

Supporting Information

Wafer-Scale Reliable Switching Memory based on 2-Dimensional Layered Organic-Inorganic Halide Perovskite

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Table S1. Lattice parameters and unit cell volumes of the samples

Sample		<i>a</i> (Å)	<i>b</i> (Å)	<i>c</i> (Å)	<i>V</i> (Å ³)
MAPbI ₃	bare	8.8528(7)		12.563(3)	984.6(2)
	Ag	8.8518(7)		12.565(3)	984.6(2)
	Ag_V	8.8559(7)		12.590(3)	987.4(2)
	AgI_0.8mmol	8.8594(7)		12.575(3)	987.0(2)
BA ₂ PbI ₄	bare	8.862	8.682	27.509(1)	2116.6(4)
	Ag	8.862	8.682	27.505(1)	2116.2(4)

Ag_V	8.862	8.682	27.512(1)	2116.8(4)
AgI_0.8mmol	8.862	8.682	27.615(1)	2124.7(4)

Table S2. Resistive switching properties of the BA₂PbI₄ based memristor.

Device structure	Switching voltage (V)	Endurance (cycle)	Retention time (s)	Switching speed (ms)
Ag/BA ₂ PbI ₄ /Pt	0.5 (SET) -0.6 (RESET)	250	10 ³	10

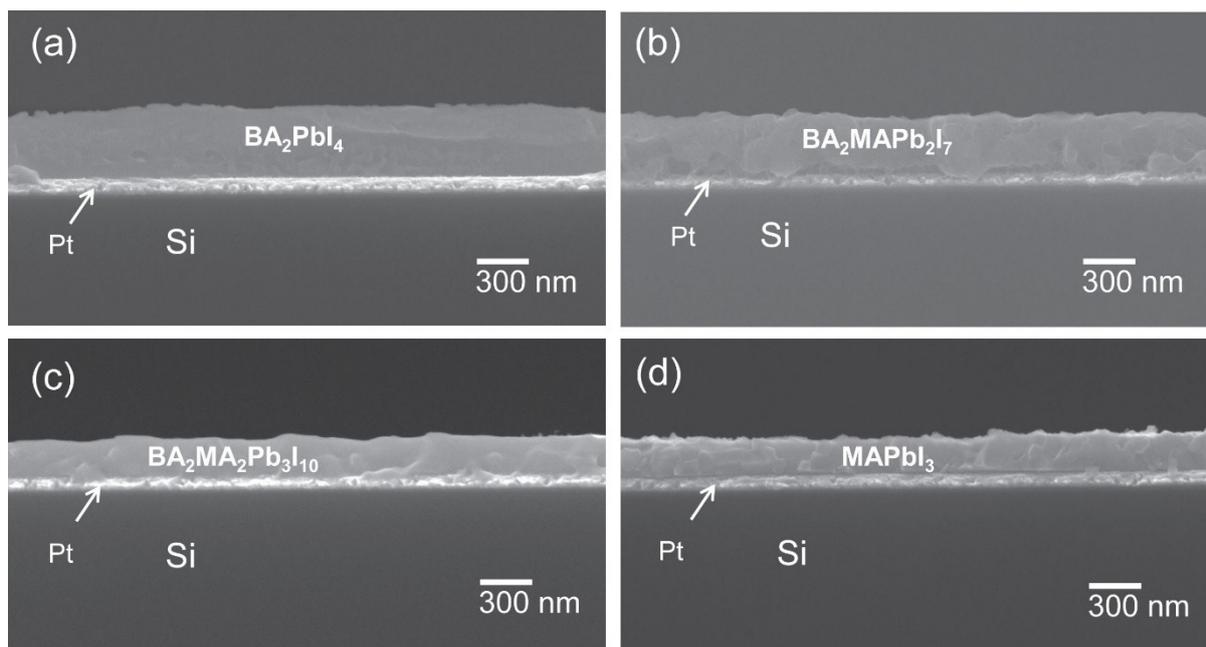


Figure S1. Cross-sectional scanning electron microscopy images for (a) BA_2PbI_4 , (b) $\text{BA}_2\text{MAPb}_2\text{I}_7$, (c) $\text{BA}_2\text{MA}_2\text{Pb}_3\text{I}_{10}$ and (d) MAPbI_3 . The OHP thin films formed on the Pt coated silicon wafer.

