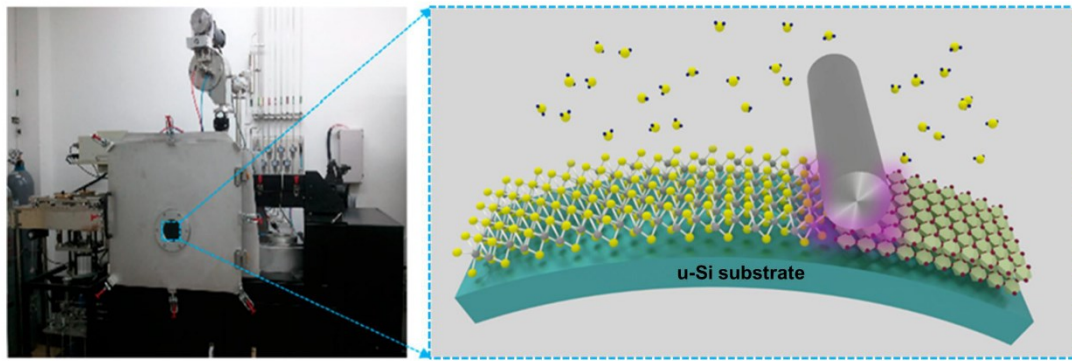


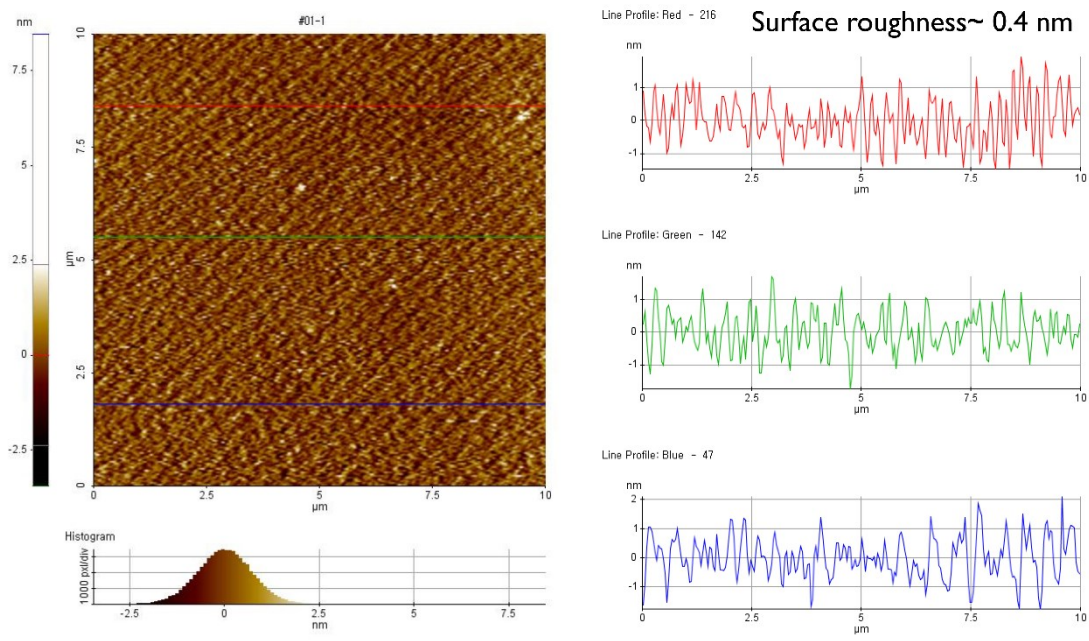
## Supporting Information

### **Ultra-Flexible and Rollable 2D-MoS<sub>2</sub>/Si Heterojunction-based Near-Infrared Photodetector via Direct Synthesis**

