Electronic Supplementary Material (ESI) for Materials Advances.

Fabrication of self-powered broadband photodetector by 50% replacement of Pb by Mg in $CH_3NH_3Pb_{0.5}Mg_{0.5}Cl_2I$ perovskite lattice

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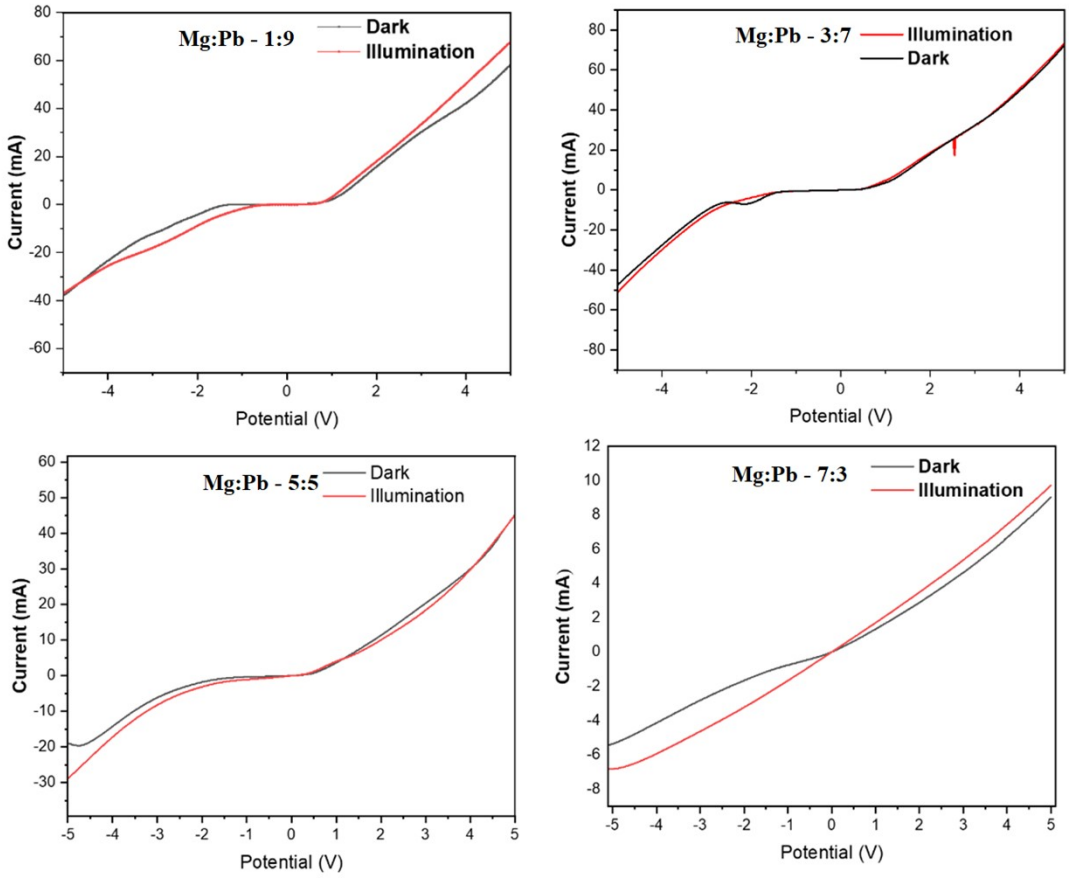

Figure S1. I-V characteristics of devices fabricated with varied ratio of Mg:Pb: a) 1:9, b) 3:7, c) 5:5 and d) 7:3

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Formulae for estimation of figure-of-merit:

$$Responsivity = R_\lambda = \frac{I_\lambda}{P_\lambda \times A}$$

$$EQE = hc \times \frac{R_\lambda}{e\lambda}$$

$$Detectivity = D^* = \frac{R}{\left(\frac{2e I_{dark}}{A}\right)^{0 \cdot 5}}$$

Where λ is wavelength of incident light, I_λ is the photocurrent, I_{dark} is the current in the device under no illumination, P_λ is the intensity of incident light and A is device active area