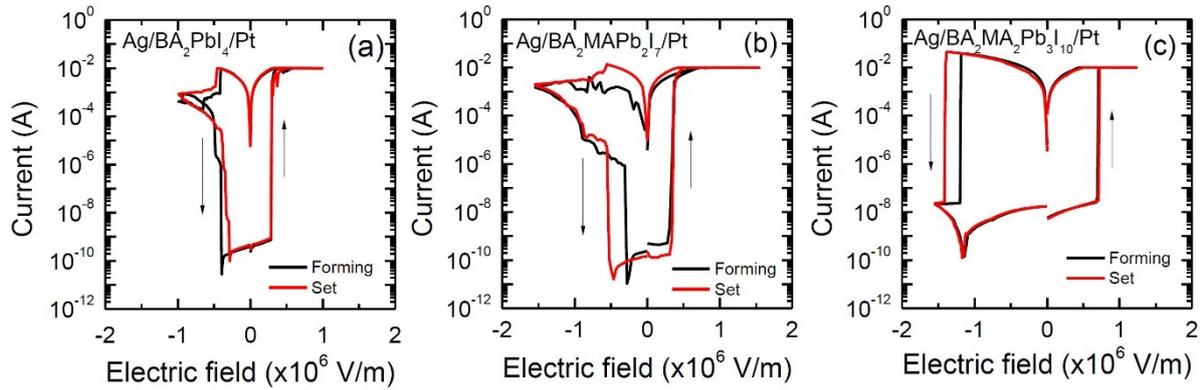


Figure S2. *I-V* curves for forming process and set process for (a) Ag/BA₂PbI₄/Pt; (b) Ag/BA₂MAPb₂I₇/Pt; (c) Ag/BA₂MA₂Pb₃I₁₀/Pt. All *I-V* curves measured at one electrode and showed electroforming-free process

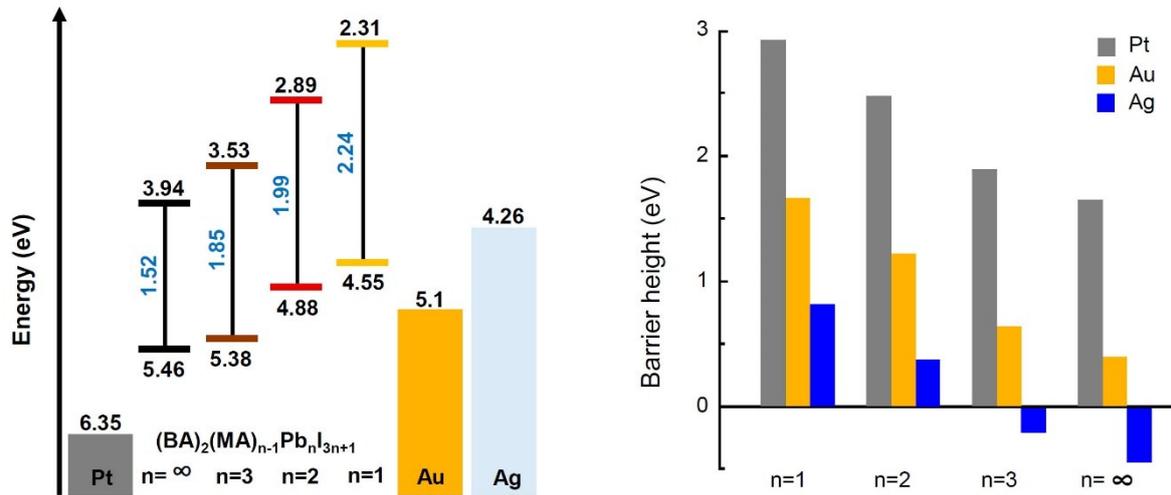


Figure S3. (a) Energy band diagram and (b) Schottky barrier heights at each metal electrode interface calculated by difference between the Fermi level of (BA)₂(MA)_{n-1}Pb_nI_{3n+1} and work function of metal.