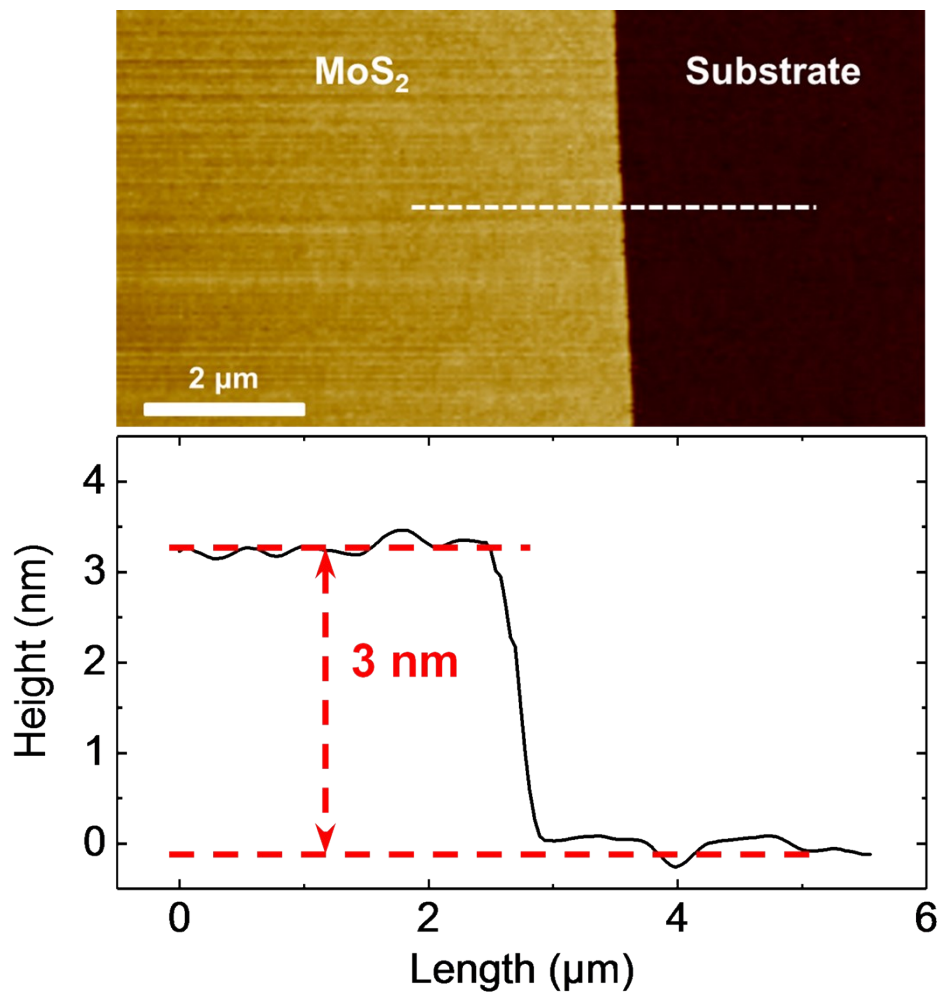
*Jung-Min Choi, Hye Yeon Jang, Ah Ra Kim, Jung-Dae Kwon, Byungjin Cho\*, Min Hyuk Park\*, and Yonghun Kim\**



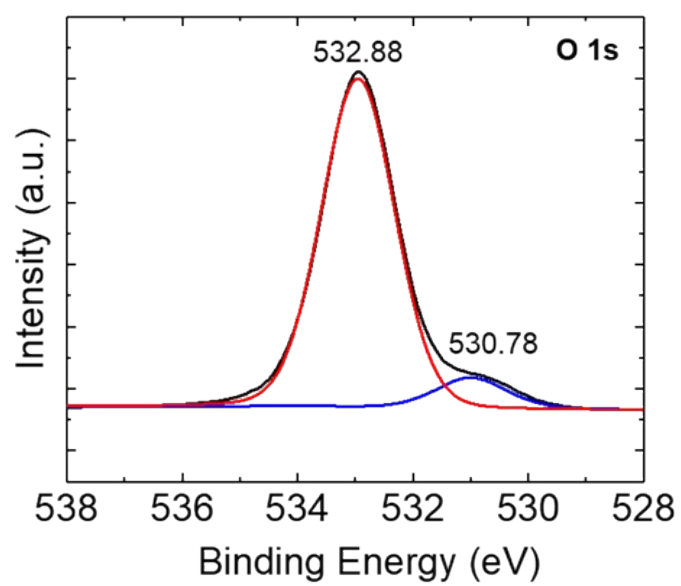
**Figure S1.** Photograph of the AP-PECVD equipment and process schematic to directly fabricate the 2D films on Si substrate using H<sub>2</sub>S plasma.



