Electronic Supplementary Material (ESI) for Nanoscale.

SUPPORTING INFORMATION

Photovoltaic Effect in Few-Layer ReS_2/WSe_2 Heterostructure

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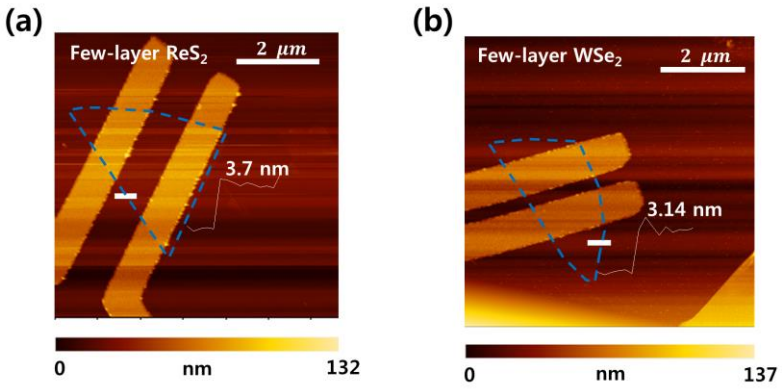

Figure S1. AFM images of the (a) few-layer ReS_2 transistor and (b) few-layer WSe_2 transistor. The thicknesses of few-layer ReS_2 and WSe_2 transistors are approximately 3.3 and 3.5 nm, respectively.

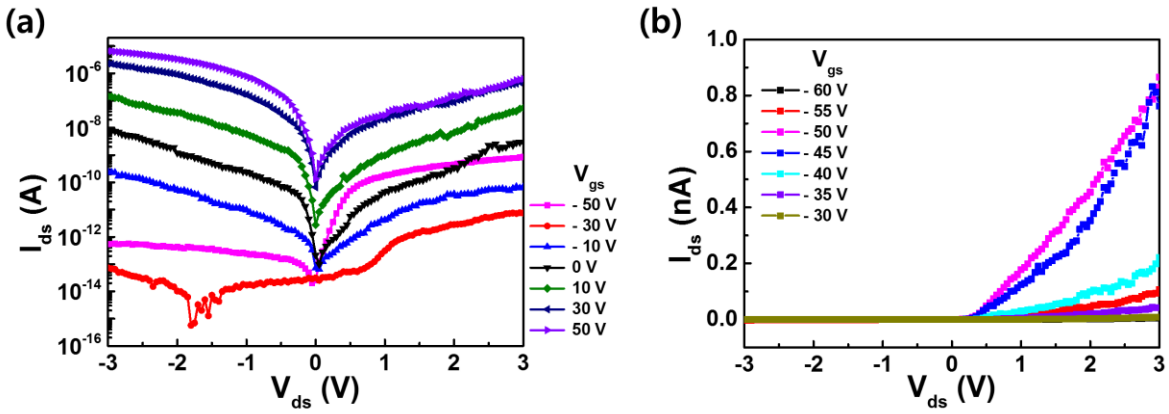

Figure S2. Gate dependence of the few-layer ReS_2/WSe_2 heterostructure. (a) Log I_{ds}–V_{ds} curve depending on the gate-bias, in the range of -50 V to 50 V. (b) I_{ds}–V_{ds} curve in the p-n junction regime (-60 V < V_{gs} < -30 V). At V_{gs} = -50 V, the few-layer ReS_2/WSe_2 heterostructure shows the highest rectification behavior.

