



Supplementary Materials for:

# Enhanced Photodetection Range from Visible to Shortwave Infrared Light by ReSe<sub>2</sub>/MoTe<sub>2</sub> van der Waals Heterostructure

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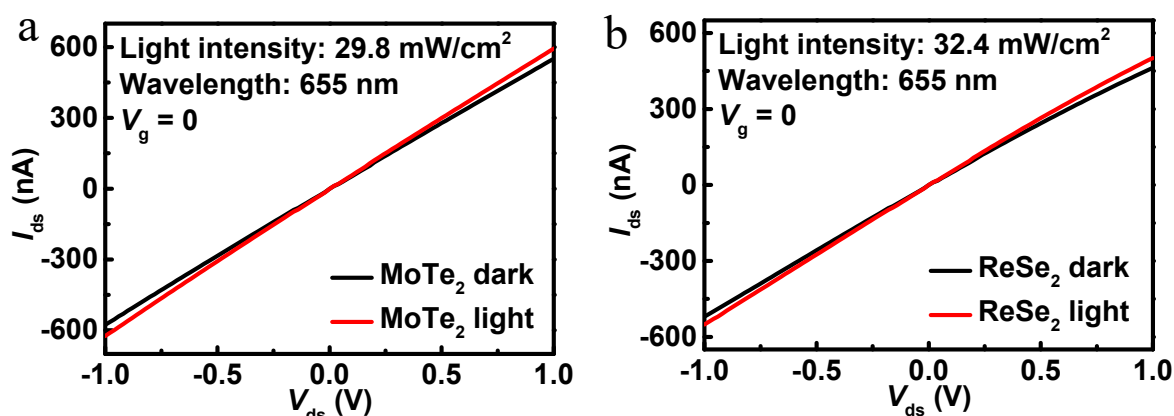


Figure S1.  $I$ - $V$  characteristics of the individual (a) ReSe<sub>2</sub> nanosheets and (b) MoTe<sub>2</sub> nanosheets under dark and red light illumination.

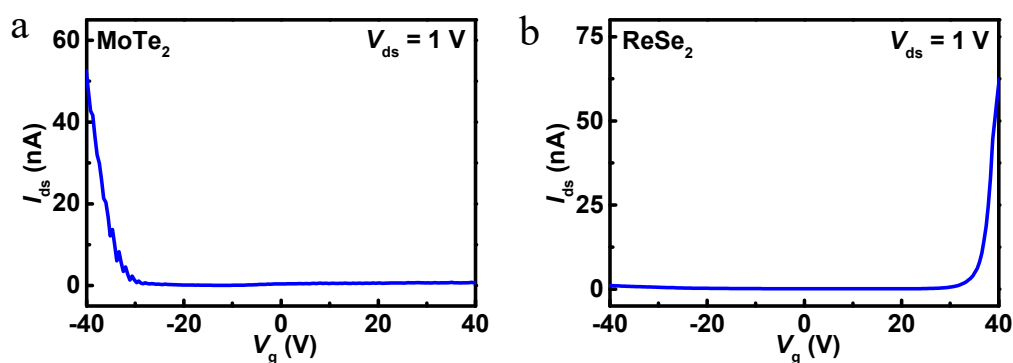
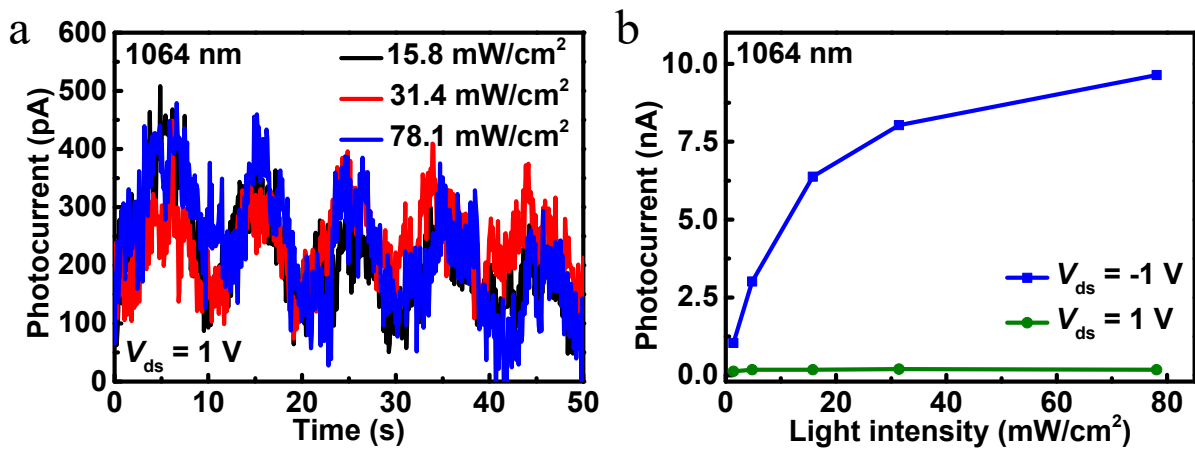
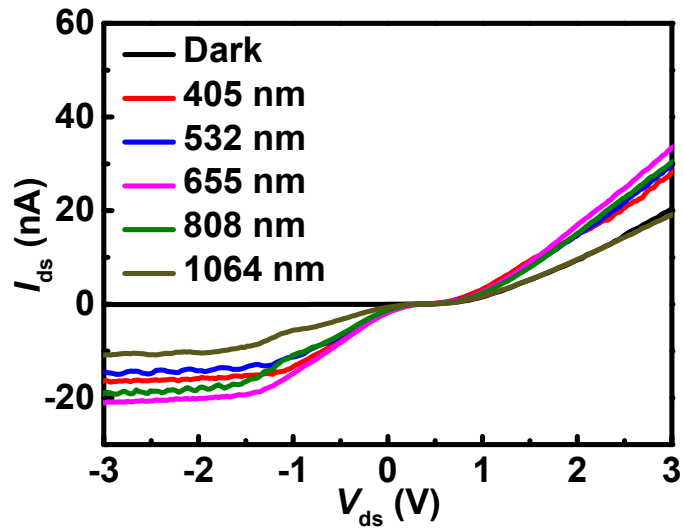


