

Supplementary Information

Integrated Bidirectional and Polarization-Sensitive Photodetection in ReSe₂/graphene/WSe₂ Heterostructure

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Note S1: Calculation of surface potential difference (SPD)

The SPD between ReSe_2 , Gr, and 2H-WSe₂ under dark conditions is extracted by Kelvin probe force microscopy (KPFM). Here, the SPD between the probe tip, ReSe_2 , Gr, and 2H-WSe₂ can be followed as:

$$eSPD_{\text{ReS}_2} = (W_{\text{tip}} - W_{\text{ReS}_2}) = 787 \text{ meV}$$

$$eSPD_{\text{Gr}} = (W_{\text{tip}} - W_{\text{Gr}}) = 690 \text{ meV}$$

$$eSPD_{\text{WSe}_2} = (W_{\text{tip}} - W_{\text{WSe}_2}) = 675 \text{ meV}$$

where e stands for elementary charge, and W_{tip} , W_{ReSe_2} , W_{Gr} , and $W_{\text{2H-WSe}_2}$ represent the work function of the KPFM tip, ReSe_2 , Gr, and 2H-WSe₂, respectively. Obviously, the Fermi level difference (ΔE_f) between ReSe_2/Gr and $\text{Gr}/\text{2H-WSe}_2$ is given by.

$$\Delta E_{f1} = eSPD_{\text{Gr}} - eSPD_{\text{ReS}_2} = W_{\text{ReS}_2} - W_{\text{Gr}} = -97 \text{ meV}$$

$$\Delta E_{f2} = eSPD_{\text{WSe}_2} - eSPD_{\text{Gr}} = W_{\text{Gr}} - W_{\text{WSe}_2} = -15 \text{ meV}$$

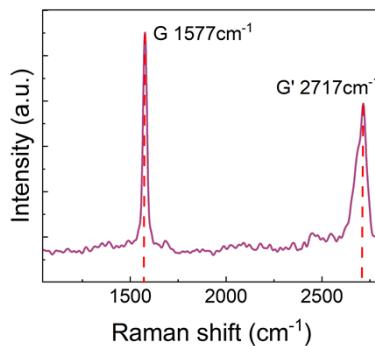


Fig. S1 Raman spectra of Graphene.

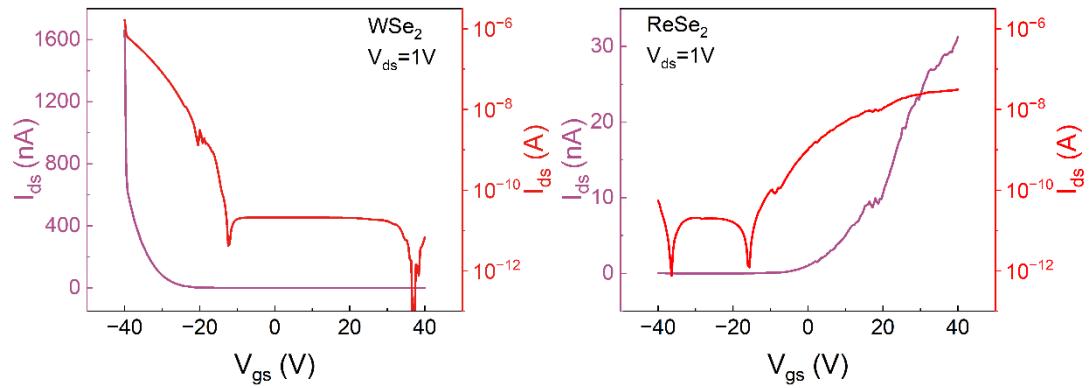


Fig. S2 The transfer characteristic curves for WSe_2 and ReSe_2 , respectively.

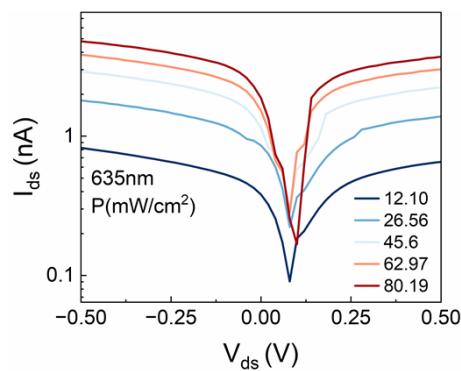


Fig. S3. Device performance in logarithmic coordinates at different optical power levels.

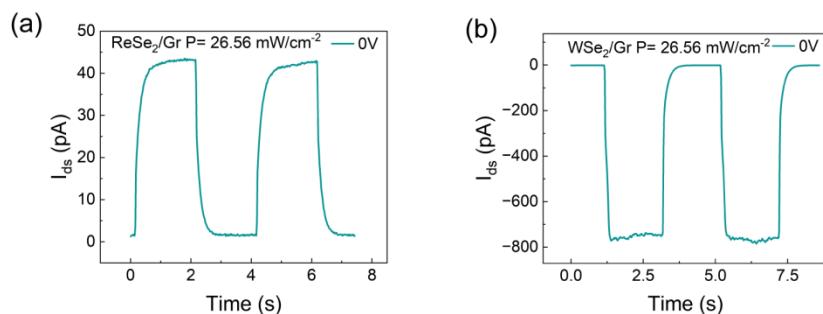


Fig. S4 I-T curves for different Schottky junctions (all connection graphene at the source electrode).