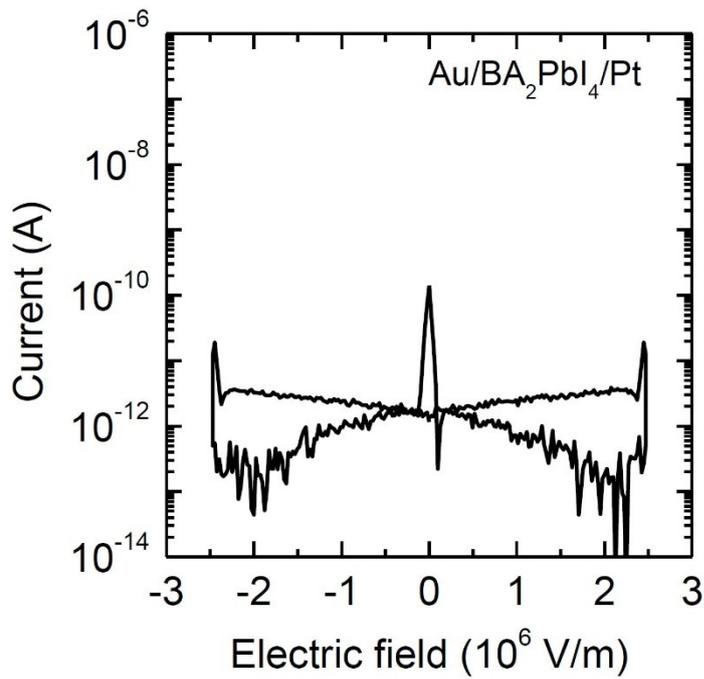


Figure S4. *I-V* curve of Au/BA₂PbI₄/Pt device. The electric field was applied from positive sweeping to negative sweeping.

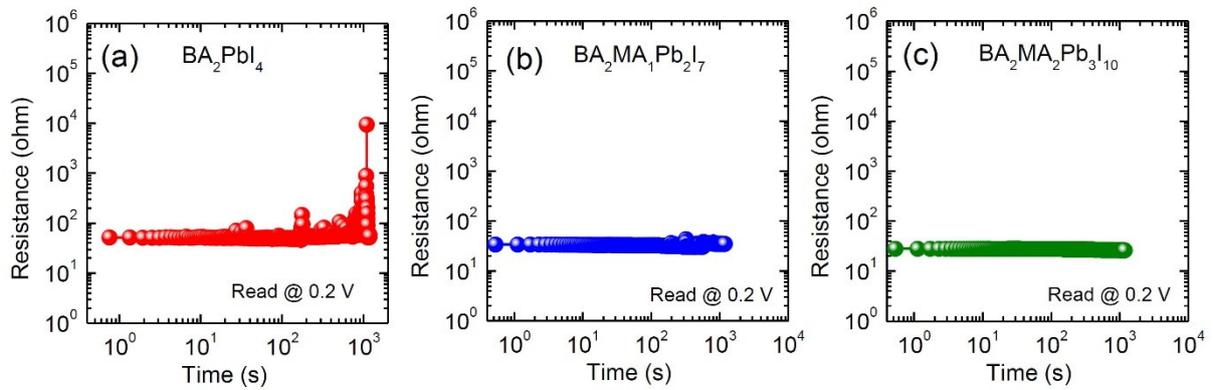


Figure S5. Retention for LRS of (a) Ag/BA₂PbI₄/Pt, (b) Ag/BA₂MAPb₂I₇/Pt and (c) Ag/BA₂MA₂Pb₃I₁₀/Pt devices. The measured resistances are 50, 33 and 27 ohm for BA₂PbI₄, BA₂MAPb₂I₇, and BA₂MA₂Pb₃I₁₀, respectively.

