ECE321 – Electronics I

Lecture 7: Basic Circuits with MOSFETs

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Review of Last Lecture

- Threshold Voltage Equation

Today's Lecture

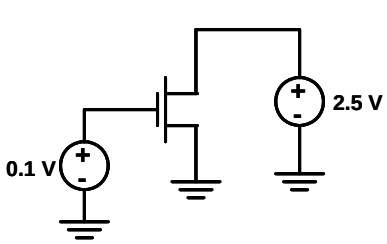
- **Some Example of MOS Circuits**

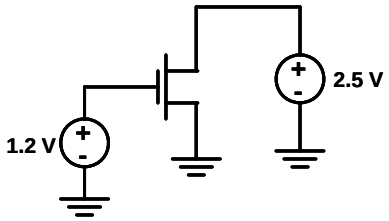
Example 1: Region of Operation

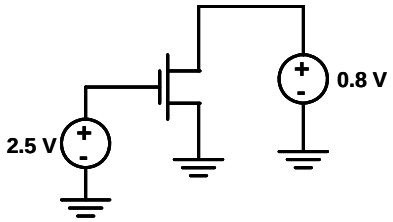
In the circuit configurations below:

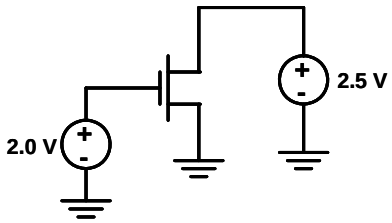
1) Identify Drain and Source terminals assuming the device is an NMOS
2) Identify operating region of each transistor (cutoff, linear, saturation)
3) Write the drain current equation

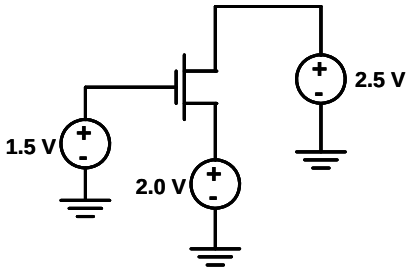
Assume $V_T = 0.5\ V$, $K_n'\left(\frac{W}{L}\right) = 1\ \frac{mA}{V^2}$. Ignore the body effect.

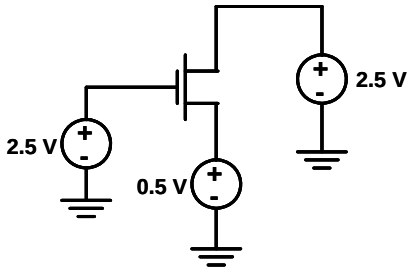


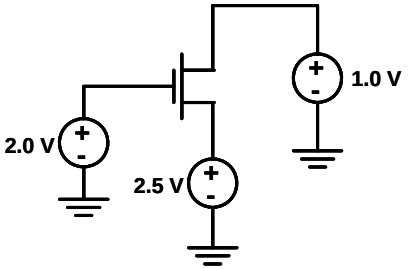






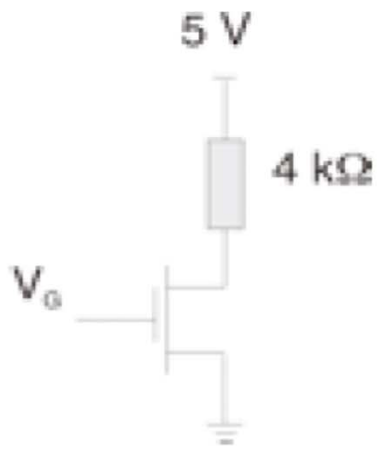






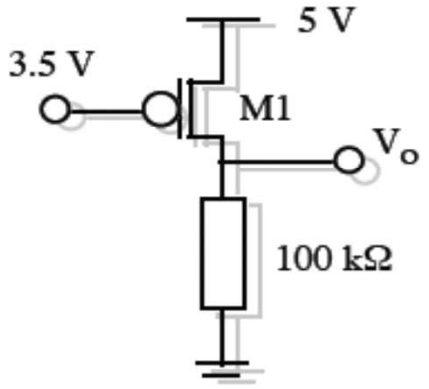
Example 2: Gate Bias Problem

3.7. Given that $K_n = 250\ \mu A$, $V_{tn} = 0.5\ V$, and $W/L = 3$. What V_G makes transistor biased at the saturated/non-saturated boundary.



Example 3: PMOS Circuit

3.12. Calculate I_D and V_O for circuit where $V_{tp} = -0.8$ V, $K_p = 30$ $\mu A/V^2$, and $W/L = 2$.



Example 4: Current Equation

- Find I_{in} as a function of V_{in} assuming $V_T < V_{in} < V_{DD}-V_T$ (assume long channel device and ignore channel length modulation)