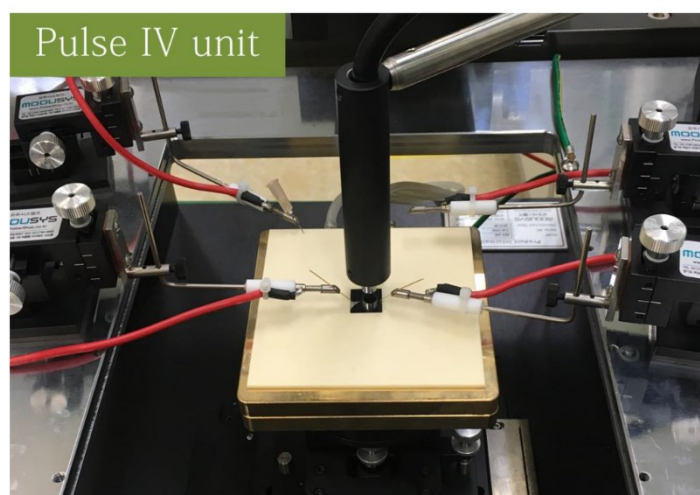
**Figure S2.** AFM surface image of 15 μm Si substrate and height profile along the lines.



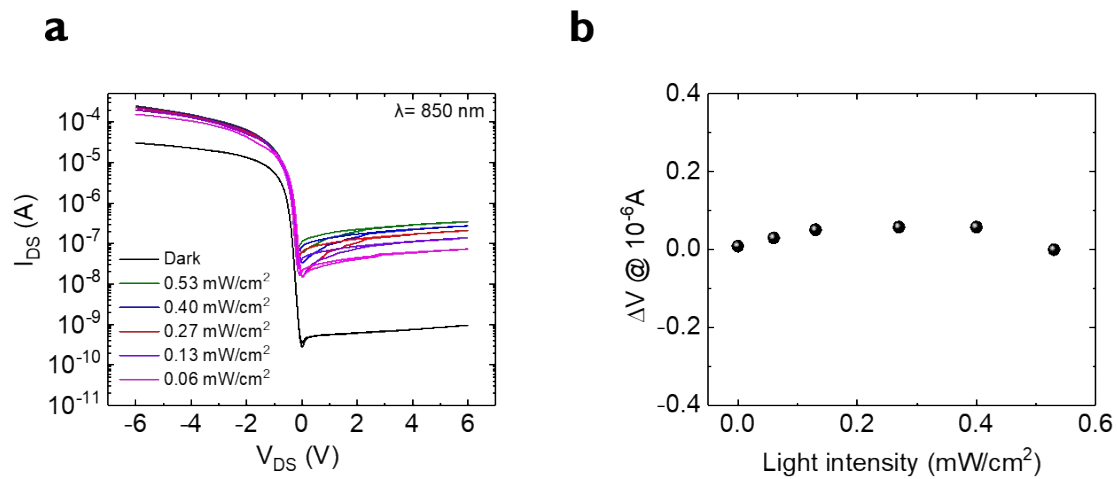
**Figure S3.** The thickness height profile for 2D-MoS<sub>2</sub> film using AFM tool.



