Electronic Supplementary Material (ESI) for Materials Horizons.

Supporting Information for

Tin dioxide quantum dots coupled with graphene enabled high-performance bulk-silicon Schottky photodetector

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Figure S1. Schematic diagrams showing the fabrication process of the SnO_2-QDs/graphene/Si heterojunction photodetector.

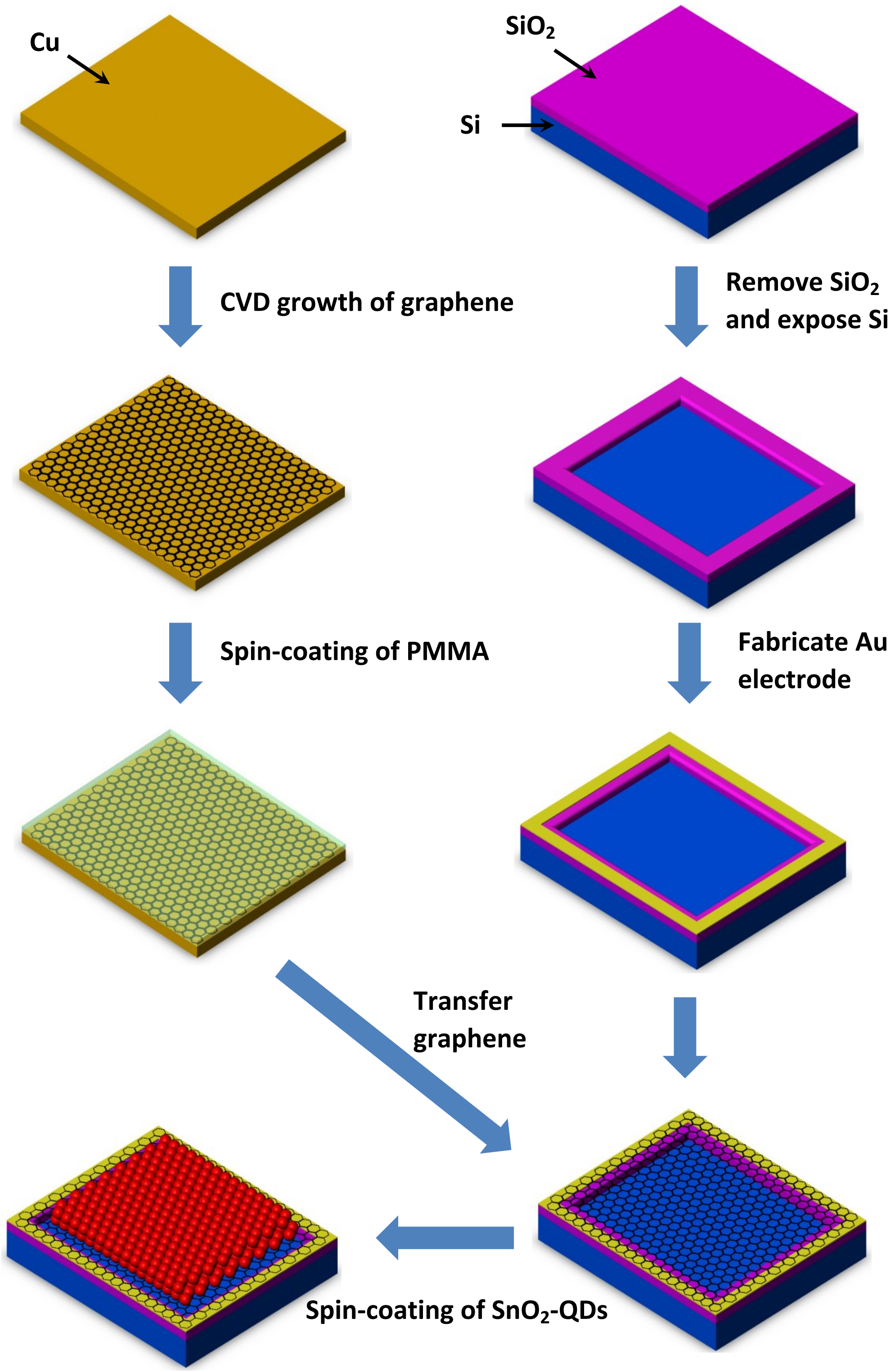

Figure S2. (a) Dark *I-V* characteristic of the graphene/Si photodetector. By fitting the I-V curve with equation 1, the reverse saturation current (I_s) is estimated to be 5.74 μA. As the area of the device is 300*300 μm^2, the temperature is 300 K, the effective Richardson constant is 112 A cm^{-2} K^{-2}, based on equation 2, the Schottky barrier height (Φ_b) is calculated to be 0.19 eV. (b) Dark *I-V* characteristic of the SnO_2-QDs/graphene/Si photodetector and fitting with equation 1. The Schottky barrier height (Φ_b) is calculated to be 0.21 eV. (c) *I-V* curves of the graphene/Si photodetector in the dark and under 532 nm light illumination with various light intensities.

