Electronic Supplementary Information for

High-Performance Self-powered UV-Vis-NIR Photodetector Based on Horizontally Aligned GaN Microwire Array/Si Heterojunctions

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Figure S1

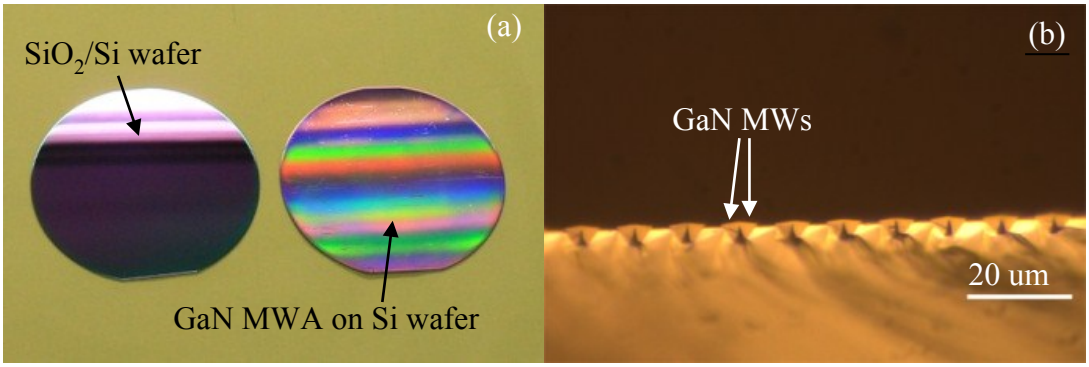

Figure S1. (a) Digital photographs of a 2'' SiO2/Si wafer and that after GaN MWA deposition to demonstrate wafer-level production ability towards large-scale device applications. (b) a typical cross-sectional optical image of GaN MWA on Si wafer.

Figure S2

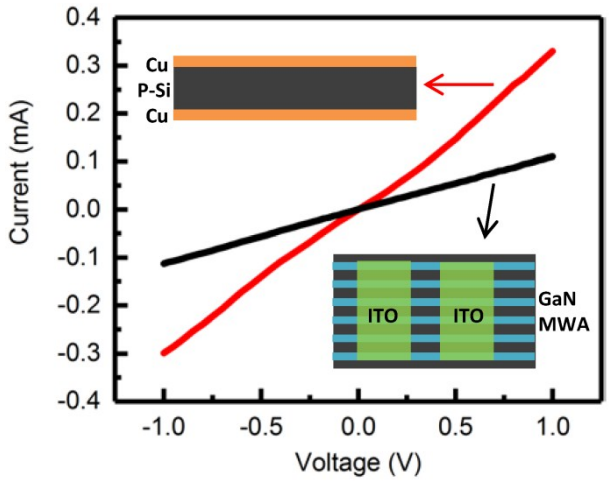

Figure S2. Nearly linear *I-V* characteristics between Cu/P-Si and ITO/GaN MWA confirm Ohmic contacts at electrode interfaces.

Figure S3

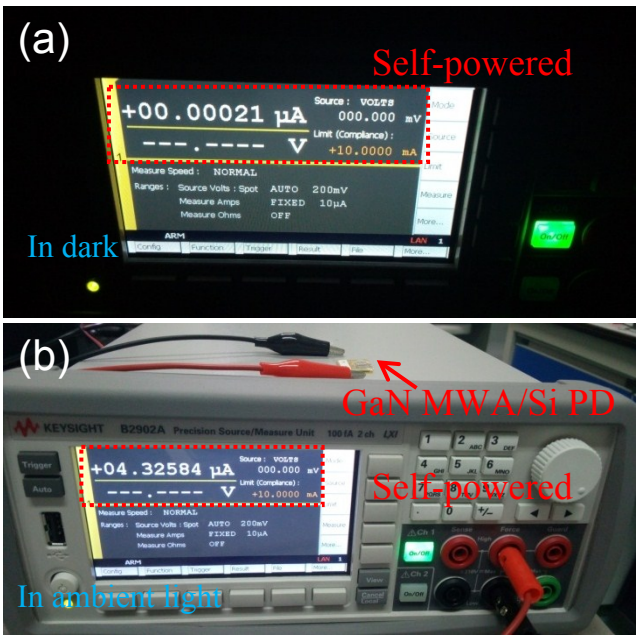

Figure S3. (a) Current of the GaN MWA/p-Si PD under dark, and (b) photocurrent generated by the PD under ambient room light are recorded with source biasing at 0 V. The clear photocurrent response with four orders of magnitude is observed at zero externally applied voltage forcefully supporting its self-powered ability. The PD showing ultra-high sensitivity may find applications in sensing ambient light in self-powered mode.

