Electronic Supplementary Material (ESI) for Nanoscale

Supporting information

The device performances under bending condition have been investigated. Typical *I-V* curves of the devices under bending angles of 0°, 30°, and 80° are shown in Fig. S1. We can see that, for identical voltage, the forward-biased current exhibits kind of decrease as the bending angle increases. Figure S2 shows the high frequency (1000 Hz switching frequency) responses of the device under flat and bend conditions (633 nm light illumination, 0.54 W cm^{-2}). Corresponding device schematic diagrams are shown in the inset. Compared to the result under flat condition, the on-state currents under both convex and concave bending conditions show kind of decrease, and the off-state currents of them remain almost unchanged.

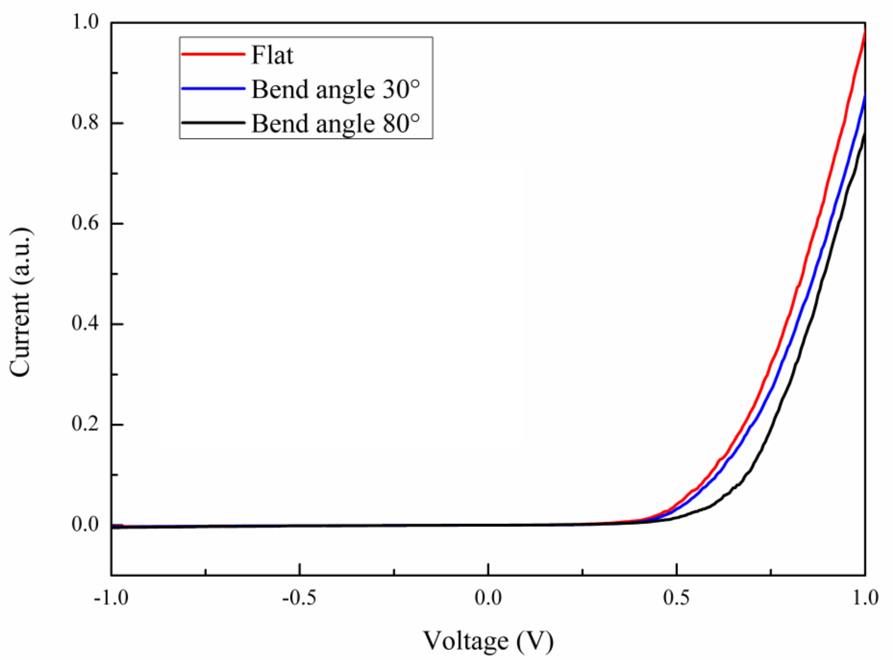

Figure S1. The dark *I-V* curve of the device under different bending angles.

