ELEC-313
Lab 6: MOSFET Characterization

November 4, 2013

Date Performed: October 30, 2013
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1 Objective

The objective is to construct and observe the operation of a CMOS inverter and NAND gate.

2 Equipment

Transistor: 1N4007	Power supply: HP E3631A
Resistors: 330 Ω (x3), 2.2 kΩ, 33 kΩ	Multimeters: Fluke 8010A (x2),

3 Schematics

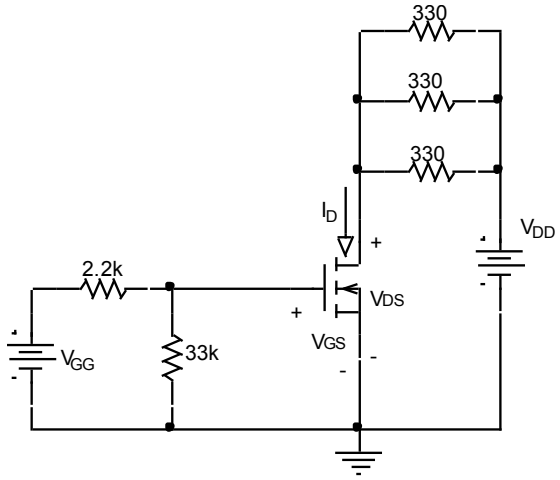

Figure 1: Circuit used in this lab.

4 Procedure

4.1 DC Characteristics

1. Obtain the 2N7000 MOSFET transistor and resistors needed to build the circuit shown.

2. Construct the circuit of figure 2. Use the HP multi-meter to measure the drain current, I_D , and the Fluke multi-meters to measure V_{DS} and V_{GS}. Use the +6 V power supply for V_{GG} and the +25 V supply for V_{DD}.

3. Set V_{GG} to 0 V and V_{DD} to 5 V and measure V_{DS} and I_D.

4. Slowly increase V_{GG} until the transistor just begins to conduct current as evidenced by a small drop in V_{DS}. Record the value of V_{GS} as the Gate Threshold Voltage, V_{TN}. V_{TN}. = V_{GG} to increase V_{GS} by 0.2 V above the threshold. Readjust V_{DD} to return V_{DS} to 5 V, and then measure the drain current (I_D). Record the value of V_{GS} in the first column of table1, and record the value of I_D in the second column (the V_{DS} = 5 V column).

   Adjust

6. Continue to increase V_{GS} in steps of 0.2 V while maintaining V_{DS} at 5 V. Measure the drain current at each step. Record the values of V_{GS} and I_D in table 1. Stop this process when the drain current reaches approximately 80mA.

7. Complete the entries in table 1 by adjusting V_{DD} and V_{GG} to obtain the various required V_{DS} and V_{GS} values, then measuring I_D at each value. Do not exceed 80mA drain current.

4.2 Small-Signal Transconductance

1. Adjust V_{GG} and V_{DD} to obtain V_{DS} = 5 V and I_D = 10 mA.
2. Record the value of V_{GS} as V_{G1}.
3. Record the exact measured value of I_D and assign it to I_{D1}. Use the full resolution of the HP multimeter.
4. Increase V_{GS} by 10 mV and record it value as V_{G2}.
5. Measure I_D , recording it as I_{D2}.
6. Compute the small signal transconductance (Eq 1).

5 Results

6 Conclusion

7 Equations

$$g_m = \frac{I_{D2} - I_{D1}}{V_{GS2} - V_{GS1}} \tag{1}$$

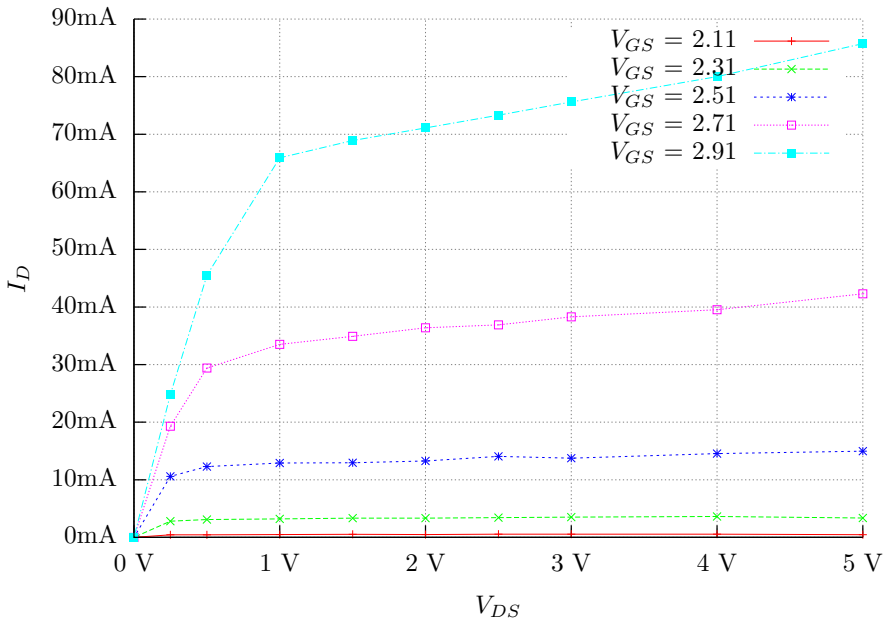

Figure 2: Graph