Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information

Non-volatile "Programmable" Transparent Multilevel Ultra-violet Perovskite Photodetector

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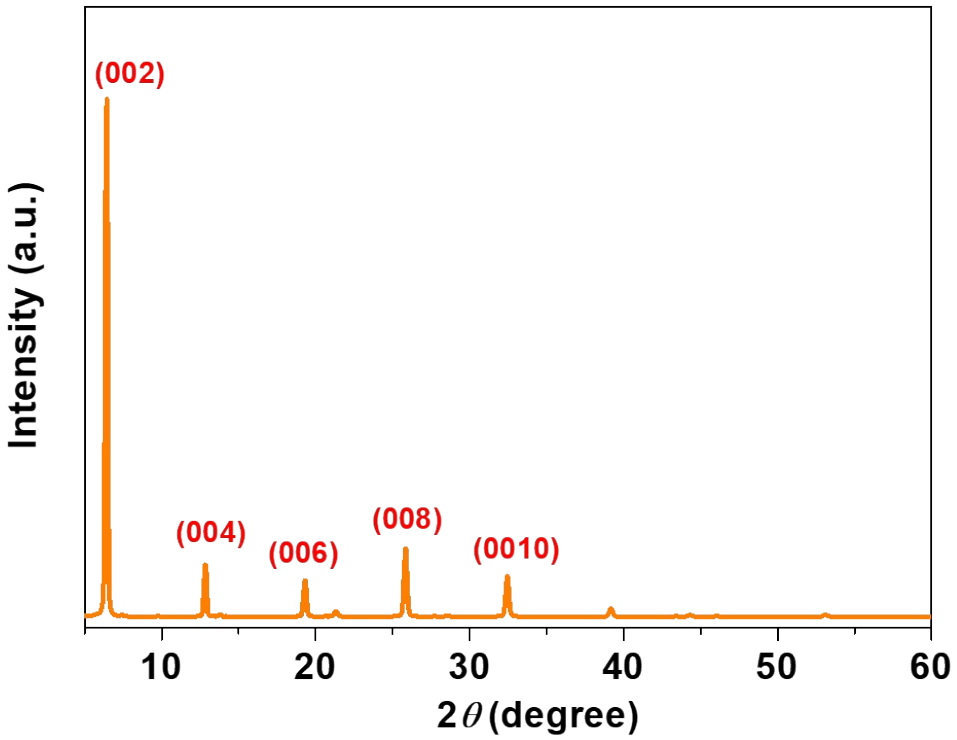