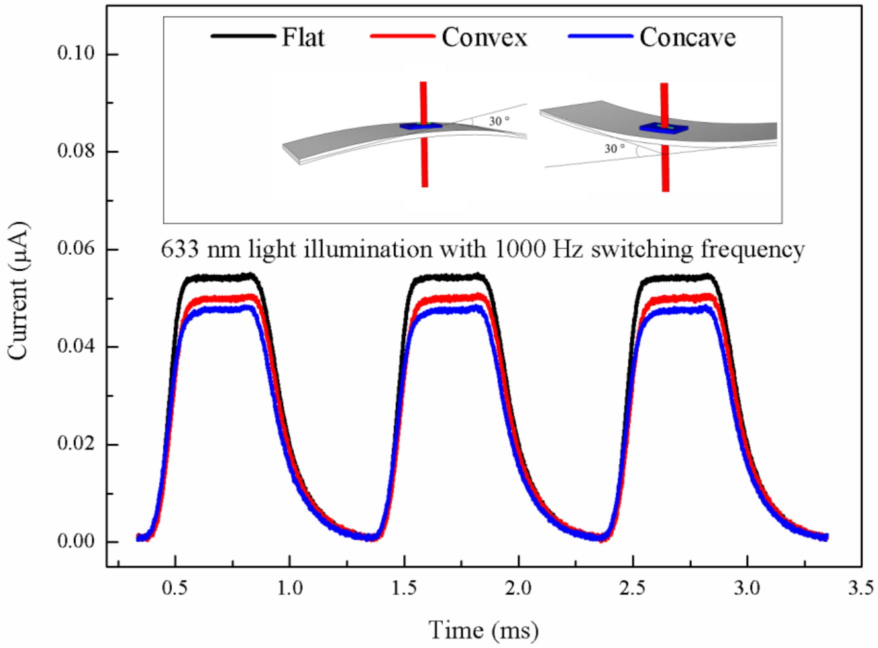

Figure S2. The high frequency responses of the device under flat and bend conditions under 1000 Hz switching frequency (633 nm light illumination, 0.54 W cm^{-2}).

The optical transmission of the graphene on the PET substrate is shown in Fig. S3. We can see that, the transparency of the graphene on the PET substrate monotonously increases from about 58% for 400 nm light wavelength to more than 80% for 1100 nm.

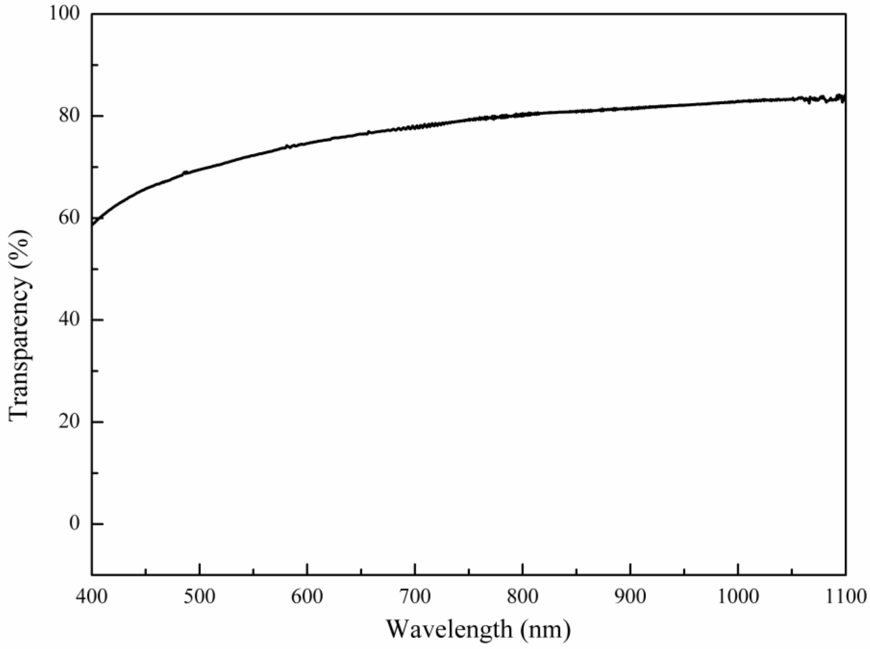

Figure S3. The transparency spectrum of the graphene on PET substrate.

We have estimated the RC time constant of the device in series with the 5 MΩ resistor by introducing an arbitrary/function generator (Tektronix AFG 3102) in the circuit, which supplied 3500 Hz forward bias (square wave) to the device. Other parts of the experimental set-up remain unchanged. Corresponding current vs. time curve is shown in Fig. S4. The RC time constant (τ_{RC}), obtained by fitting the rising edge of the normalized current with the equations $I = 1 - \exp(-t/\tau_{RC})$, is about 9.1 μs, smaller than the measured photoresponse time constant of our device (27 μs). Therefore, the influence of the RC time constant of the circuit on the photoresponse time of the device is not that serious.

