Supporting Information

Enhanced Photoresponse in 2D Seamless metal-semiconductor Contact Photodiodes via One-Step Sulfurization Synthesis

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Fig. S1. UPS spectra of (a) MoS_2 , (b) NbS_2 , and (c) $Mo_xNb_{1-x}S_2$ illustrating work function characteristics



Fig. S2. XPS valence band spectra of MoS_2 and NbS_2 , showing the electronic structure and density of states near the Fermi level



Fig. S3. I_{ph}/I_{dark} ratio as a function of drain voltage for $Mo_xNb_{1-x}S_2/n-MoS_2/p-Si/Au$ and $Au/n-MoS_2/p-Si/Au$ photodiode



Fig. S4. Temporal photoresponse of the Au/n-MoS $_2$ /p-Si/Au photodiode



Fig. S5. Light switching dynamics of the NbS₂/n-MoS₂/p-Si seamless contact photodiode under a 100 ms switching speed at (a) 656 nm (red light) and (b) 850 nm (infrared light), demonstrating the device's response to different wavelength in visible and infrared regions



Fig. S6. Dynamic photo-response of the $Au/n-MoS_2/p-Si$ photodiode measured under illumination with light at varying wavelengths (455,530,656 and 850 nm)



Fig. S7. Photocurrent of the Au/n-MoS $_2$ /p-Si photodiode as a function of light intensities under 656 nm light illumination



Fig. R8 (a,b) PL spectra of the MoS_2 and $Mo_xNb_{1-x}S_2$. (c) UV-vis absorbance spectrum of the MoS_2 , NbS_2 , and $Mo_xNb_{1-x}S_2$



Fig. S9. (a) Responsivity and detectivity of the Au/n-MoS $_2$ /p-Si photodiode as a function of wavelength (455 to 850 nm). (b) The EQE values as a function of wavelength