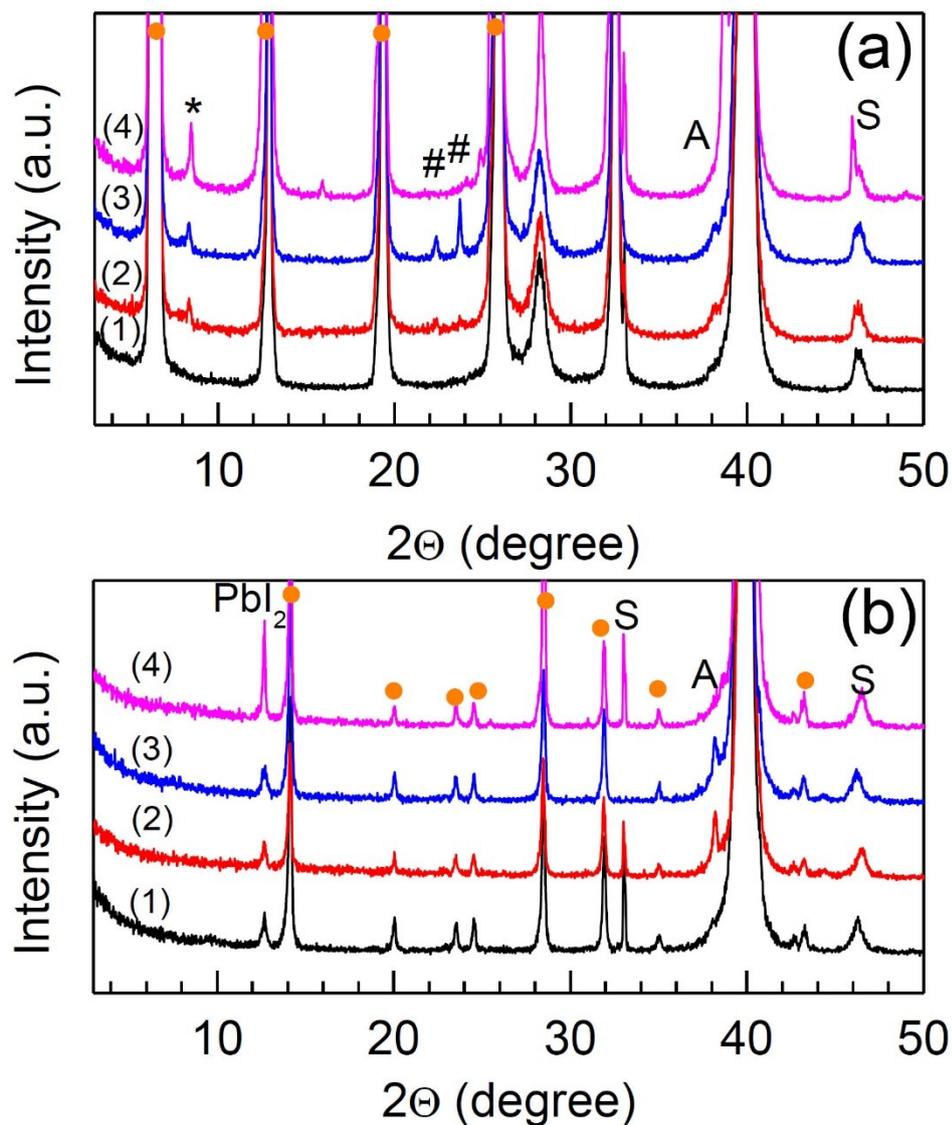


Figure S6. XRD patterns of four different samples for (a) BA_2PbI_4 and (b) MAPbI_3 , where (1) represents the as-prepared perovskite on Pt electrode (Perovskite/Pt), (2) the as-prepared perovskite with Ag electrode (Ag/perovskite/Pt), (3) the sample after 10 cycles of voltage sweeping (bias aged Ag/perovskite/Pt) and (4) a thin film of mixture of AgI and perovskite with 0.8 mmol of AgI with respect to 1 mol of perovskite (mixture perovskite/Pt). The area of Ag was 0.09 cm^2 with the thickness of 150 nm. The voltage sweeping cycle was $0.5 \text{ V} \rightarrow 0 \text{ V} \rightarrow -0.5 \text{ V} \rightarrow 0 \text{ V}$. The perovskite phase is marked with orange circles. A indicates metallic Ag, # denotes AgI and S corresponds to peak from silicon wafer. * denotes unknown peak.

