

Supporting information:

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Title:

## **Photovoltaic Behaviour of Lead Methylammonium Triiodide Perovskite Solar Cells Down to 80K**

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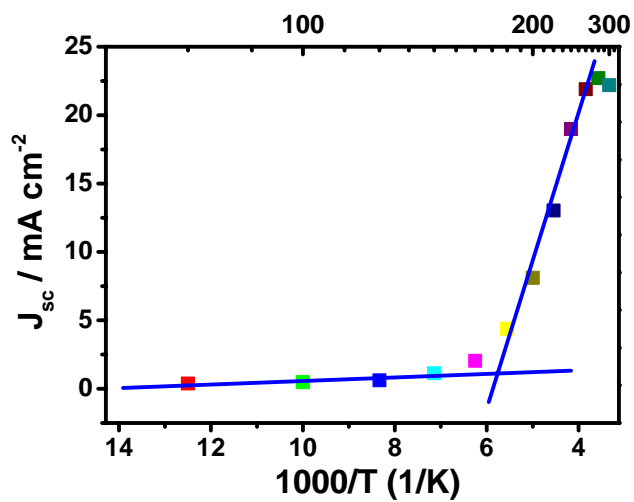
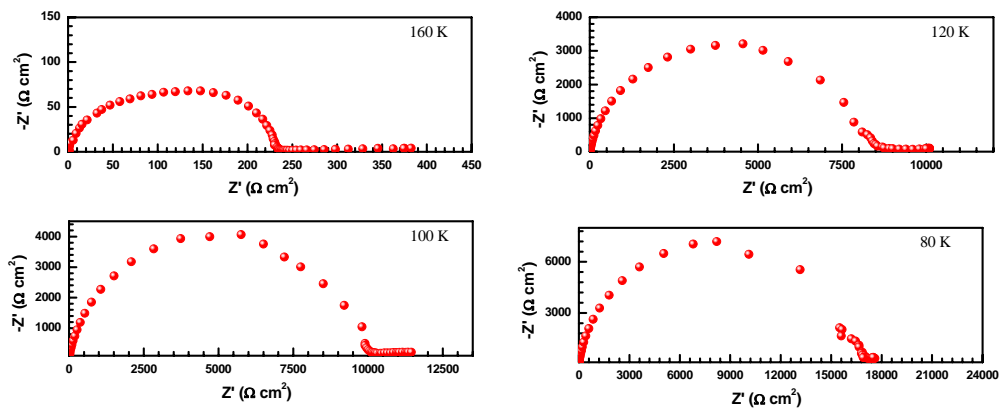
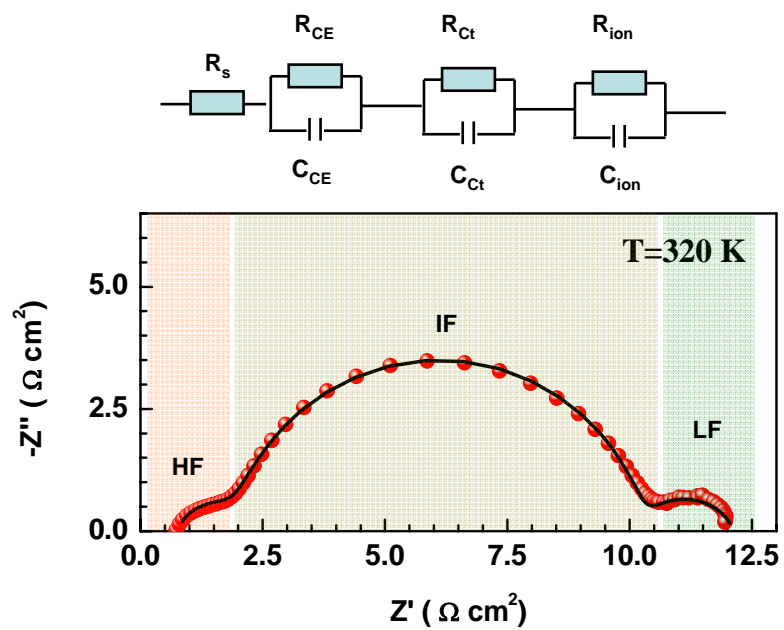