Figure S4

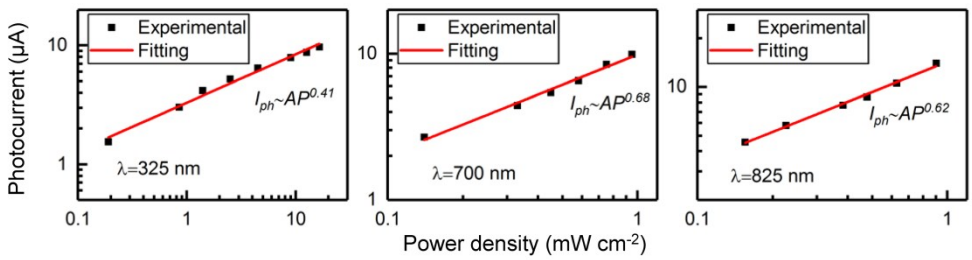

Figure S4. Experimental data and fitting curves of power density dependent photocurrents at biasing voltage of 0 V under 325 nm (a), 700 nm (b), 825 nm (c) wavelength light illuminating, respectively. Both photocurrent and power density are shown in log-scale. According to the fitting formula, I~AP$^{\theta}$, the θ values are determined by linear fitting the log-log scale curves.

Figure S5

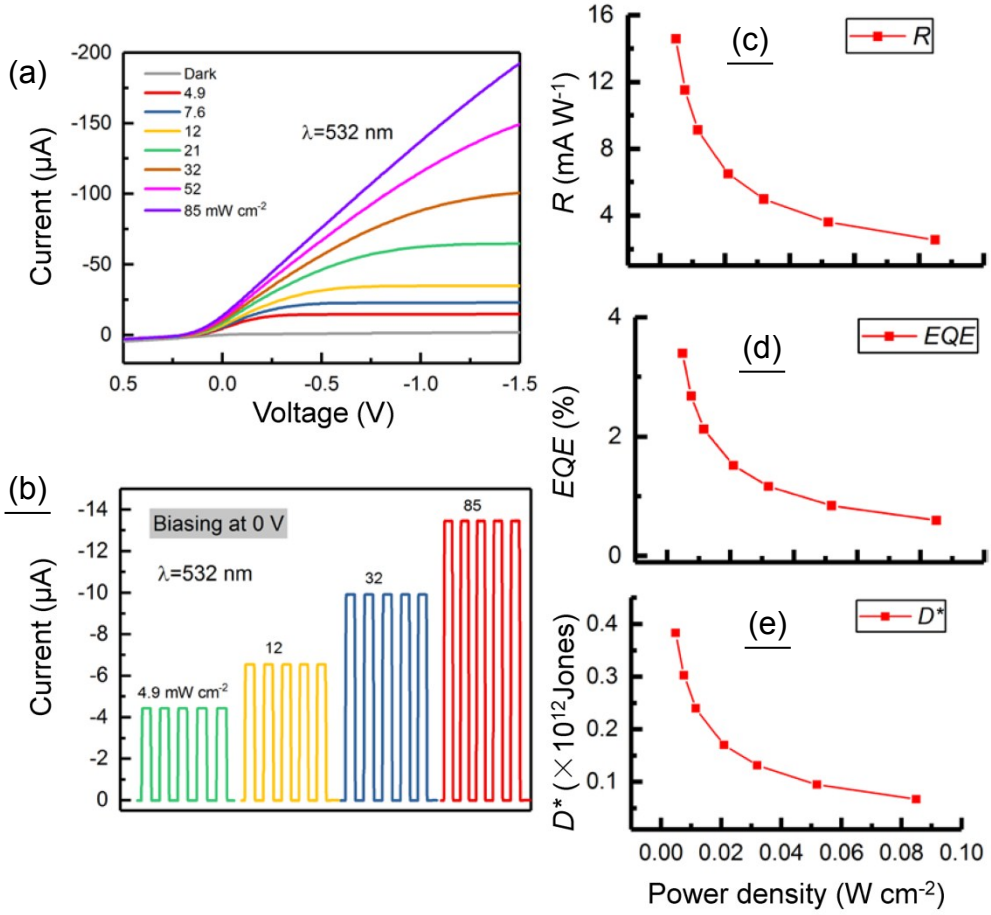

Figure S5. *I-V* and photoresponse characteristics of the self-powered PD under light illumination of 532 nm. (a) and (b) *I-V* and *I-t* curves recorded under a series of light intensities. (c)-(e) light intensity dependent *R, EQE, D** respectively.