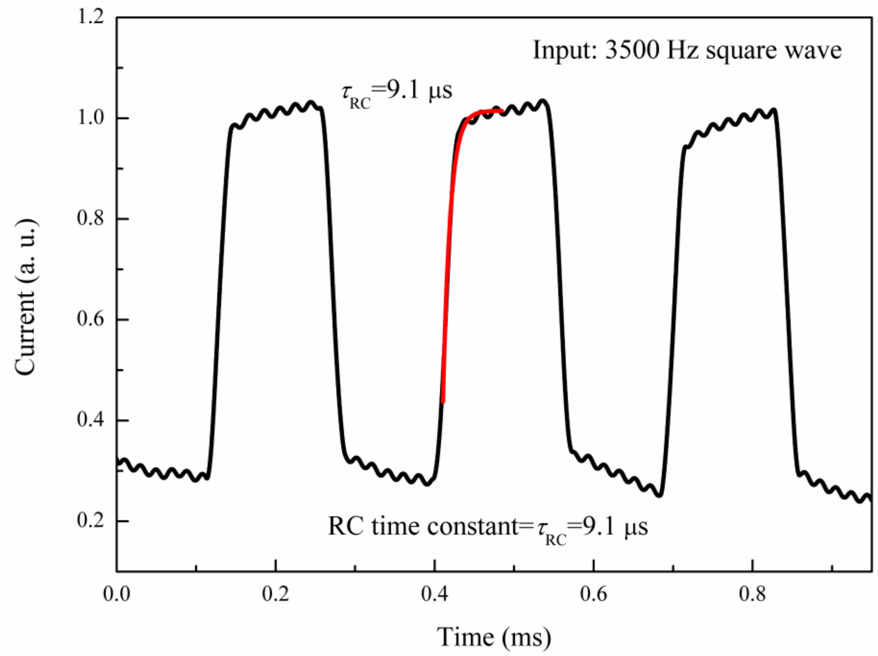

Figure S4. The current response of the device in series with a 5 MΩ resistor driven by arbitrary/function generator with 3500 Hz forward bias (square wave). The red line represents the fitting results of the rising edge with the equations $I = 1 - \exp(-t/\tau_{RC})$, (the current is normalized) and the RC constant of the device in series with the 5 MΩ resistor can be estimated to be 9.1 μs.

The influence of the excitation profile of the chopped laser beam (633 nm laser) is measured by using a fast photodiode (Dongbao 2CU2C). Figure S5 shows the photoresponse of the photodiode under 3500 Hz switching frequency. We can see that, the response and recovery times are 35 and 32 μs, respectively. Considering this influence, we think the real response and recovery times of our devices under identical measurement condition should be faster than 70 and 137 μs, respectively.

