Electronic Supplementary Material (ESI) for Nanoscale.

Synaptic memristor based on two-dimensional layered WSe_2 nanosheets with short- and long-term plasticity

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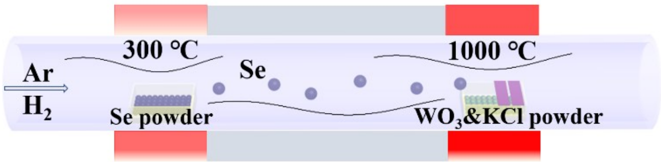

Fig. S1. Schematic of growth process of WSe_2 by chemical vapor deposition method.

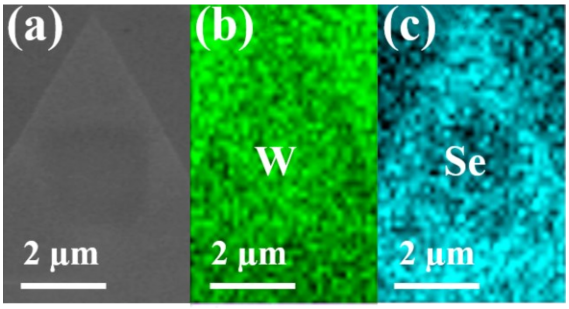

Fig. S2. (a) Field emission scanning electron microscope (FE-SEM) image of the prepared WSe_2 nanosheet. Energy dispersive X-ray spectroscopy (EDX) elemental mapping images of W (b) and Se (c).

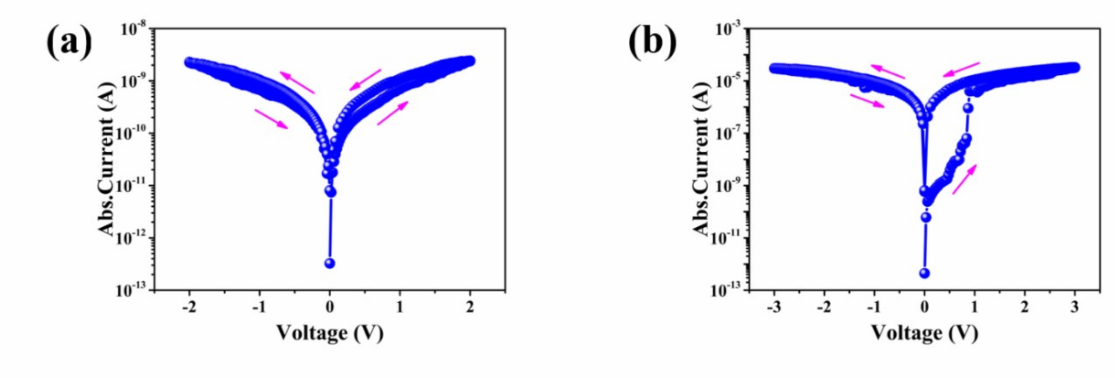

Fig. S3. The initial Current–Voltage loops of WSe_2-based memristor with sweeping voltage of (a) 2 V and (b) 3 V. For the fresh device, no obvious resistive switching behaviors can be observed, as shown in Fig. S3a. When the sweeping voltage is increased to 3 V, we observed a WORM behavior in *I–V* loop. However, the observed WORM behavior is not stable and will disappear after several sweeping cycles. Then, when the sweeping voltage is further increased, stable conductive filaments can be formed. Accordingly, the typical bipolar non-volatile resistive switching behaviors can be detected.

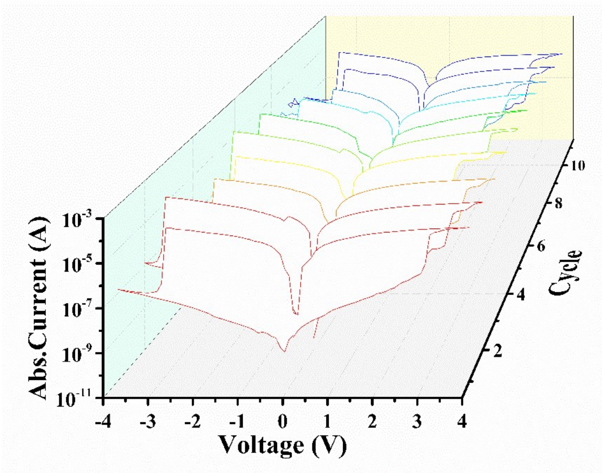

Fig. S4. 10 experimental switching loops of the fabricated memristor based on WSe_2 nanosheet.

