181 and 257, which shows that Rq values for Ge/Pt layer always lie much below their respective values for the Ta/Pt and Ti/Pt layers.

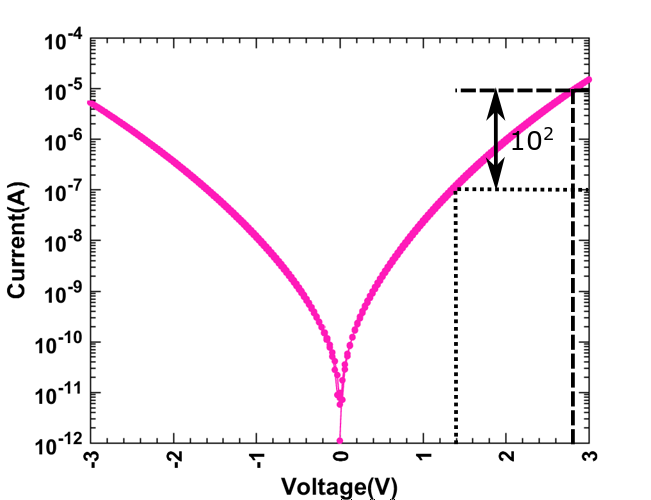
**Supporting information 4**



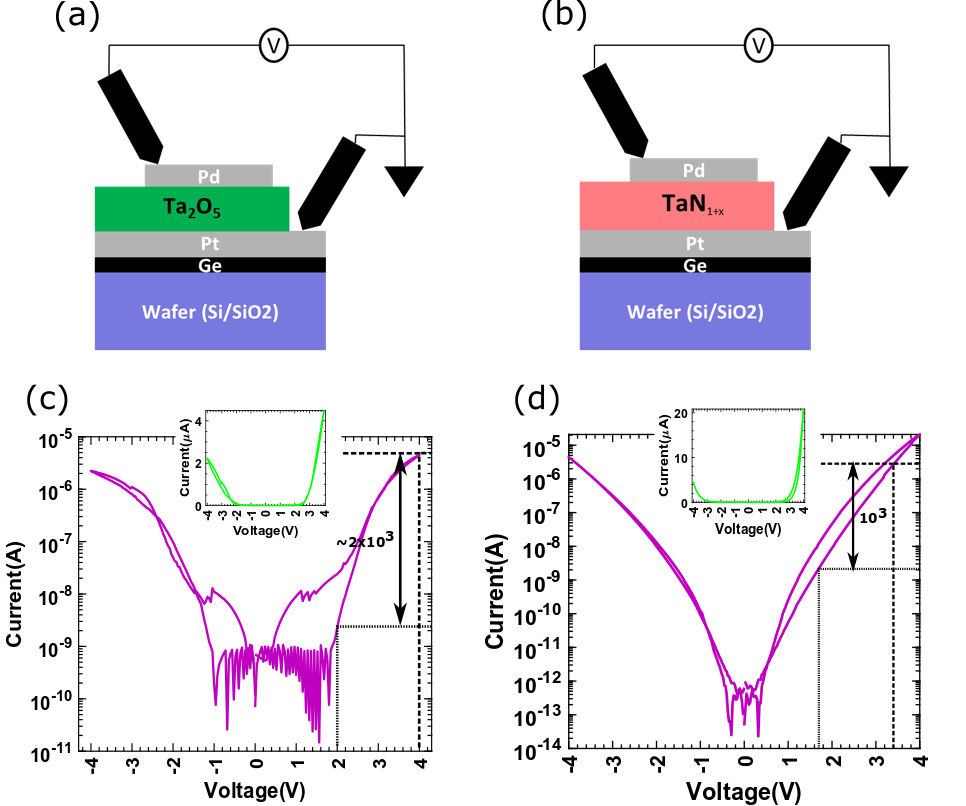
**Supplementary Figure S4.** The peak-to-valley surface topological height distribution for : a) SiO2 (Substrate) surface, b) Ta/Pt, c) Ti/Pt, d) Ge/Pt.

**Supporting information 5**

**Supplementary Figure S5.** Multicycle I-V characteristics of the selector device.

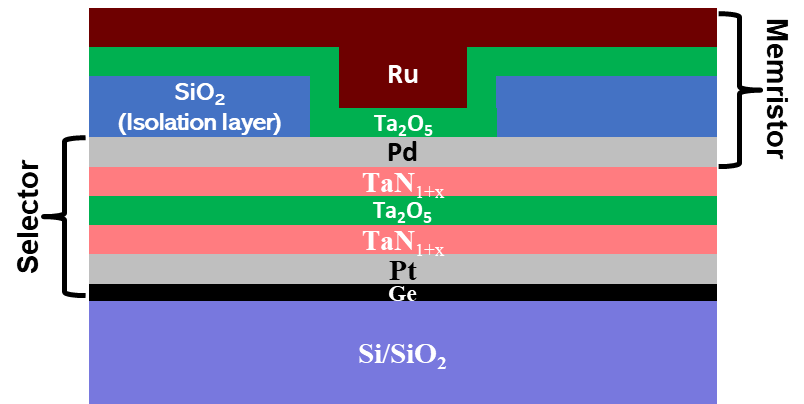
**Supporting information 6**

**Supplementary Figure S6.** I-V characteristics of the trilayer tunnel selector device with Ti/Pt as BE (Ti/Pt/TaN1+x/Ta2O5/TaN1+x/Pd).**Supporting information 7**

