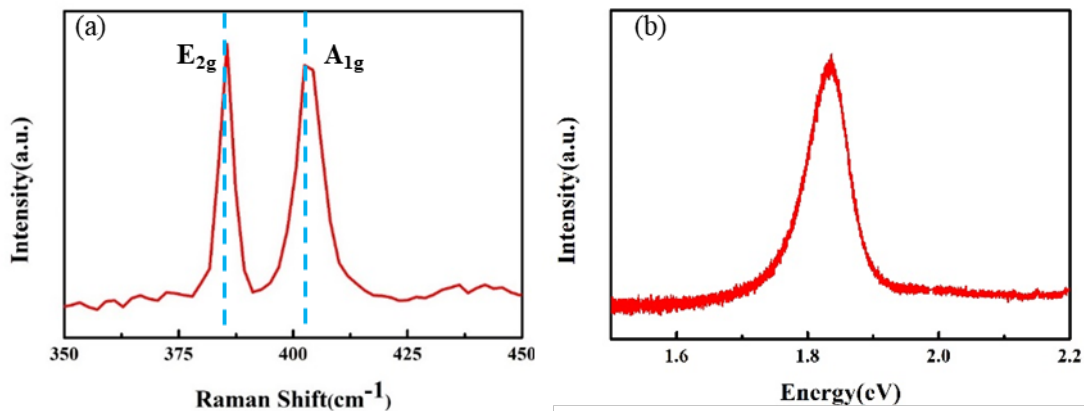


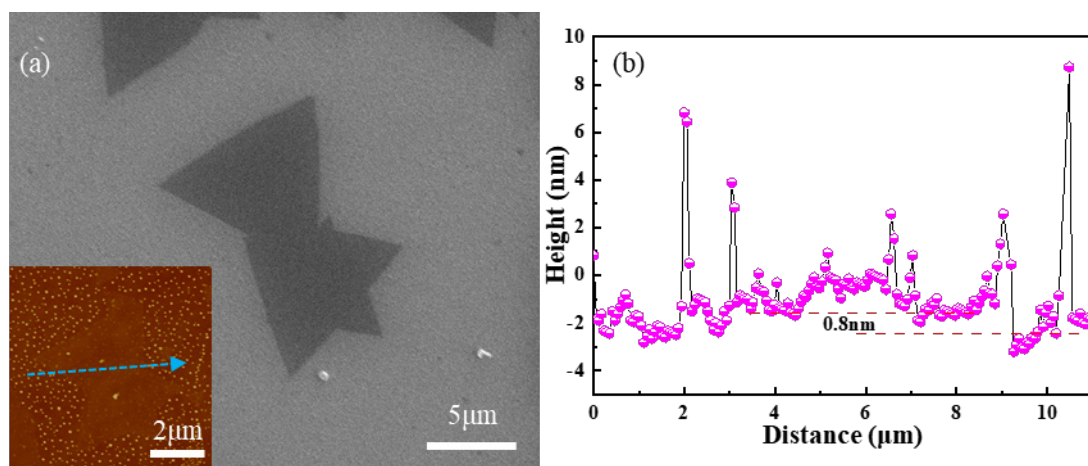
**Figure S1. Schematic diagram of device fabrication.** (a) Schematic diagram of MoS<sub>2</sub> transfer process. (b) Schematic diagram of MoS<sub>2</sub> two-dimensional device preparation process.



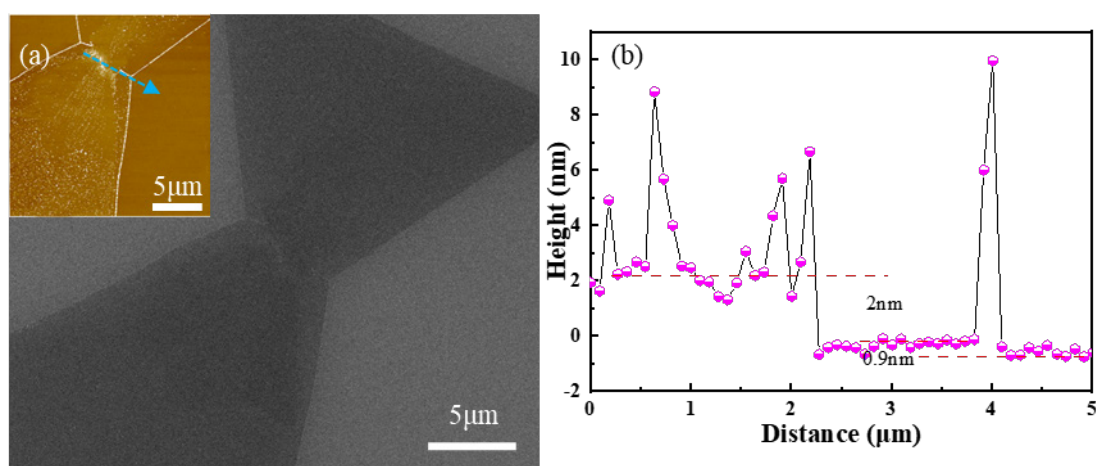
**Figure S2. Raman spectroscopy and photoluminescence spectroscopy of MoS<sub>2</sub>.** (a) Raman spectroscopy. (b) Photoluminescence spectroscopy.