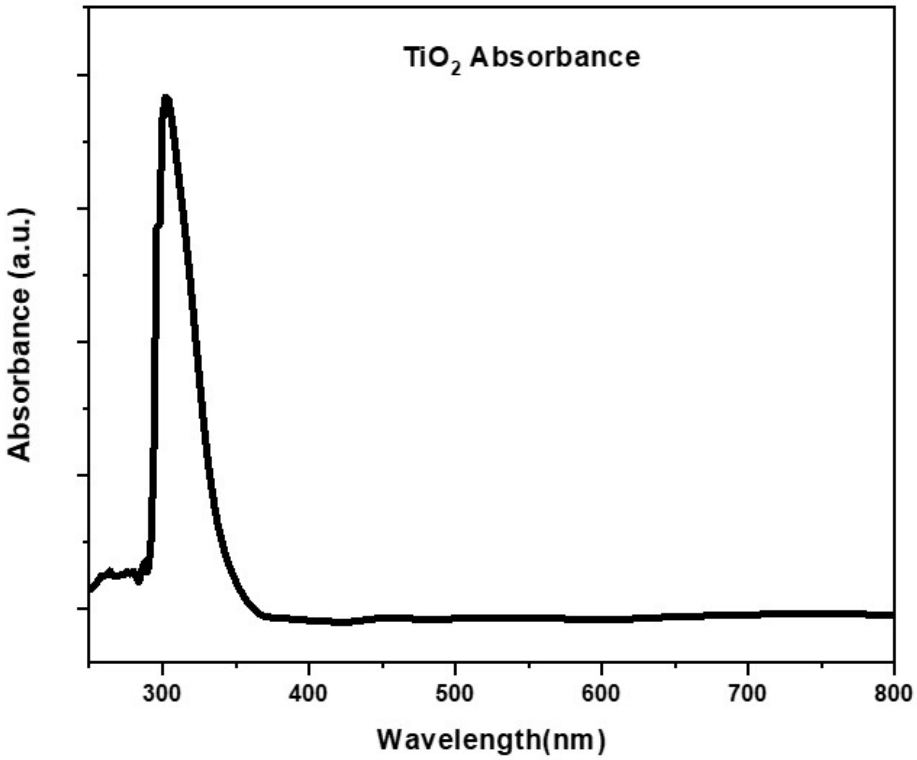
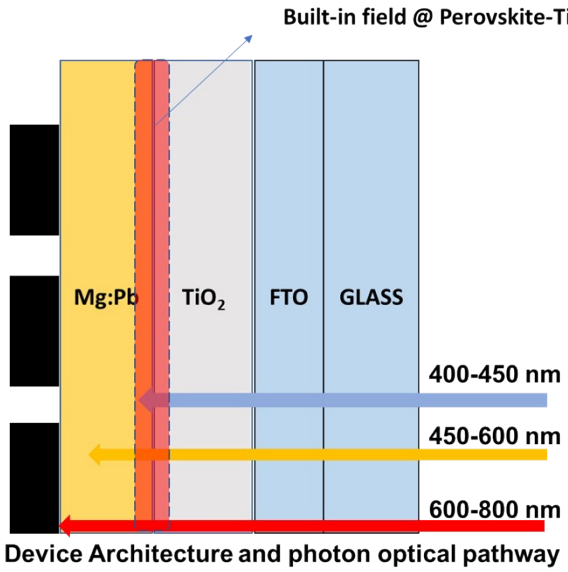


Figure S2. Optical absorption of TiO_2 electron transport layer



Wavelength	Spatial Absorption	Collection Probability
400-450 nm Photons	Absorption at the interface of TiO_2-Perovskite	High
450-600 nm Photons	Absorption at the center of the perovskite	Poor
600-800 nm Photons	Absorption at the interface of Carbon and Perovskite	High

Figure S3. Pictorial representation of optical pathway of illuminated photons and their spatial absorption.