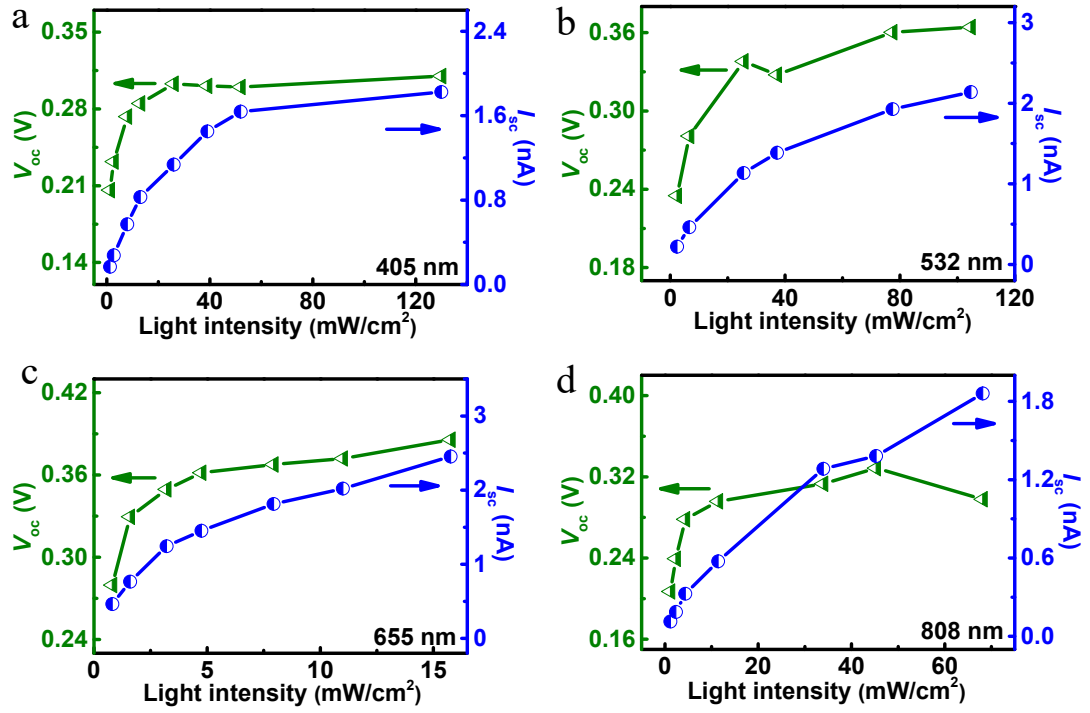
Figure S2.  $I_{ds}$ - $V_g$  curves of the single MoTe<sub>2</sub> (a) and ReSe<sub>2</sub> (b) nanosheets FET.



