Supporting Information

Improved Contacts to p-Type MoS_2 Transistors by Charge-Transfer Doping and Contact Engineering

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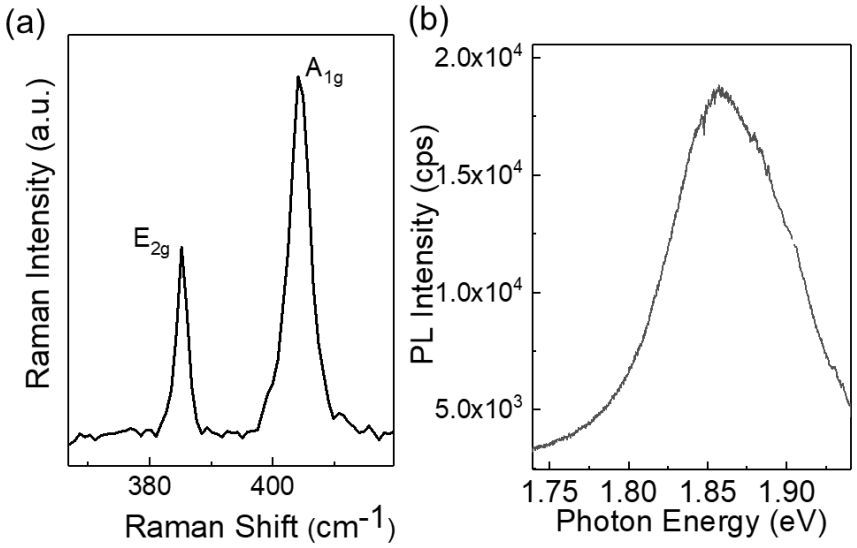

Figure S1. Characterization of the MoS_2 layer thickness. (a) Raman spectrum of MoS_2 used in this study. The A_{1g} and E_{2g} peak frequencies of 404.1 cm^{-1} and 385.0 cm^{-1} confirm it is monolayer.[1] (b) PL spectrum of the monolayer MoS_2.

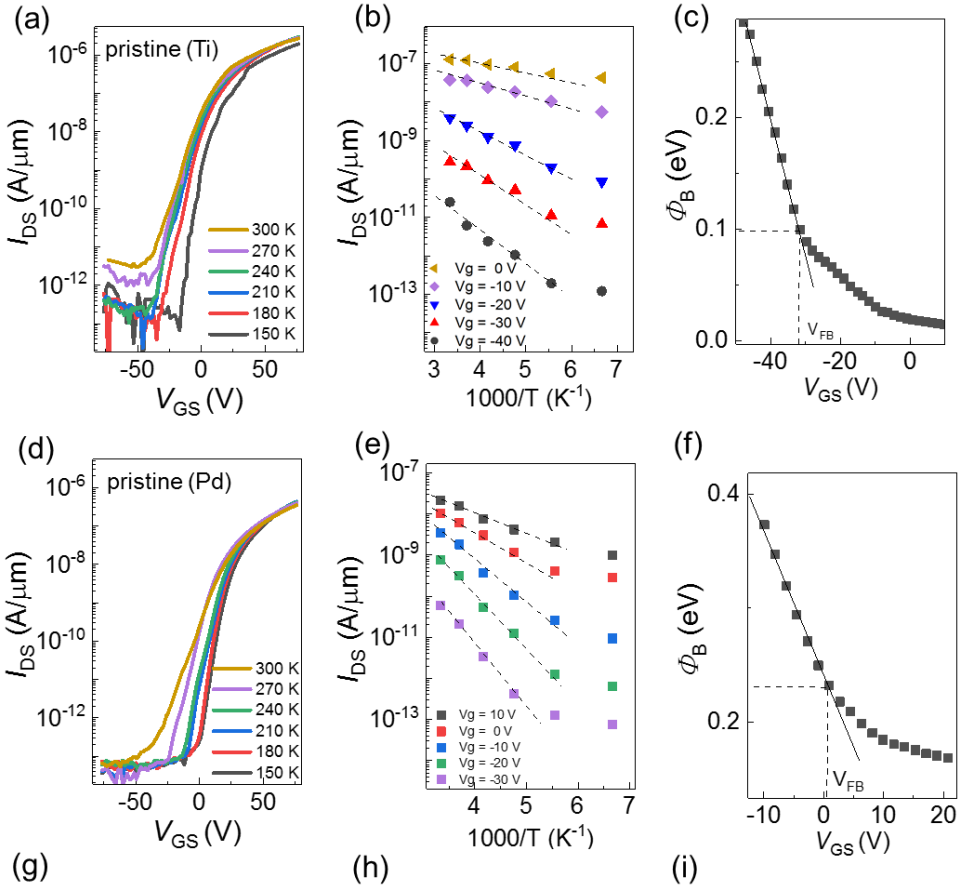

Figure S2. Schottky barrier extraction. For pristine MoS_2 transistor with Ti contacts: (a) experimental transfer characteristics at different operating temperature; (b) Arrhenius-type plot constructed at different gate voltages; (c) extracted Schottky barrier height as a function of applied gate voltages. For pristine MoS_2 transistor with Pd contacts: (a) experimental transfer characteristics at different operating temperature; (b) Arrhenius-type plot constructed at different gate voltages; (c) extracted Schottky barrier height as a function of applied gate voltages. The bias voltage fixed at 5 V and the channel length is 5 μm.