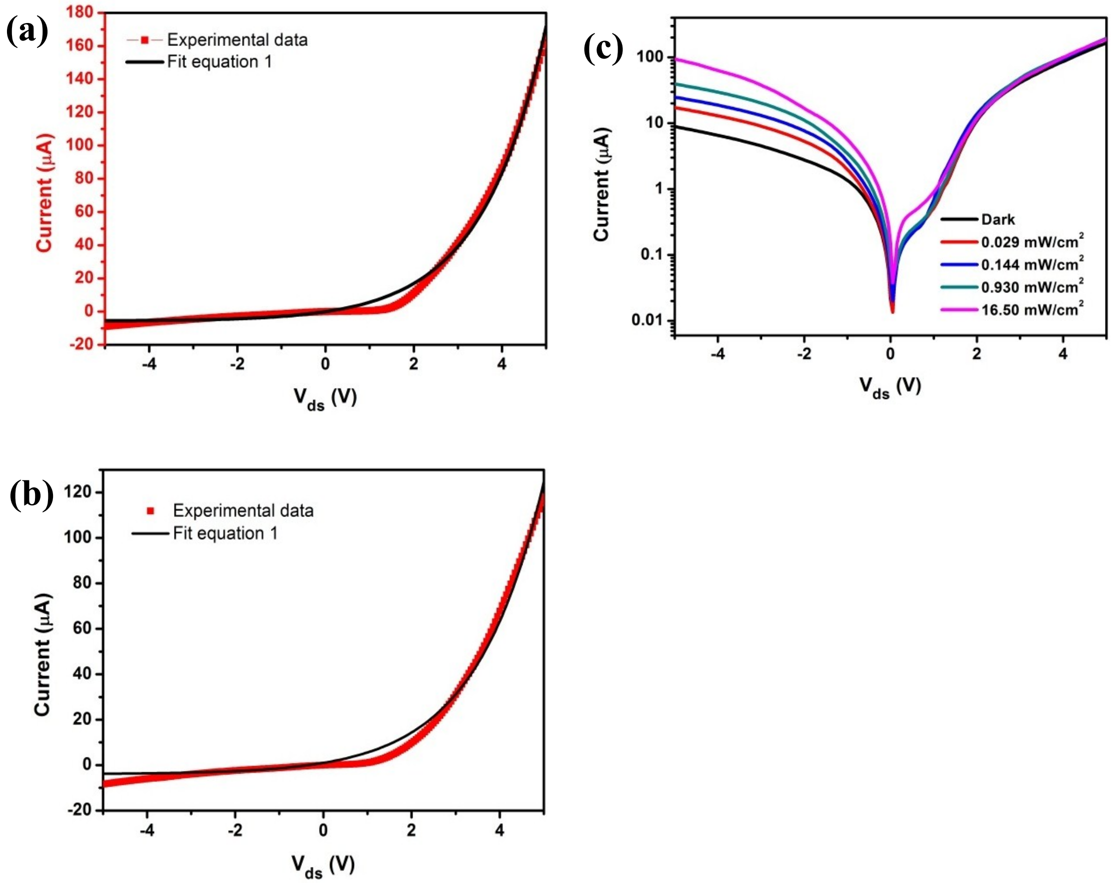

Figure S3. Voltage-dependent photocurrent upon illumination with 532 nm light: (a) graphene/Si photodetector; (b) SnO_2-QDs/graphene/Si hybrid photodetector.