Figure S6

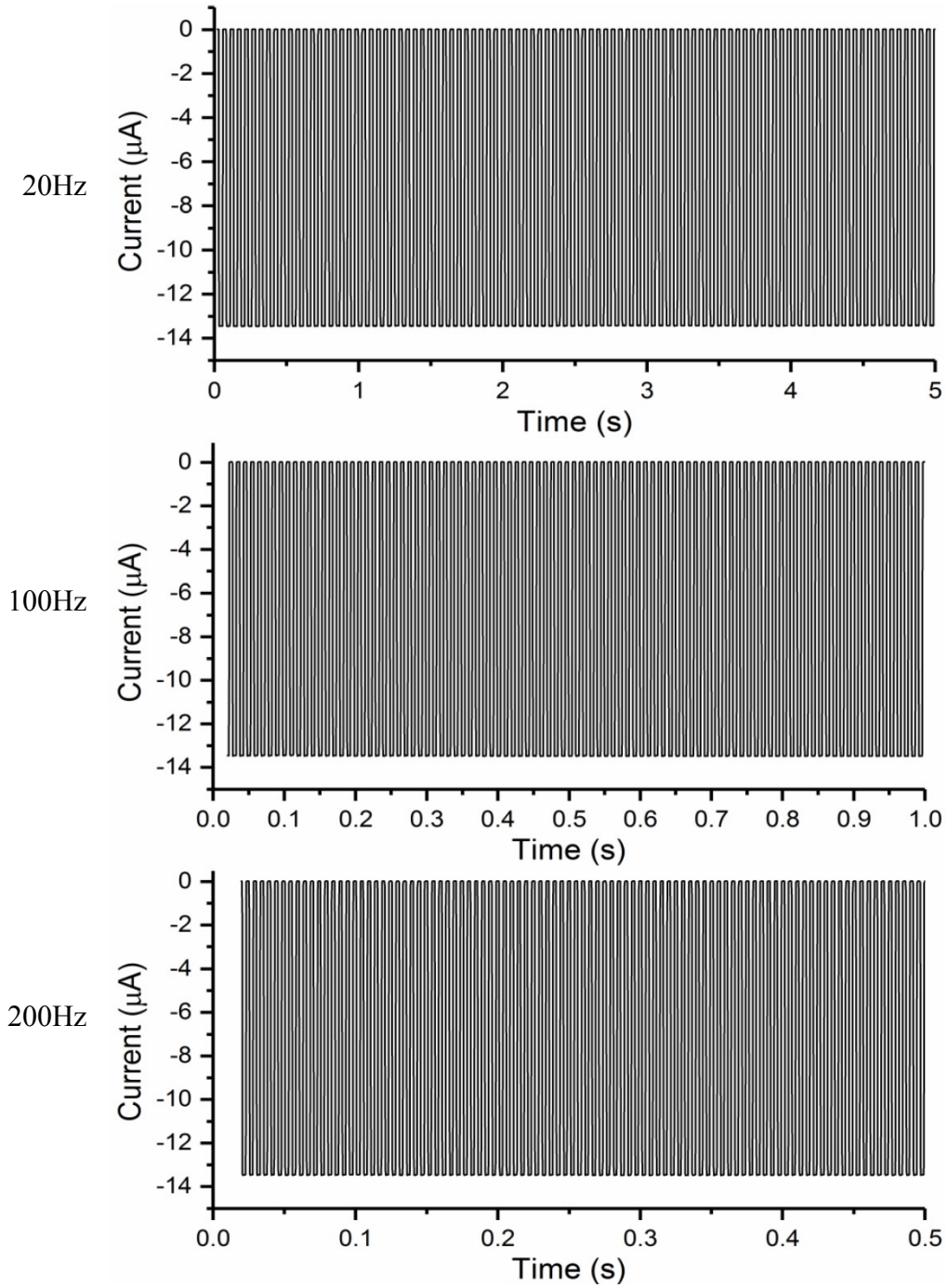

Figure S6. 100 stable on/off cycles switched by mechanical chopper at frequency of 20 Hz, 100 Hz, and 200 Hz, respectively, to confirm the stability and repeatability of the PD. The photocurrent is recorded at 0 V.

Figure S7

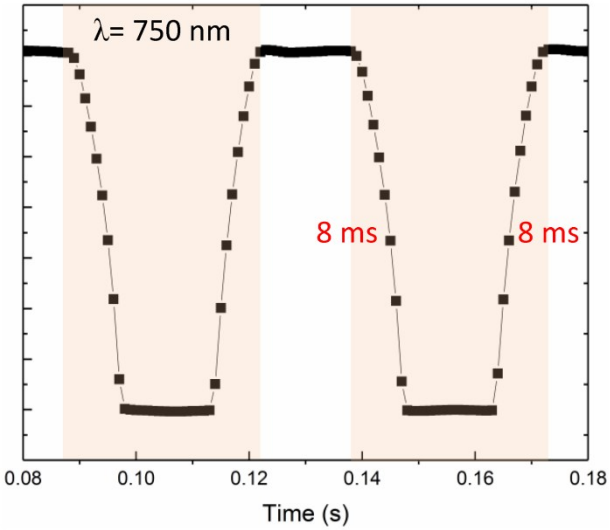

Figure S7. Photoresponse speed determined from transient *I-T* test. The rise/decay time