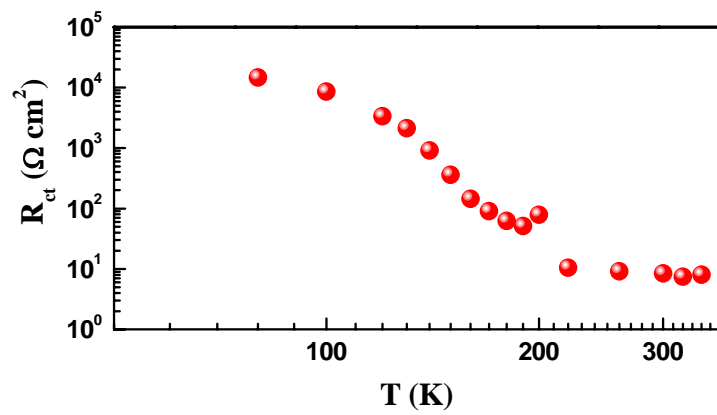
Figure S1 Short-circuit current  $J_{sc}$  as a function of temperature  $T$ .



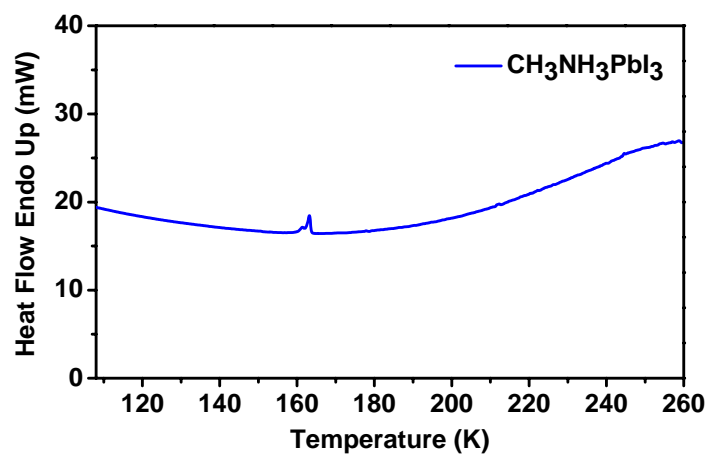
**Figure S2** Impedance spectrum measured under illumination by 100% solar light intensity at open circuit at different temperature 160 K, 120 K, 100 K, and 80 K.



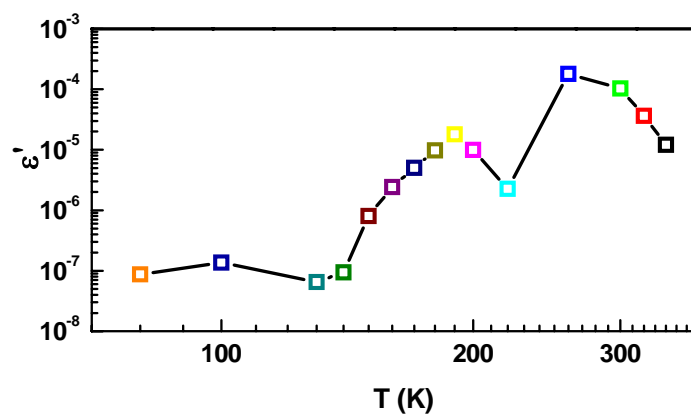
**Figure S3.** The equivalent circuit for fitting of electronic impedance spectroscopy. The Nyquist plot at 320 K is given as an example.



**Figure S4.** The interfacial charge recombination resistance  $R_{ct}$  obtained by fitting the impedance spectrum at the intermediate frequency region with a RC circuit.



**Figure S5** Differential scanning calorimetry for  $\text{MAPbI}_3$  showing the phase transition from orthorhombic to tetragonal at 161 K.



**Figure S6** The temperature dependence of the real part of the dielectric permittivity of perovskite solar cell device taken at 0.1 Hz.