Figure S1. XRD data of $(C_4H_9NH_3)_2PbBr_4$ on glass substrate

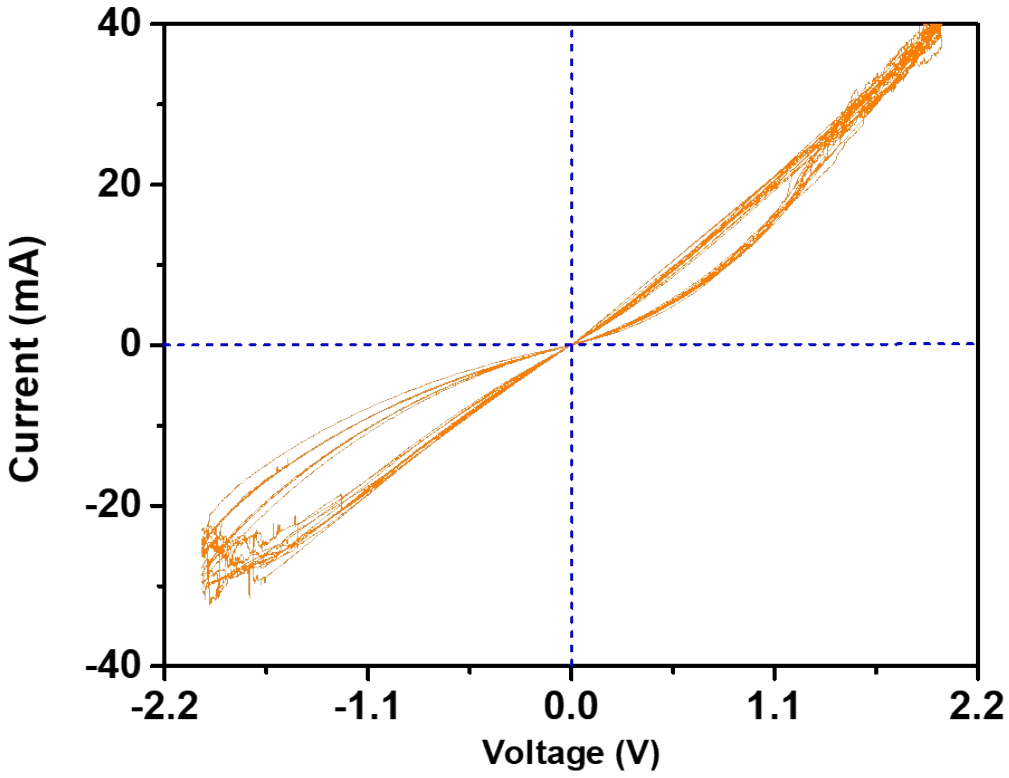

Figure S2. Current-voltage characteristics measured with the fast ramp rate of 0.2 V s^{-1} at a fixed location.

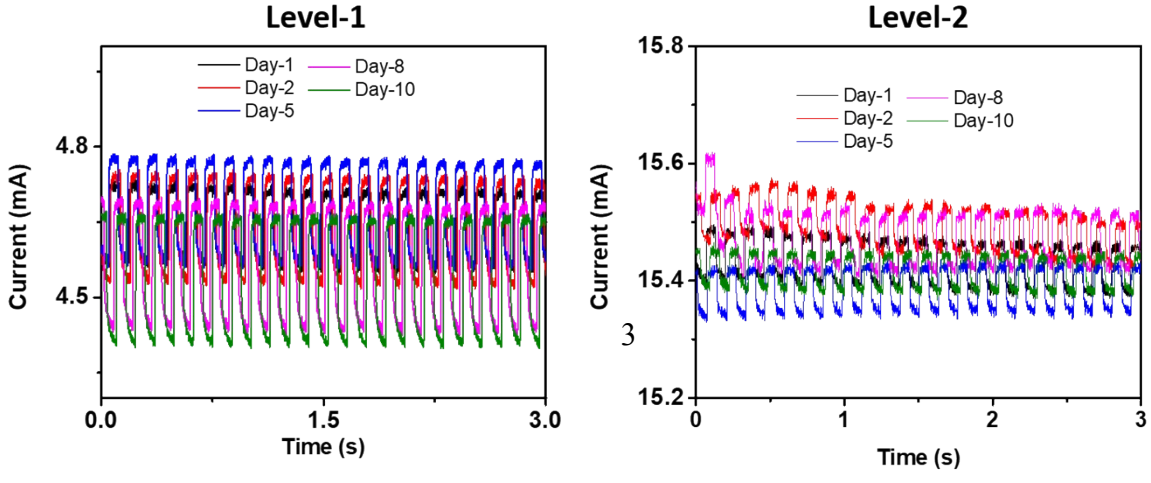

Figure S3. Transient response in respective level-1 and level-2, measured with 0.5 V, 365 nm, and 7 mW cm^{-2}. The data were measured for 10 days in ambient air with humid (>50%) conditions, confirming the high air stability of the photodetector.

