# **Supplementary Information**

## Ultrafast and self-powered MoS<sub>x</sub>Se<sub>2-x</sub>/Si photodetector with high-

### light trapping structures and SiO<sub>x</sub> interface layer

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#### **Figure caption**

Fig. S1. The transmission spectra of the as-grown  $MoS_xSe_{2-x}$  nanosheets.

Fig. S2. The reflectance spectra of the Si substrate with IP structures and without.

Fig. S3. Histogram of the size distribution of the inverted pyramid structures.

Fig. S4. XPS spectra data of Si 2p core level for Si wafer surface before and after Piranha solution for 30 min.

Fig. S5. I-V curves of the  $MoS_xSe_{2-x}/Si$  photodetectors obtained under 980 nm illumination with different light power densities at zero bias voltage. (a)  $MoSe_2/Si$ , (b)  $MoS_1Se_1/Si$ , (c)  $MoS_{1.5}Se_{0.5}/Si$ , (d)  $MoS_2/Si$ .

**Fig. S6.** I-T curves of the  $MoS_{0.5}Se_{1.5}/SiO_x/Si$  photodetectors obtained under 980 nm illumination with different light power densities and wet oxidization time. (a) 10 min, (b) 20 min, (c) 40 min, (d) 50 min.

Fig. S7. Photocurrent versus the light intensity under 980 nm illumination with  $SiO_x$  interface layer and without.

**Fig. S8.** I-T curves of the  $MoS_{0.5}Se_{1.5}/SiO_x/Si$  photodetectors obtained under different laser wavelength illumination at 1.5 mW/cm<sup>2</sup> light power density with different wet oxidization time. (a) 10 min, (b) 20 min, (c) 40 min, (d) 50 min.



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