## **Supporting information**

## Performance Enhancement of Self-Powered Imaging CsPbBr<sub>3</sub> Photodetector by Tuning the Trap Effect of Carriers

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Fig. S1 Schematic representation of a  $\mathsf{CsPbBr}_3$  photodetector with MSM structure.



 $\mbox{Fig.S2}$  The cross-sectional SEM image of the  $\mbox{CsPbBr}_3$  film.



**Fig. S3** The SEM of CsPbBr<sub>3</sub> film and CsPbBr<sub>3</sub>:ZnO hybrid films on *c*-plane sapphire substrates. (a) CsPbBr<sub>3</sub> film; (b) CsPbBr<sub>3</sub>:ZnO hybrid film (0.6 wt% ZnO QDs); (c) hybrid film (1.5 wt% ZnO QDs); (d) hybrid film (3.0 wt% ZnO QDs); (e) hybrid film (6.0 wt% ZnO QDs ) film; (f) hybrid film (11.0 wt% ZnO QDs).



Fig. S4 The EDS of  $CsPbBr_3$  film and the  $CsPbBr_3$ :ZnO hybrid films with different ZnO QDs contents.



Fig. S5 The XRD pattern of CsPbBr<sub>3</sub>, ZnO QDs and CsPbBr<sub>3</sub>:ZnO samples.



Fig. S6 The PL spectra of CsPbBr<sub>3</sub>:ZnO hybrid films.



**Fig. S7** (a) Absorbance spectrum of the ZnO QDs. (b) It shows  $(\alpha hv)^2$  versus hv, referring to a band gap of 3.57 eV. (c) TEM image of ZnO QDs. (d<sub>1</sub>) and (d<sub>2</sub>) the HRTEM image and SAED pattern of ZnO QDs.



Fig. S8 Experimental flow chart for the fabrication of the photodetector based on hybrid film.



Fig. S9 Responsivity value of PDs based on hybrid film at 500 nm in the Fig. 2(c).



Fig. S10 (a) The schematic diagram of S0, S1, S2, and S3 devices. (b) The optical images of the S0, S1, S2, and S3 devices. The morphologies of the interdigitated electrodes in S0 (c), S1 (d), S2 (e), and S3 (f) devices. The scale bar: 50  $\mu$ m.



Fig. S11 The *I-V* curves of S1 and S2 PDs in the dark (a) and light state (b).



Fig. S12 (a) (b) The responsivity spectra of S1 and S2 PDs at 0 V and 10 V, respectively.



Fig. S13 /-V curves of the PDs based on CsPbBr<sub>3</sub> film and CsPbBr<sub>3</sub>:ZnO hybrid films with different ZnO QDs contents.



Fig. S14 I-t curves of S1 and S2 PDs at 0 V (a) and 10 V (b), respectively. (c) The photovoltaic time-resolved response of S3 at 0.9 V.



Fig. S15 The object of the imaging system with "HRBNU".