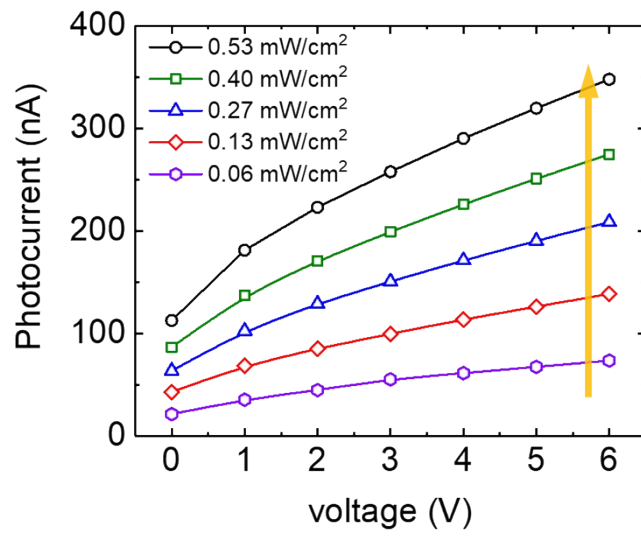
**Figure S4.** The O 1s XPS data of MoS<sub>2</sub>/Si device.



**Figure S5.** Optical image of experimental set-up for current-voltage ( $I-V$ ) measurement.

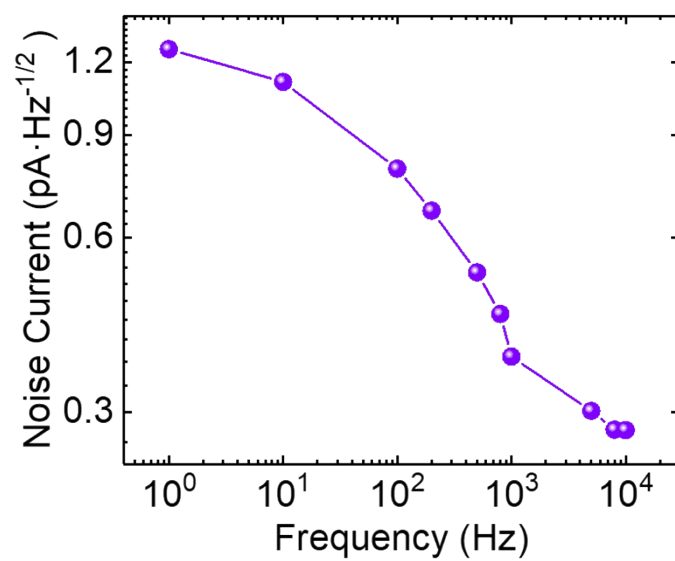


**Figure S6.** a) Hysteresis measurement of the MoS<sub>2</sub>/Si photodetector with different light intensities. b) Value of hysteresis shift under different light intensities.

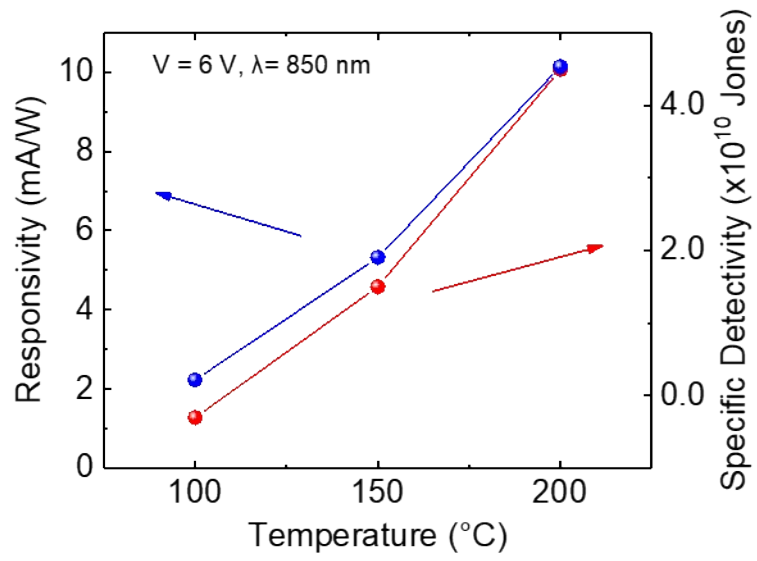


**Figure S7.**  $I$ - $V$  curves of the device obtained under different light intensities from 0.06 to 0.53  $\text{mW}/\text{cm}^2$  at wavelength of 850 nm.