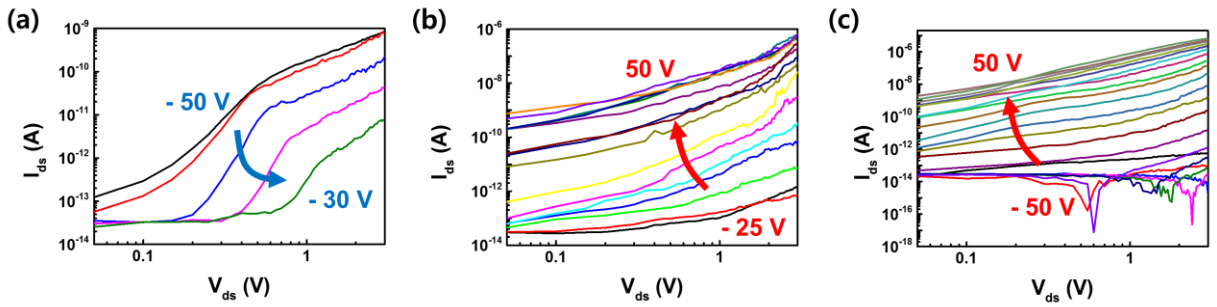

Figure S3. Electrical properties of the few-layer ReS_2/WSe_2 heterostructure. (a) Log I_{ds}–log V_{ds} curve of the forward bias in the p-n junction regime (V_{gs} = -50 to -30 V) and in the n-n junction regime (V_{gs} = -25 to 50 V). (c) Log I_{ds}–log V_{ds} curve of the reverse bias depending on the gate bias. In the forward bias of the p-n junction regime, the few-layer ReS_2/WSe_2 heterostructure has a rapid current increase section only.

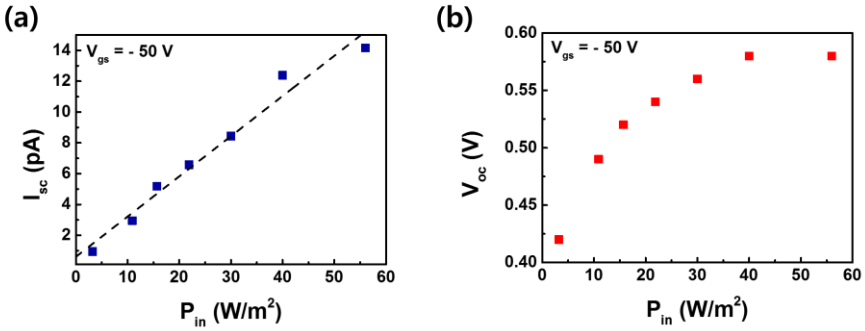

Figure S4. Optoelectronic properties of the few-layer ReS_2/WSe_2 heterostructure. (a) Short-circuit current (I_{sc}) and (b) open-circuit voltage (V_{oc}) with respect to the incident power of the 405-nm laser. I_{sc} exhibits a linear increase, and V_{oc} is saturated with incident power, as I_{sc} and V_{oc} are related to the illumination intensity and bandgap, respectively.

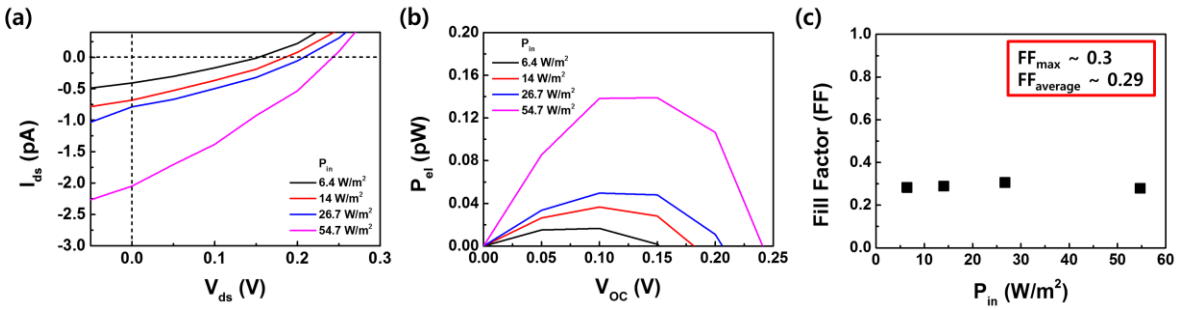

Figure S5. (a) Photovoltaic effect of the few-layer ReS_2/monolayer WSe_2 heterostructure. (b) Electrical power (P_{el}) with an incident laser power (P_{in}). (c) Fill factor with respect to P_{in}. All of measurement were conducted at -50 V gate bias with 405-nm laser. Although both layers have direct band gap, it exhibits low fill factor compared with few-layer ReS_2/WSe_2 heterostructure. Because this structure has very low short circuit current. Therefore, we assume that monolayer has not enough absorbing layer due to ultrathin thickness.