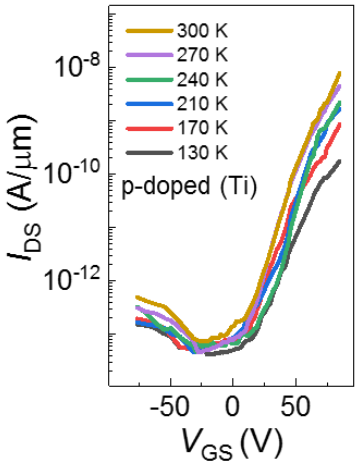

Figure S3 Experimental transfer characteristics for p-doped MoS_2 transistor with Ti contacts at different operating temperature. The tunneling regime was not observed.

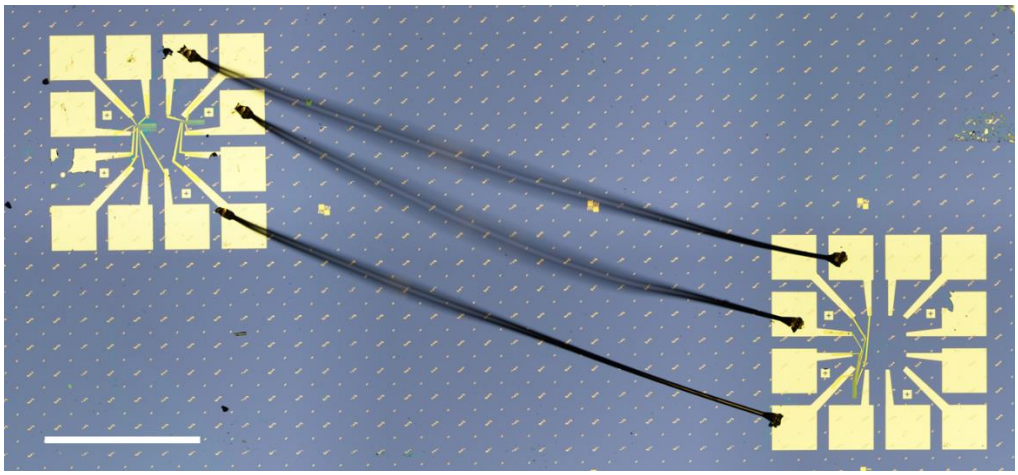

Figure S4. Optical image of the MoS_2 inverter (scale bar is 1 mm). n-FETs and p-FETs were connected through wire-bonding.

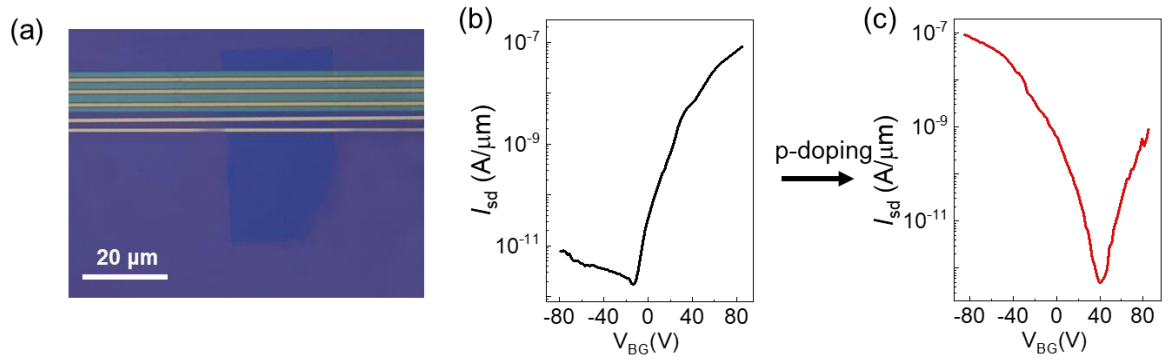

Figure S5. (a) Optical image of the initial design of the inverter. The n-FETs were protected by 100 nm SiO_2. (b) The transfer characteristics of a pristine MoS_2 FET covered by 100 nm SiO_2. (c) The same transistor after 10 min p-doping. V_{DS} = 5 V. The channel length L is 3 μm. The protected transistor showed p-doping effects after 10 min treatment. These data suggest that the dopants can diffuse beneath the SiO_2 layer.

Reference

1. H. Li, Q. Zhang, C. C. R. Yap, B. K. Tay, T. H. T. Edwin, A. Olivier and D. Baillargeat, Adv. Funct. Mater. **22** (7), 1385-1390 (2012).