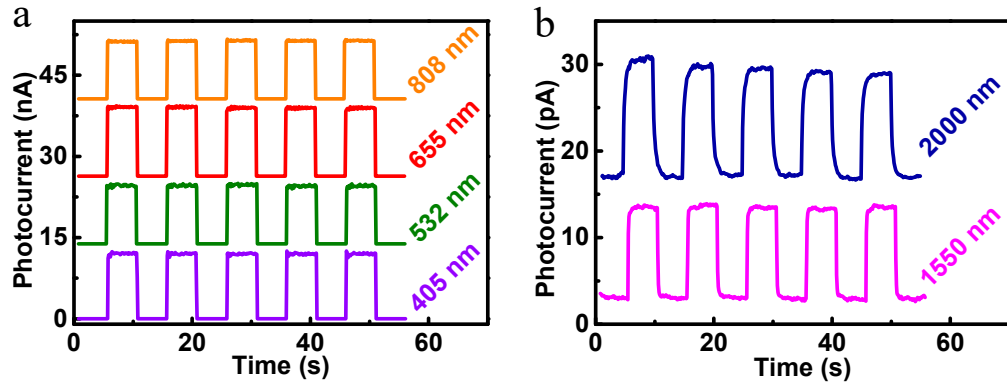
**Figure S3.** (a) Time-dependent photoresponse of the ReSe<sub>2</sub>/MoTe<sub>2</sub> heterojunction under varied light intensities (1064 nm,  $V_{ds} = 1$  V), (b) The photocurrent as functions of light intensity under 1064 nm incident light ( $V_{ds} = \pm 1$  V).



**Figure S4.**  $I$ - $V$  curves of the photodetector under light illumination with different wavelengths.



**Figure S5.** Extracted open-circuit voltage ( $V_{oc}$ , left axis) and short-circuit current ( $I_{sc}$ , right axis) as functions of light intensity under different wavelengths of 405 nm (a), 532 nm (b), 655 nm (c), and 808 nm (d).



**Figure S6.** (a–b) Time-dependent photoresponse of the  $\text{ReSe}_2/\text{MoTe}_2$  heterojunction under various wavelengths from visible to shortwave infrared ( $V_{ds}=-1$  V and  $V_g=0$  V). Measurements were carried out in the atmosphere at room temperature.

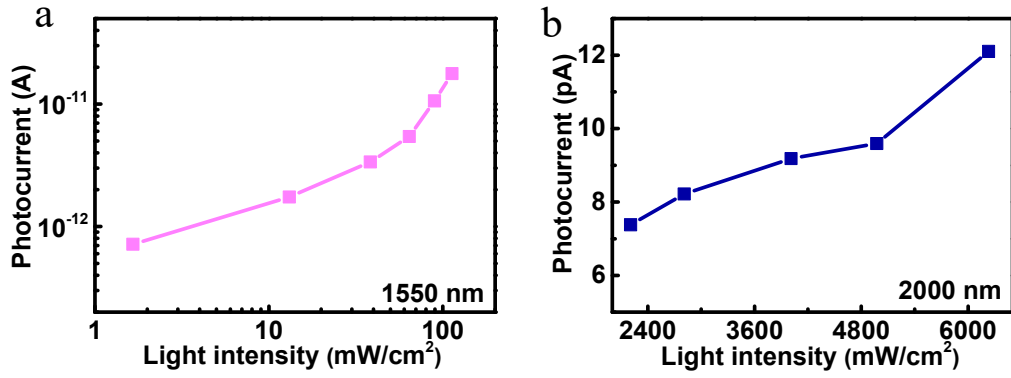


Figure S7. (a) Logarithmic plot of the photocurrent as functions of light intensity under 1550 nm incident light. (b) The photocurrent as functions of light intensity under 2000 nm incident light.