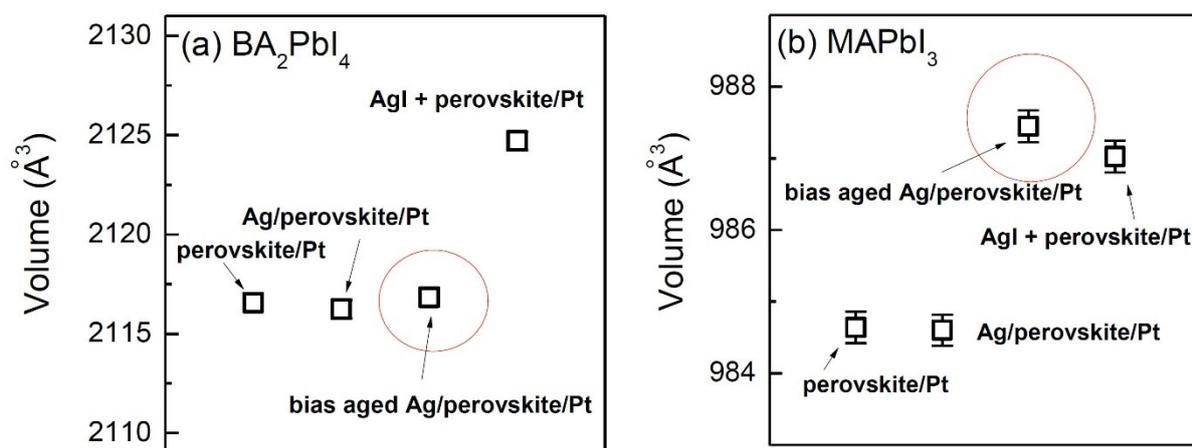


Figure S7. The unit cell volumes of three different samples mentioned in Figure S6 for (a) BA_2PbI_4 , and (b) MAPbI_3 calculated by lattice parameters listed in Table S1.

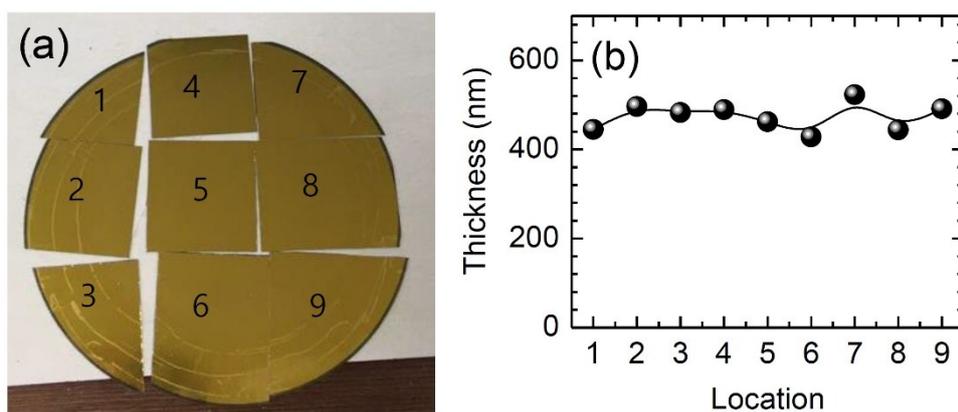


Figure S8. BA_2PbI_4 film deposited on (a) Si wafer and (b) its thickness measured from different part designated in (a).