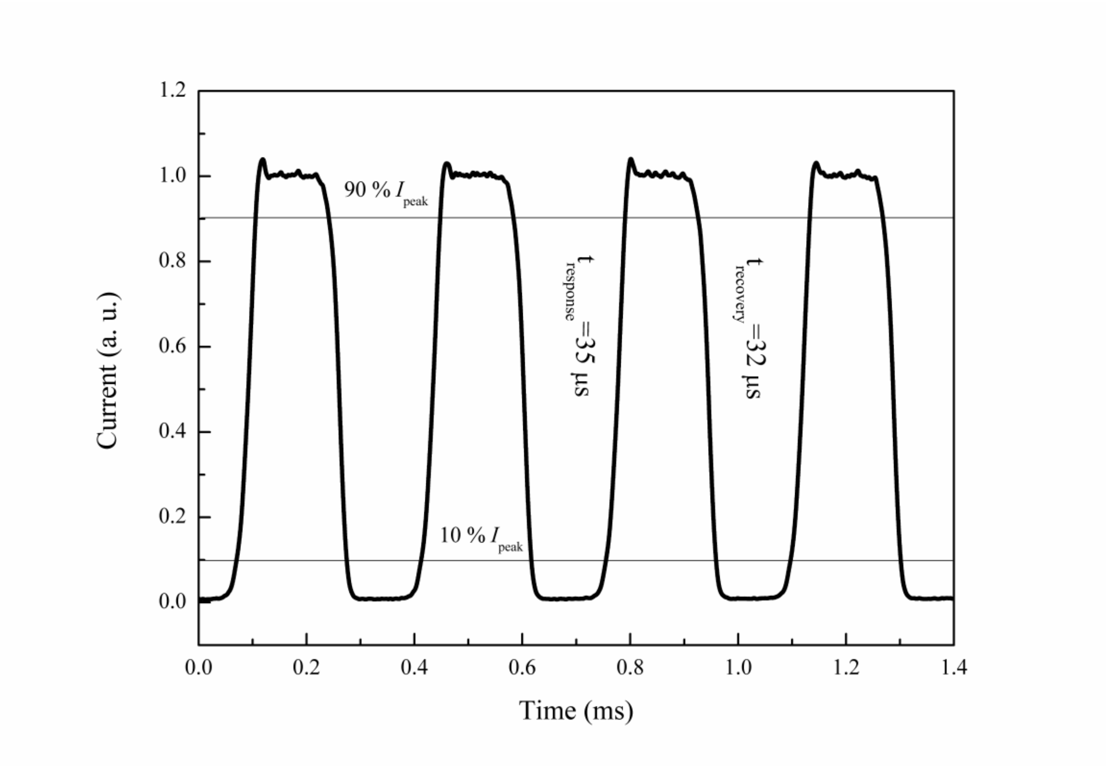

Figure S5. Photocurrent response of a fast photodiode under 633 nm laser with 3500 Hz chopping frequency (under same intensity used in Fig. 4b).

The contact between CdSe and In/Au and that between graphene and Au are proved to be ohmic contacts in Fig. S6 and Fig. S7, respectively, where both *I*-*V* curves are straight lines.

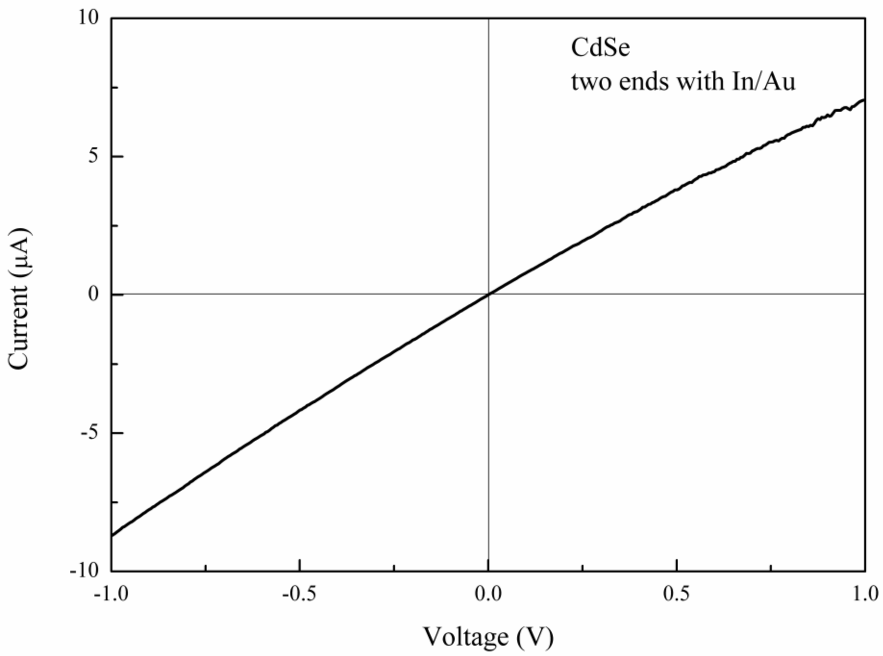

Figure S6. The *I-V* curve of CdSe NB with In/Au contacts on the two ends.