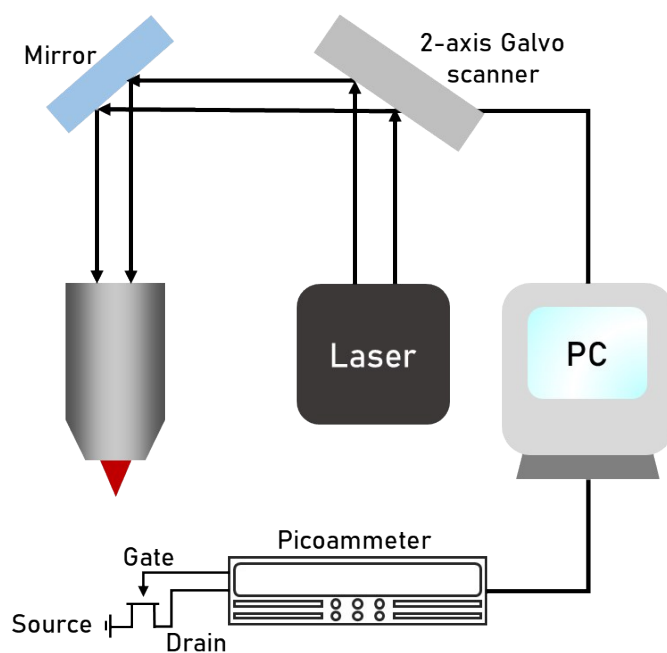




**Figure S8.** The Plots for measured noise currents of flexible 2D-MoS<sub>2</sub>/Si photodetector device as a function of frequency ranging from 1 Hz to 10 KHz.

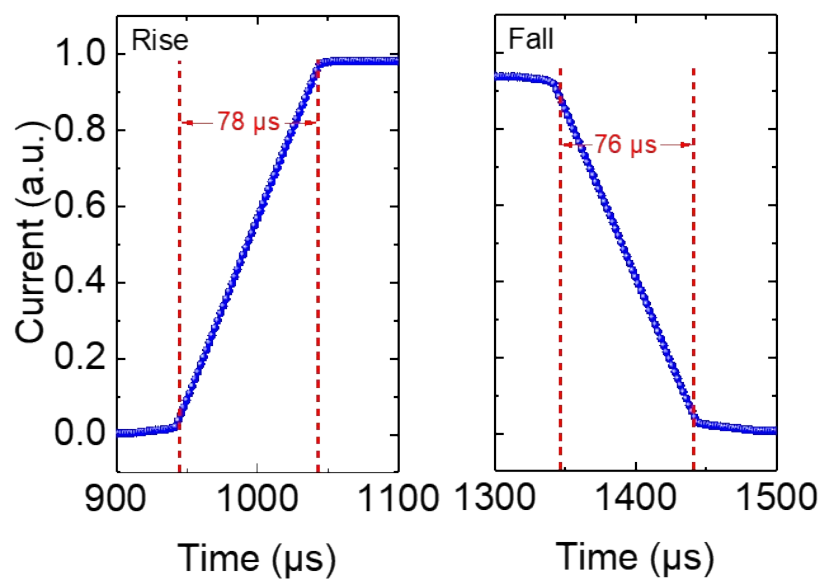


**Figure S9.** The plots for Responsivity (R) and specific detectivity ( $D^*$ ) as a function of incident light intensities with different processing temperatures (100, 150, and 200 °C).