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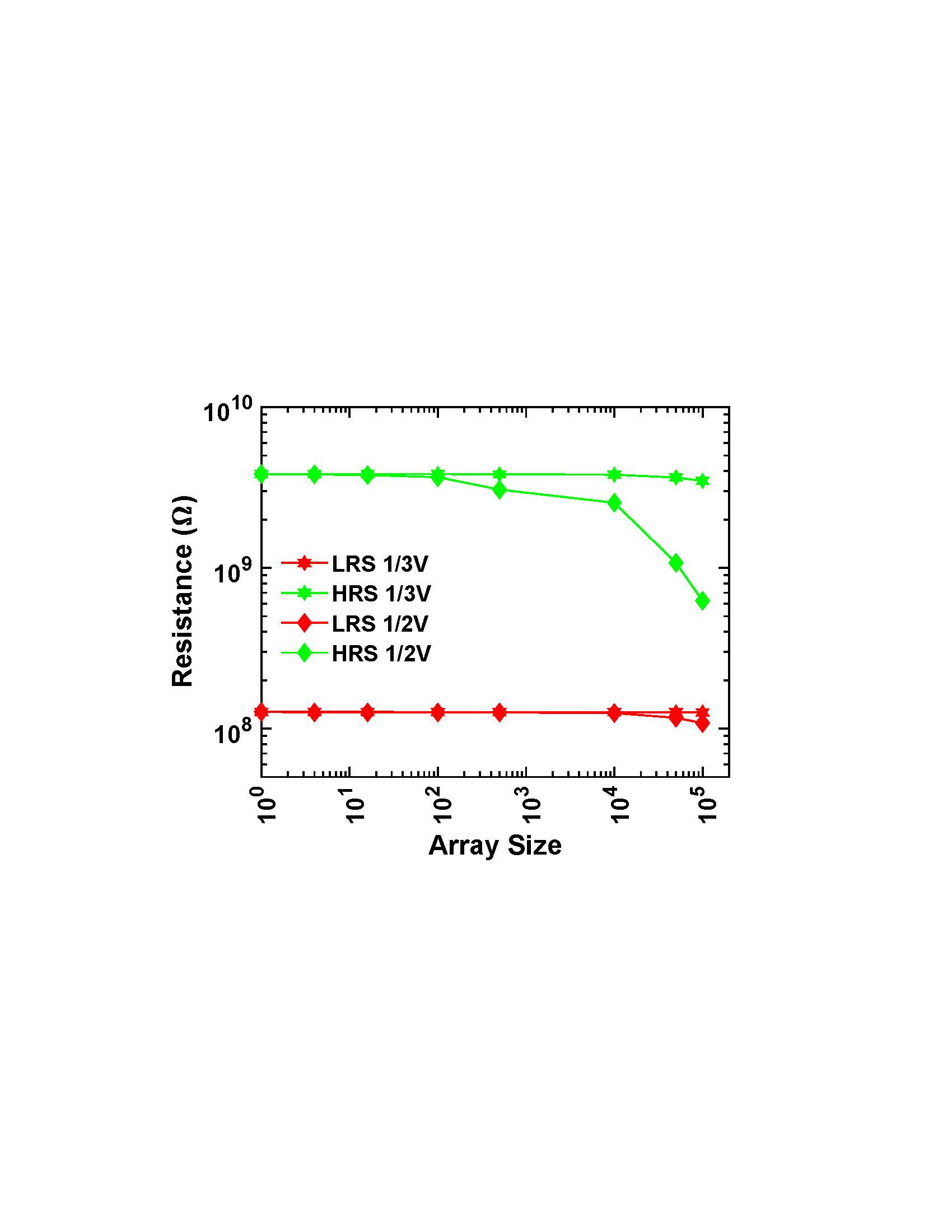
**Supplementary Figure S7.** Single-layer tunnel selector devices: Schematic of the a) Ta2O5 & b) TaN1+x based tunnel selectors with Ge/Pt BE. I-V characteristics of the c) Ta2O5 & d) TaN1+x based single-layer tunnel barrier based selector devices.

**Supporting information 8**



**Supplementary Figure S8.** Schematic showing a wide-angle view of cross-section of the vertically integrated 1S1R cell.

**Supporting information 9**



**Supplementary Figure S9.** The HRS and LRS resistance of the selected device in a CBA with different size capacity and biasing schemes. The HRS resistance decreases with array size due to larger sneak path current. 1/3V biasing scheme is more resilient to the sneak path current.

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