is lower than 8/8 ms excited by a wavelength of 750 nm light.

Figure S8

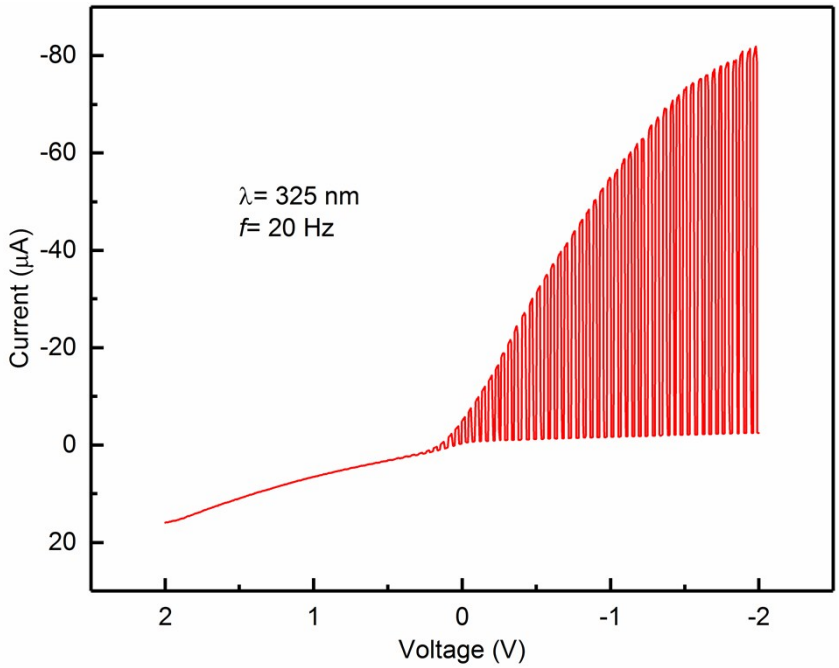

Figure S8. The *I-V* characteristic of the self-powered PD measured under chopped UV light (λ= 325 nm, *f*=20 Hz) illumination clearly indicates that the PD is responsive to the light from a small forward bias to reverse bias, while no obvious photoresponse is observed at larger forward bias.