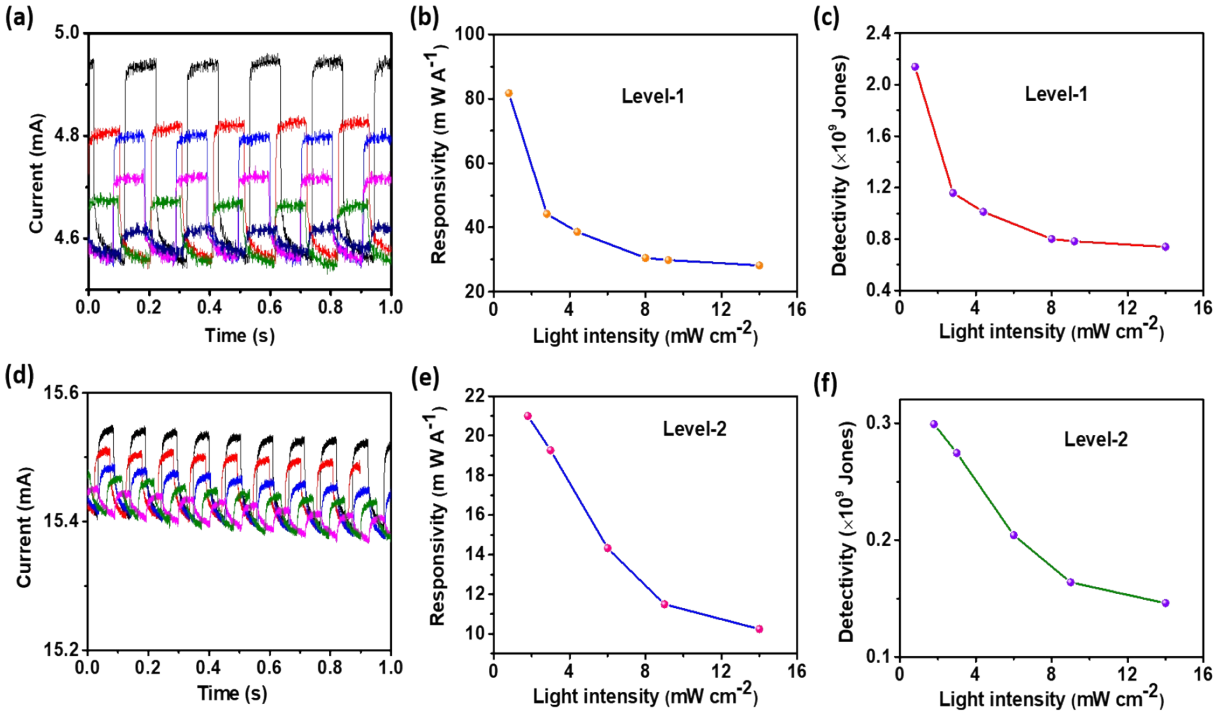

Figure S4. (a) Intensity-dependent transient photoresponse of the device in Level-1, (b) and (c) Responsivity and detectivity as a function of illuminated intensity in Level-1, respectively. (d) Intensity-dependent transient photoresponse of the device in Level-2, (e) and (f) Responsivity and detectivity as a function of illuminated intensity in Level-2, respectively.

Table-1. Comparison of the data of the ultra-violet operated photodetectors. T, Transmittance; *R*, responsivity; *D*, detectivity. Rise time (τ_r) and fall time (τ_f).

Material structure	Wavelength (nm), Intensity	Bias (V)	T (%)	R (A W^{-1})	D (Jones)	τ_r/τ_f (s)	Ref.
$CH_3NH_3PbI_3$	650, 100 μW cm^{-2}	10	Semi-transparent	0.1	1.02×10^{12}	0.3/. m	[1]
$CH_3NH_3PbI_{3-x}Cl_x$	254,	2	…	7.85	…	0.2/0.7 μ	[2]
$CH_3NH_3PbCl_3$ single crystals	365, 100 mW cm^{-2}	15	Visible blind	46.9 m	1.2×10^{10}	24/62 m	[3]
$CsPbBr_3$ microcrystals	400, 1 mW cm-2	3 V	…	6×10^{4}	…..	1/. m	[4]
$CH_3NH_3PbI_3$ films on ITO	365, 10 μW cm^{-2}	10	…	3.49	…..	<200 m	[5]
$CH_3NH_3PbI_3$ microwires on SiO_2/Si	420, 500 μW cm^{-2}	5	…	13.57	…	0.08/0.2 m	[6]
$CH_3NH_3PbI_3$	400-800 nm	1	....	....	10^{11}	0.23/0.38 m	[7]
$CH3NH3PbI_{3-x}Cl_x$	30-800 nm	0	....	....	8×10^{13}	180/160 n	[8]
$(C_4H_9NH_3)_2PbBr_4$	365, 7 mW cm^{-2}	0.5	76%	32 m	8.5×10^{8}	2/16 m	This work

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