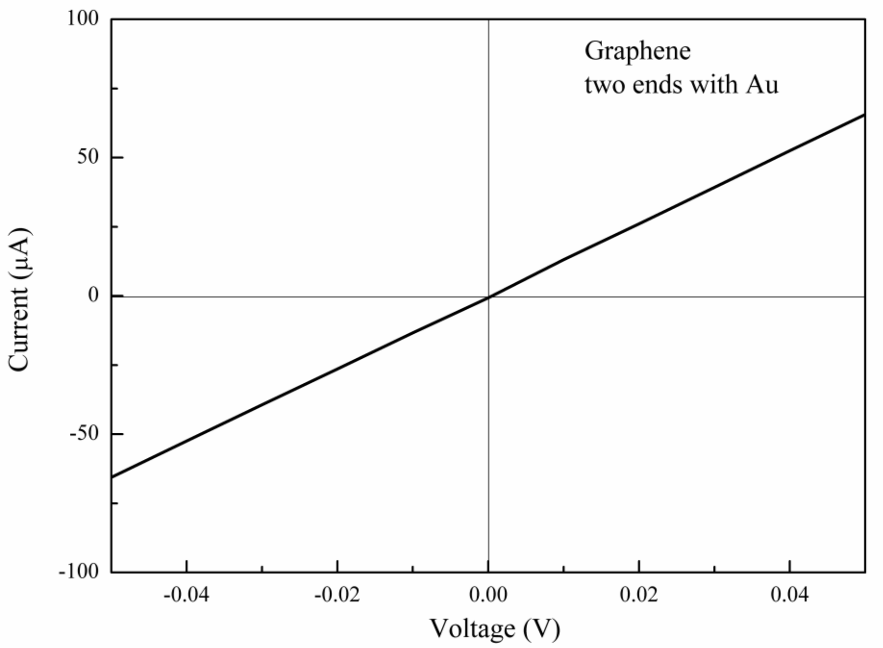

Figure S7. The *I-V* curve of graphene with Au contacts on the two ends.

We have investigated the light switching frequency dependence of the photocurrent (I_{photo}) of the device under 633 nm light illumination. The light intensity is 0.040 W cm^{-2}. Corresponding result is shown in Fig. S8. We can see that the I_{photo} decreases as the light switching frequency increases (especially at low frequency region). Specifically, from 100 Hz to 500 Hz, the photocurrent decreases by about 25%. This phenomenon makes the ~20% EQE difference observed in Fig. 3b and Fig. 3d in the paper to be understandable.

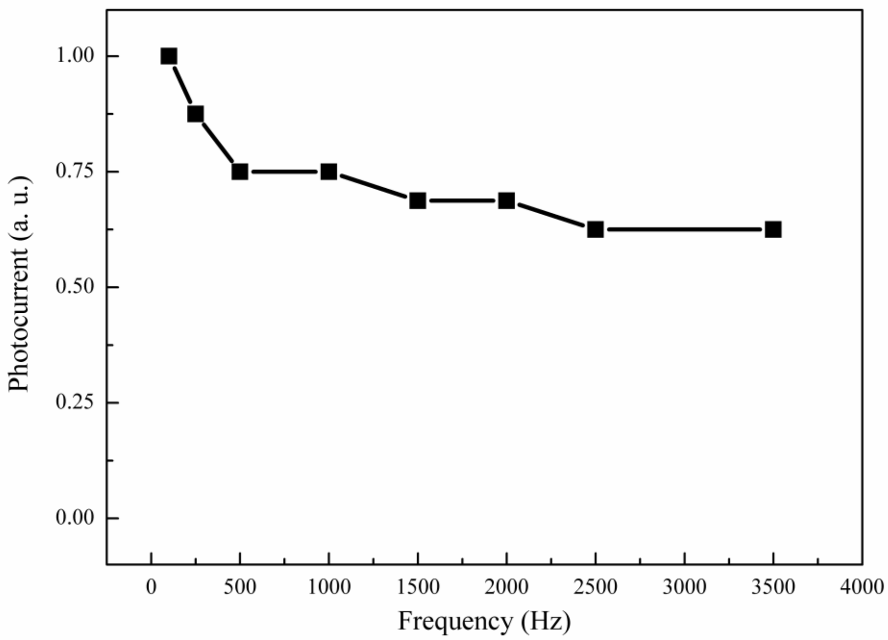

Figure S8. The light switching frequency dependence of the photocurrent of the device under 633 nm light illumination with an intensity of 0.040 W cm^{-2}.