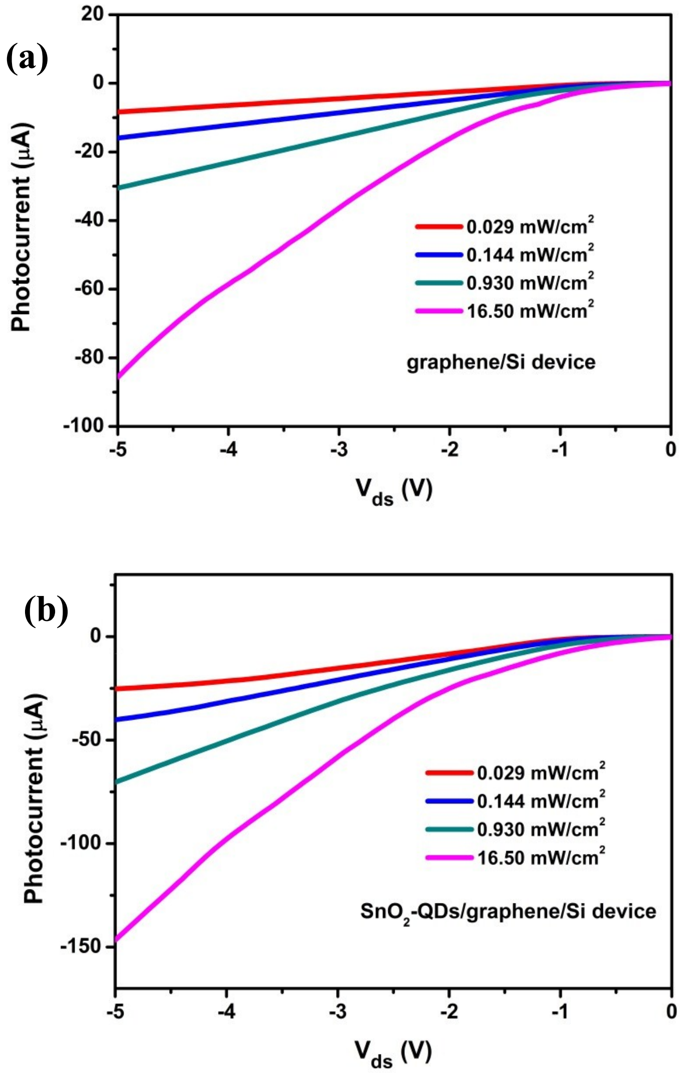

Figure S4. Photocurrent evolved with the thickness of the SnO_2-QDs film under the same incident intensity (29 μW/cm^2). The graphene/Si device without SnO_2-QDs (the thickness of the SnO_2-QDs film is 0 nm) is also shown for comparison.

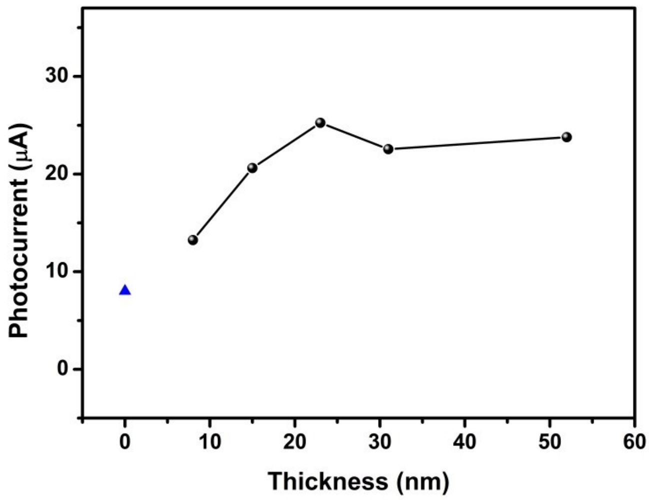

Figure S5. Light intensity dependent external quantum efficiency (EQE) of the graphene/Si and hybrid SnO_2-QDs/graphene/Si photodetectors at V_{ds} = -5 V.

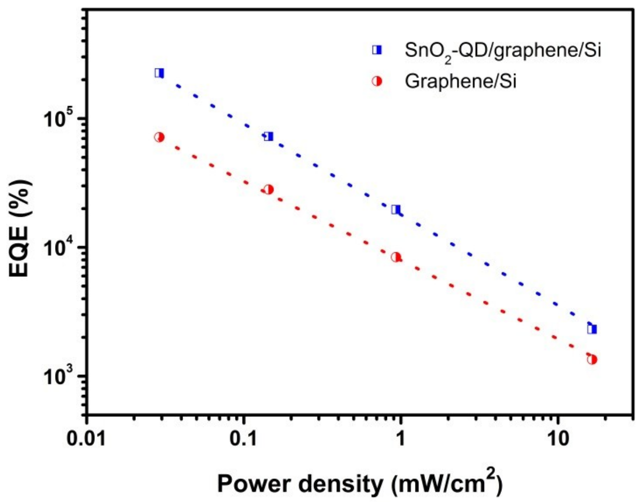

Figure S6. Stability of the SnO_2-QDs/graphene/Si photodetector. (a) I-V characteristics of the SnO_2-QDs/graphene/Si photodetector before and after exposing to ambient environment for two months. (b) Photoswitching curves of the SnO_2-QDs/graphene/Si photodetector before and after exposing to ambient environment for two months.