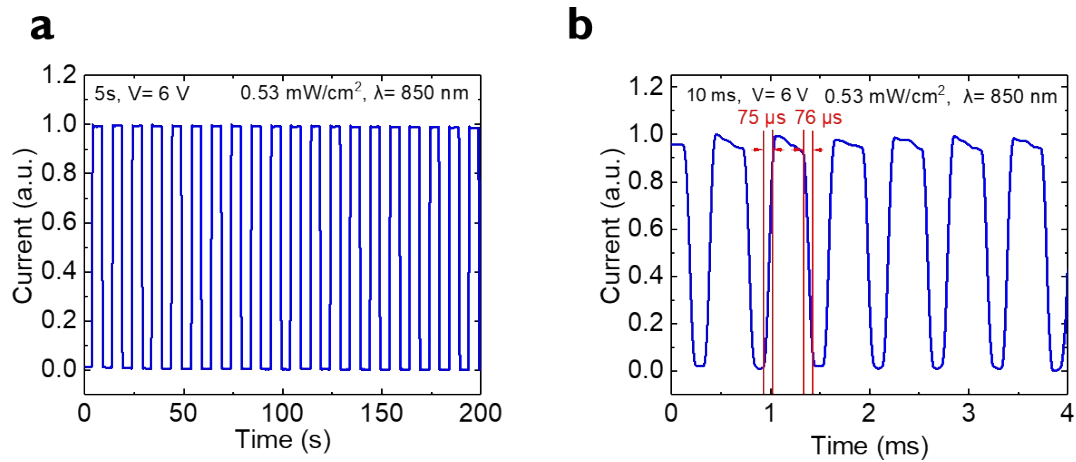


**Figure S10.** Schematic diagram of the scanning photocurrent mapping (SPCM) measurement configuration.

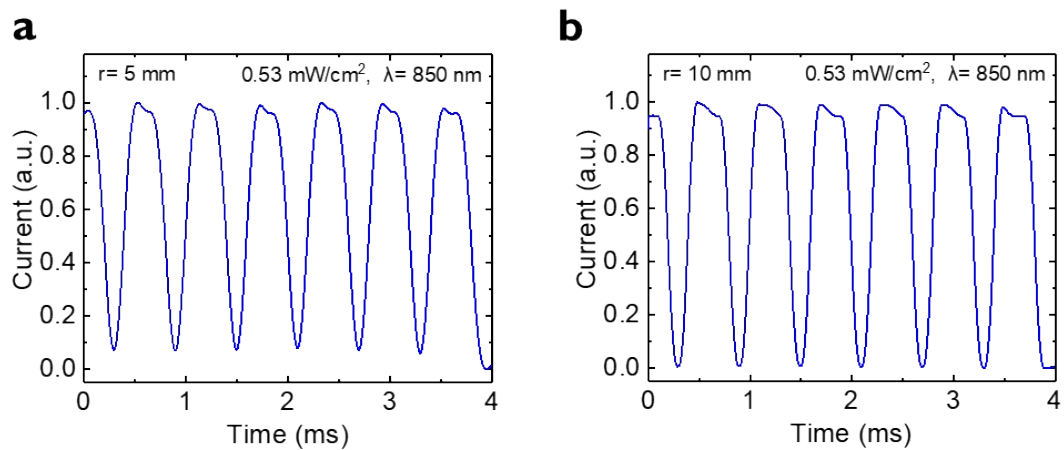
The schematic illustration of scanning photocurrent mapping (SPCM) for measuring time-resolved photocurrent with laser illumination is shown in Figure S10. The continuous wave laser beam generated from solid-state laser diode was focused onto the device. A two axis Galvo mirror for X- and Y-axis rasters the beam across the device. Electrical measurement was performed using Keithley Model 4200 parameter analyzer and bias was controlled using 2502 dual-channel picoammeter. All the measurements were performed under ambient conditions.



**Figure S11.** Enlarged graph of estimating the photoresponse at 1 ms.



**Figure S12.** Photoresponse under pulsed light illumination at a) 5 s, b) 10 ms.



**Figure S13.** Dynamic photoresponse as a function of time with a frequency of 1 ms with different bending radius of a) 5 mm and b) 10 mm.