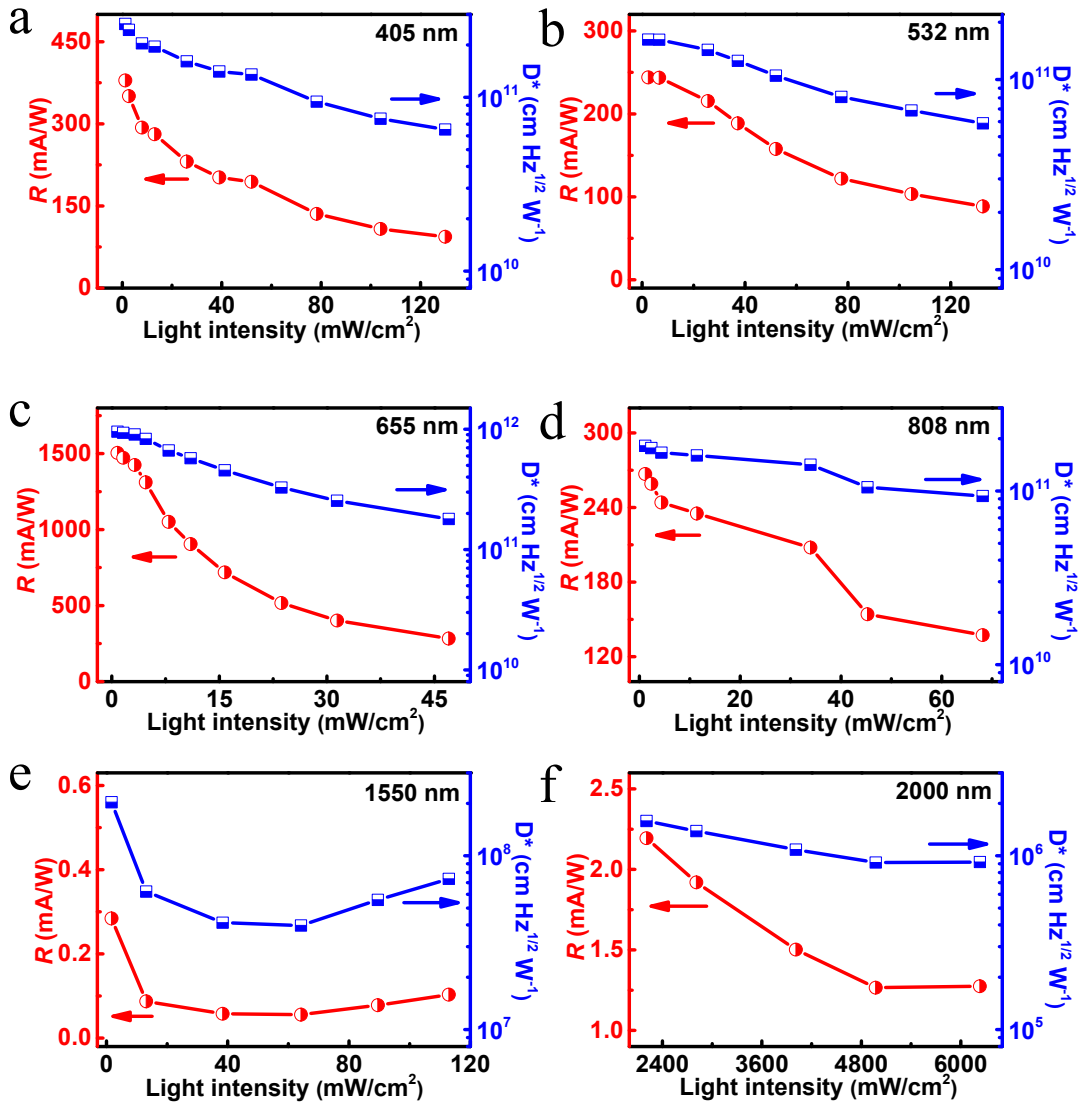


Figure S8. Responsivity and specific detectivity of the  $\text{ReSe}_2/\text{MoTe}_2$  heterojunction photodetector as functions of light intensity under different wavelengths of (a) 405 nm, (b) 532 nm, (c) 655 nm, (d) 808 nm, (e) 1550 nm, (f) 2000 nm.

**Table S1.** Key parameter comparison list of ReSe<sub>2</sub>/MoTe<sub>2</sub> heterojunction photodetector.

Structure	Thickness (nm)	Wavelength (nm)	Responsivity (A/W)	Detectivity (Jones)	Rise/Fall time (ms)	Ref
ReSe <sub>2</sub> /MoTe <sub>2</sub>	15.1/8.4	405-2000	1.05	6.66×10 <sup>11</sup>	5.6/4.2	This work
ReS <sub>2</sub> /ReSe <sub>2</sub>	64/48	400-550	2.1×10 <sup>2</sup>	NA	400	[1]
ReSe <sub>2</sub> /MoS <sub>2</sub>	60/7	633	6.75	NA	NA	[2]
InSe/ReSe <sub>2</sub>	10.7/2.9	300-980	53.29	4.70×10 <sup>11</sup>	0.36/0.39	[3]
WSe <sub>2</sub> /ReSe <sub>2</sub>	6/50	405-980	0.57	NA	NA	[4]
BP/ReSe <sub>2</sub>	5.9/6.5	405-633	0.44	NA	18.0/20.2	[5]
BP/h-BN/ReSe <sub>2</sub>	5.8/0.91/10	532	0.012	28.9×10 <sup>12</sup>	NA	[6]
GeSe/ReSe <sub>2</sub>	7/9	405-1550	2.89×10 <sup>5</sup>	4.91×10 <sup>13</sup>	0.016/ 0.02	[7]
ReS <sub>2</sub> /ReSe <sub>2</sub>	6.5/5.5	350-980	126.56	1.76×10 <sup>11</sup>	0.006/ 0.0089	[8]
ReSe <sub>2</sub> /WSe <sub>2</sub>	12/25	520	0.28	1.1×10 <sup>12</sup>	NA	[9]
MoTe <sub>2</sub> /ReSe <sub>2</sub>	5.5/5	455-980	5.6×10 <sup>2</sup>	8.1×10 <sup>13</sup>	NA	[10]
Gr/ReSe <sub>2</sub> /Gr	14.5	220-1064	1.5×10 <sup>7</sup>	NA	5420/ 2980	[11]

## References

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