**Table S1. Analysis of X-ray photoelectron spectroscopy**

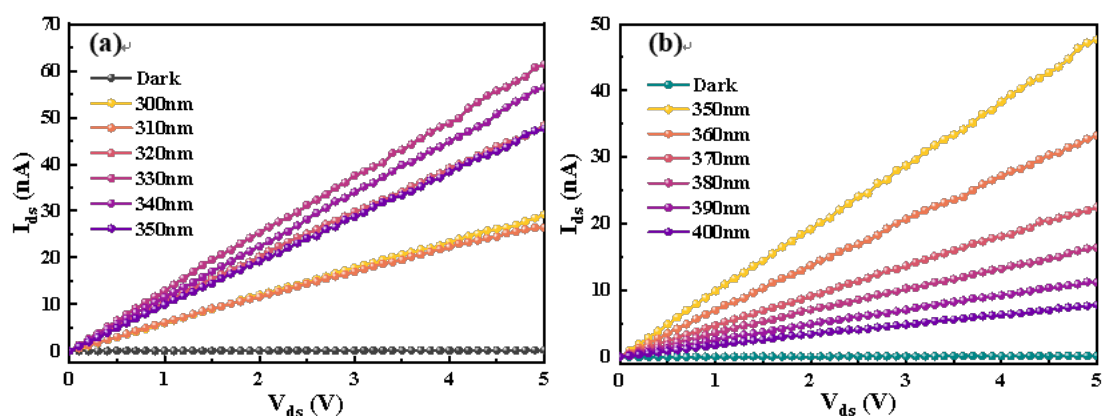
Element	Scanning peak/eV	Theoretical peak/eV	Peak area ratio	Theoretical ratio	Peak	Valence state
Mo	229.8	229.1	1:0.92	3:2	Mo 3d <sub>5/2</sub>	Mo <sup>4+</sup>
	233.0	232.3			Mo 3d <sub>3/2</sub>	
S	162.6	162.1	1:0.47	2:1	S 2p <sub>3/2</sub>	S <sup>2-</sup>
	163.9	163.2			S 2p <sub>1/2</sub>	



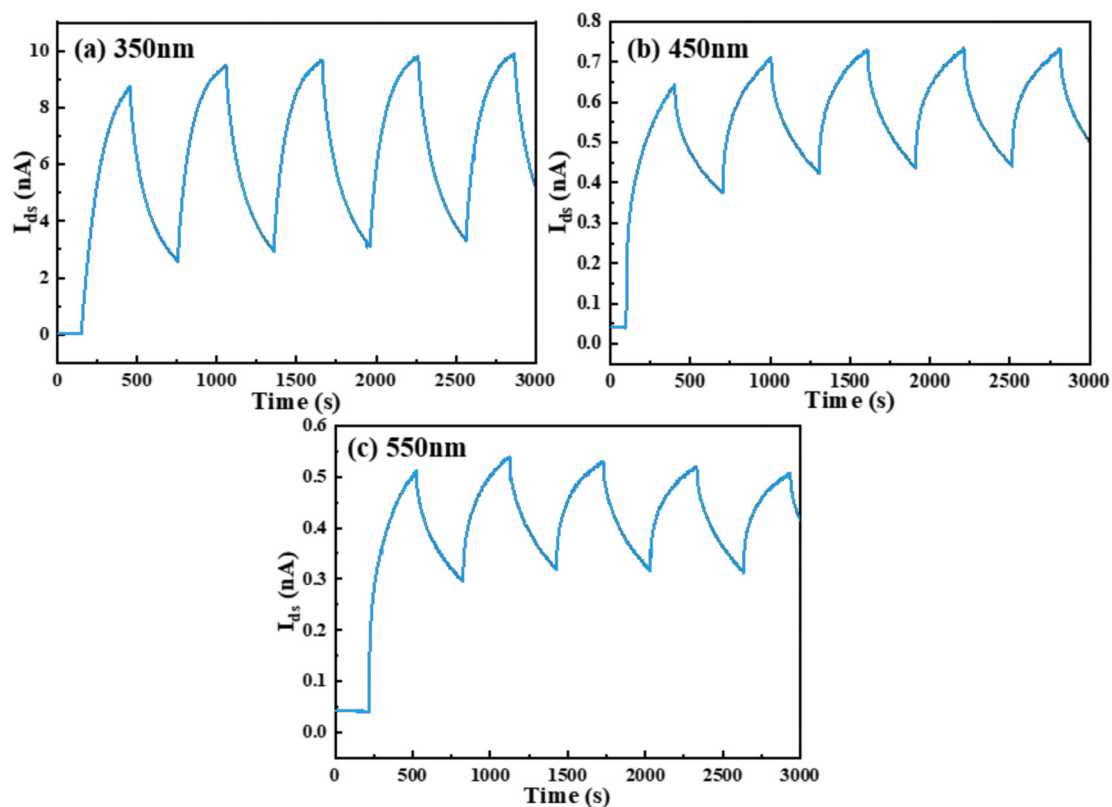
**Figure S3. Contaction between monolayer MoS<sub>2</sub> during lateral growth.** (a) SEM image of MoS<sub>2</sub>. Inset is the selected region AFM image of MoS<sub>2</sub>. (b) Corresponding height profile along the dashed line.



