

## Multi-Level Control of Conductive Nano-Filament Evolution in HfO<sub>2</sub> ReRAM by Pulse-Train Operations

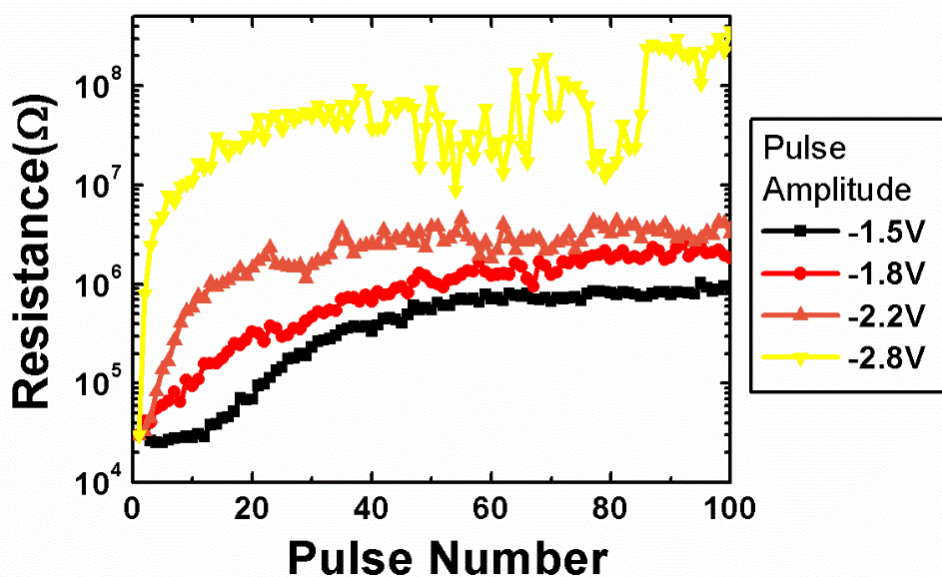
### Supplementary Information

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**Figure S1** Resistance-change characteristics of a 1x1 μm<sup>2</sup> TiN/HfO<sub>2</sub>/Pt device, upon the applications of 100 identical pulses with different amplitudes