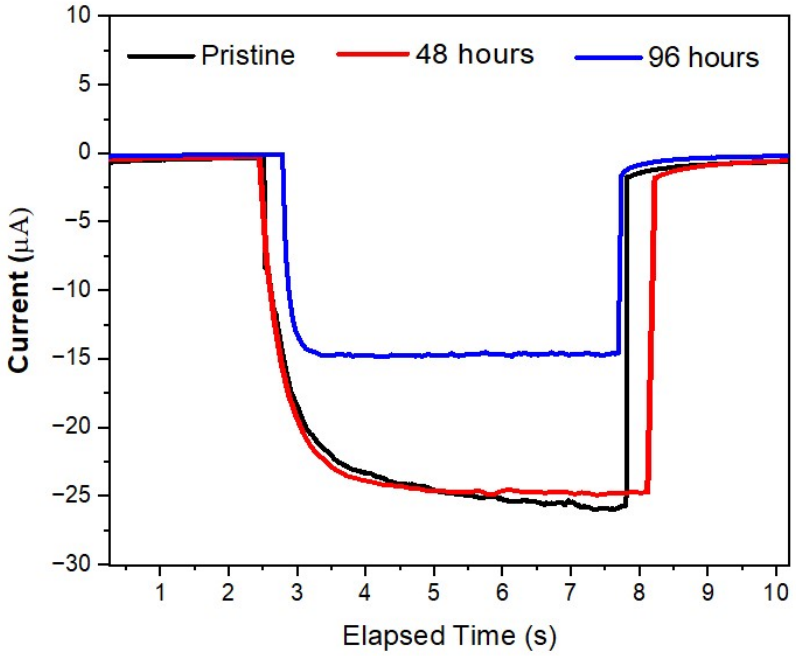


Figure S4. Stability studies of device fabricated using optimized $MAPb_{0.5}Mg_{0.5}X_3$.

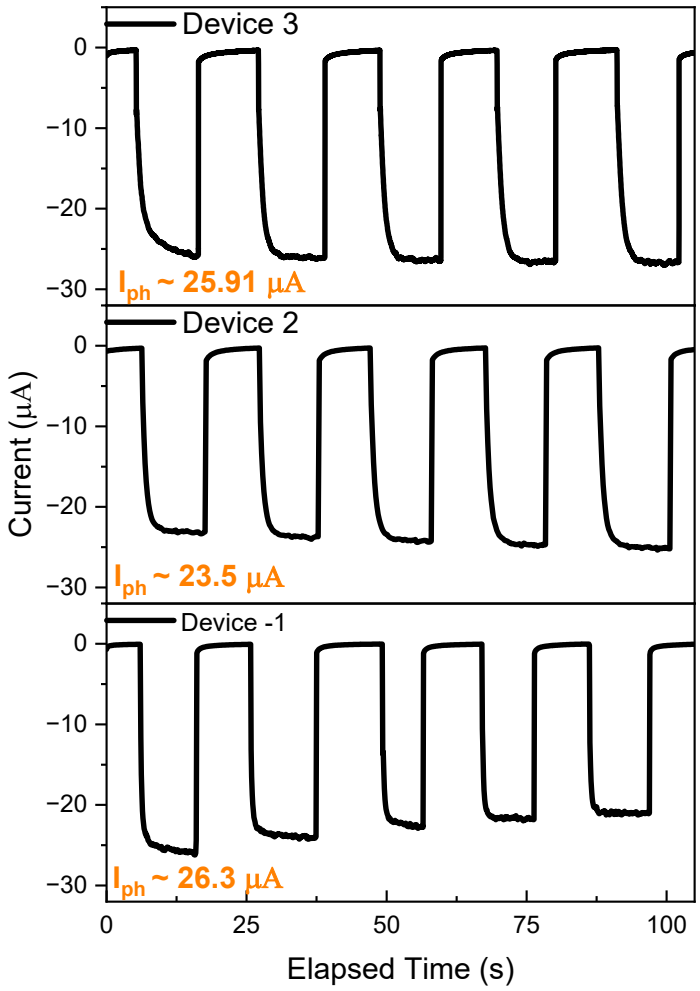


Figure S5. Repeatability studies of device fabricated using optimized $MAPb_{0.5}Mg_{0.5}X_3$.