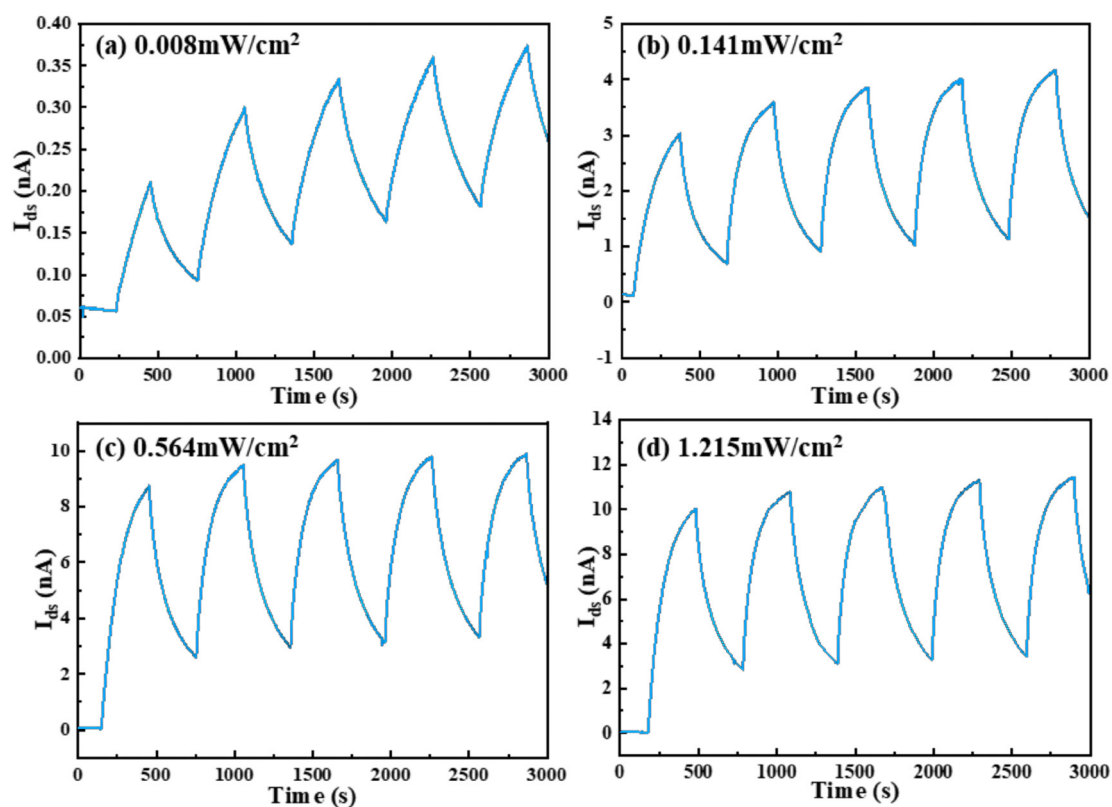
**Figure S4. Contaction between MoS<sub>2</sub> during vertical stacking.** (a) SEM image of MoS<sub>2</sub>. Inset is the selected region AFM image of MoS<sub>2</sub>. (b) Corresponding height profile along the dashed line.



**Figure S5. Output curves of MoS<sub>2</sub> photodetector under 300-400nm monochromatic light with intensity of 0.564 mW/cm<sup>2</sup>.** (a) 300-350nm. (b) 350-400nm.



**Figure S6.** I-t curves of MoS<sub>2</sub> photodetector under different wavelength with intensity of 0.564 mW/cm<sup>2</sup>. (a)350nm. (b)450nm. (c)550nm.



**Figure S7.** I-t curves of MoS<sub>2</sub> photodetector under different light intensities at 350nm wavelength. (a) 0.008 mW/cm<sup>2</sup>. (b) 0.141 mW/cm<sup>2</sup>. (c) 0.564mW/cm<sup>2</sup> (b) 1.215mW/cm<sup>2</sup>.