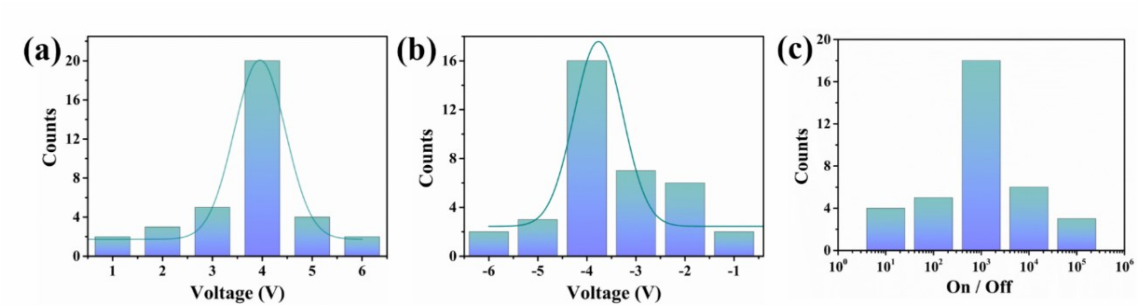

Fig. S5. Statistical analysis of the memristive parameters of the fabricated 36 WSe_2-based memristors. (a) Statistical analysis of the set voltages. (b) Statistical analysis of the reset voltages. (c) Statistical analysis of the ON/OFF ratio.

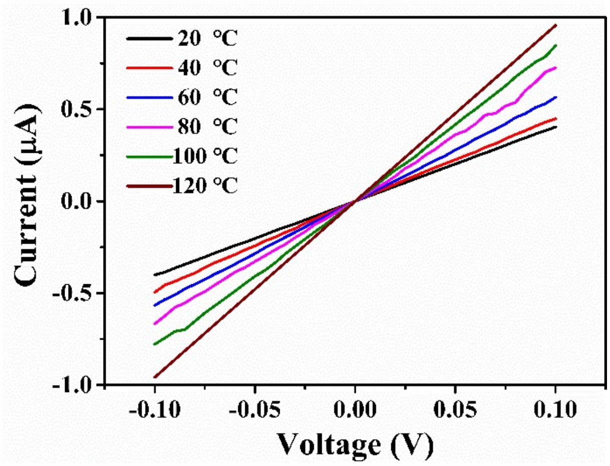

Fig. S6. The temperature dependent conductive behaviors of the WSe_2 based memristor at the low resistance state. As the temperature is increased, the current (resistance) increases (decreases), suggesting the semiconducting behaviors rather than the metallic conductance.

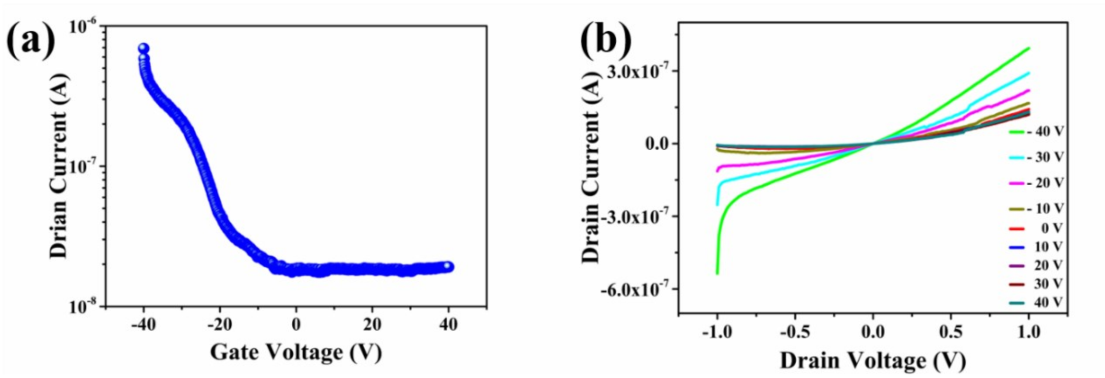

Fig. S6. (a) The transport property and (b) the output characteristics of WSe_2-based field effect transistor with SiO_2 as gate dielectric and Ag as source and drain electrodes.

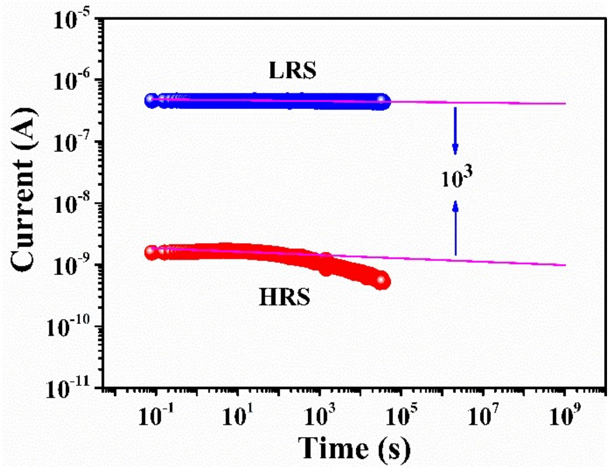

Fig. S8. Retention performance of the 2D WSe_2 based memristor with power law extrapolation to 10 years.