

Article

Supplementary Materials: Transilient Response to Acetone Gas using the Interlocking p+n Field-effect Transistor Circuit

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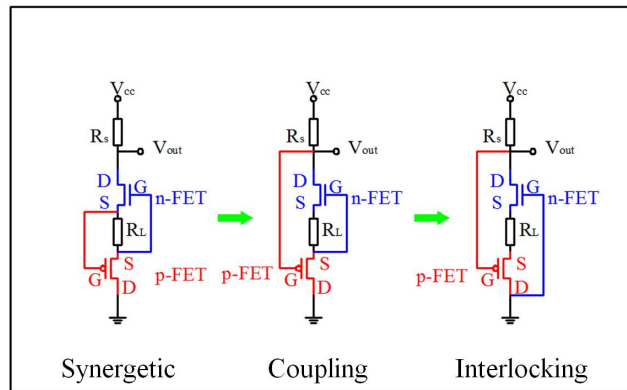


Figure S1. The difference among the synergetic, coupling and interlocking p+n FET circuit for MOX acetone sensor.

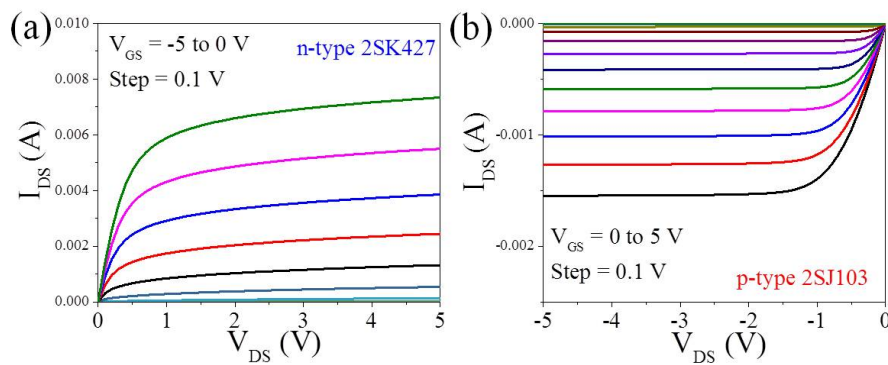


Figure S2. (a) V_{DS} - I_{DS} curves of FET 2SK427, V_{GS} changes from -5 V to 0 V (step is 0.1 V). (b) V_{DS} - I_{DS} curves of FET 2SJ103, V_{GS} changes from 0 V to 5 V (step is 0.1 V).

$$V_{GS(n)} = V_{DS(p)} \dots\dots\dots (7)$$

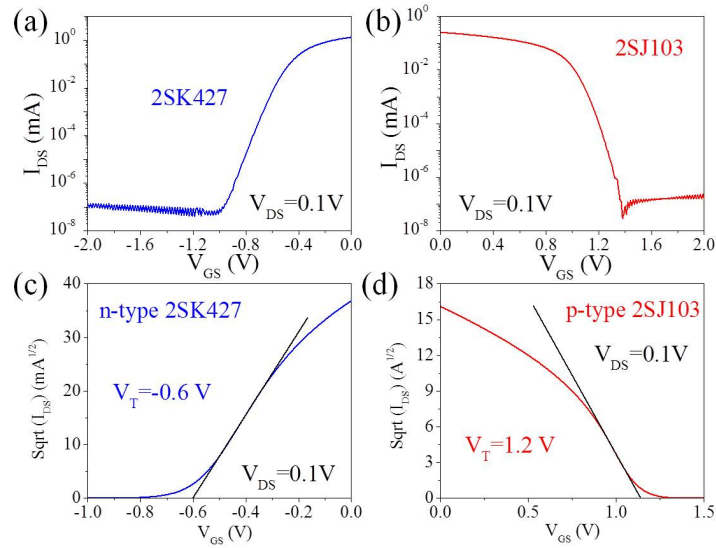
$$V_{GS(p)} = V_{DS(n)} \dots\dots\dots (8)$$

$$V_{GS(n)} = -1.3V \quad (V_{T(n)} = -0.6V)$$

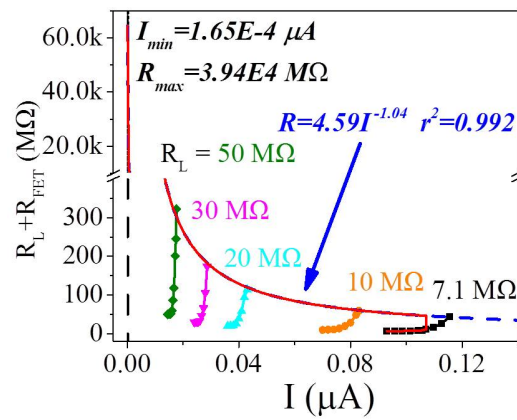
$$V_{GS(p)} = 3.7V \quad (V_{T(p)} = 1.2V)$$

$$I_{min} = 1.65 \times 10^{-4} \mu A$$

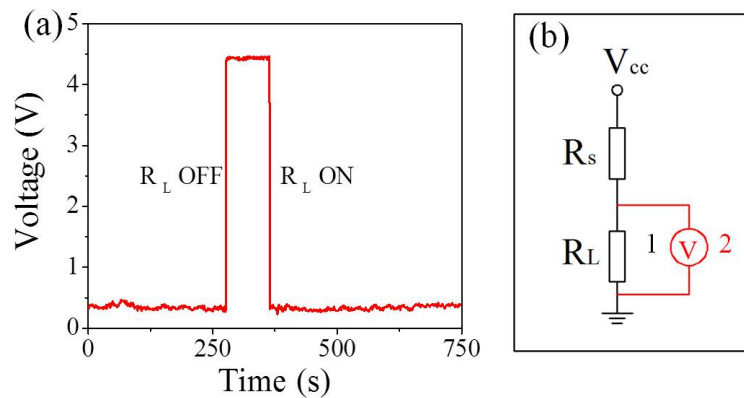
$$V_{OUT} = IR_L - V_{DS(p)} + V_{DS(n)} = 5V$$



25 **Figure S3.** I_{DS} - V_{GS} curves of FETs 2SK427 (a) and 2SJ103 (b). (c) (d) the calculation of V_T .



26
27 **Figure S4.** The approximate curve of interlocking p+n FET circuit with R_L of 7.1 MΩ (red solid
28 curve). The blue dash curve is the fitting curve of the maximum points from five solid curves of
29 n-type FET 2SK427 circuit with R_L 7.1, 10, 20, 30 and 50 MΩ respectively. The fitting curve
30 formula is $R = 4.59 I^{-1.04}$ ($r^2 = 0.992$).



31 **Figure S5.** (a) Output voltage of Mn doped ZnO (MZO) in the traditional electric circuit and the
32 interlocking p+n FET circuit with R_L ON or OFF. (b) Circuit schematic of the static gas sensing test
33 system.

34 When R_L is connected, the circuit 1 is closed. When R_L is cut off, the circuit 1 is open, but the circuit 2 is
35 closed and R_v is calculated to be $\sim 800\text{ M}\Omega$.