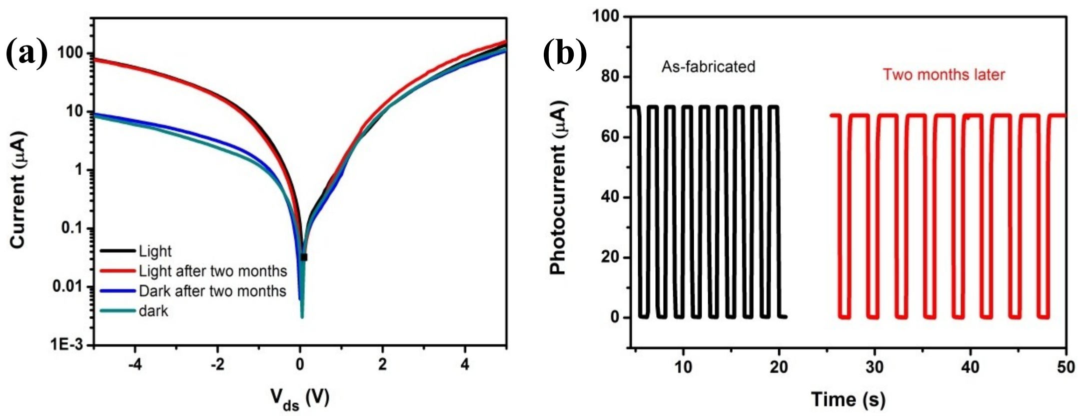

Figure S7. UV-vis-NIR absorption curve of the SnO_2-QDs.

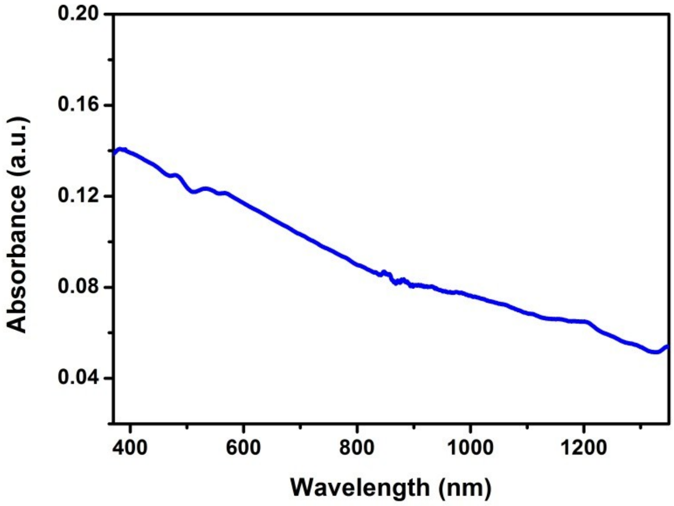

Figure S8. Reflection spectra of the graphene/Si film and SnO_2-QDs/graphene/Si film.

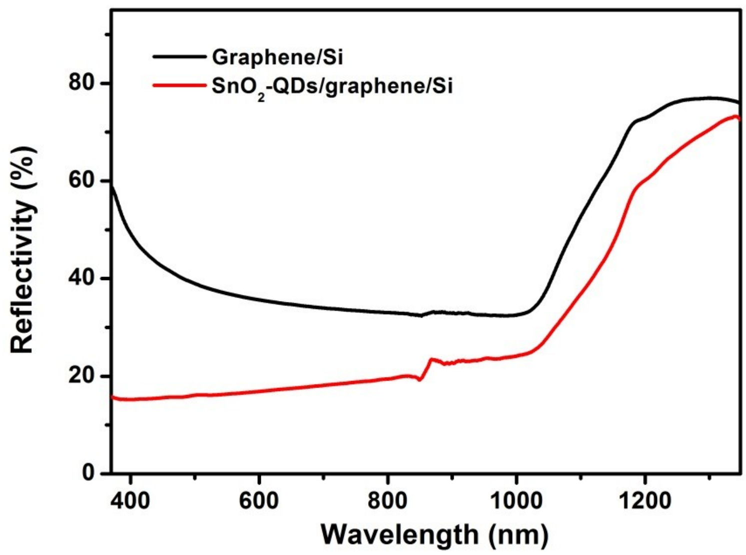

Figure S9. The energy band diagrams for graphene and n-Si in the dark and light.