Simulation Exercise: PMOS characteristics

1. Download the model file for PMOS transistor(from ALD1107 model file) from the "Downloads" .
2. Write ngspice netlist to plot I_D/V_{DS} characteristics for the same with the voltage V_{GS} varied from -1.5 V to -3 V in steps of -0.5 V. You may vary V_{DS} from 0 V to -5 V.

   Show all the 4 curves on a single plot.
3. From these characteristics, obtain r_{DS} (linear region) for each value of V_{GS}. "Early voltage" and r_0 in saturation region.

Effect of body bias:

1. Bias the transistor in linear region by keeping V_{DS} = 200 mV.
2. Now write ngspice netlist to plot $I_D/\ V_{GS}$ characteristics by varying V_{GS} from 0 to -5 V for V_{SB}=0V.
3. Repeat the above step to get four more sets of $I_D/\ V_{GS}$ characteristics for V_{SB} = 1, 2, 3, and 4 V.
4. Show all five $I_D/\ V_{GS}$ characteristics on the same plot.
5. Obtain the value of threshold voltage from each plot.
6. Plot V_t v/s V_{SB} and find the value of α.

**ALD1107 SPICE Parameter File

.MODEL ALD1107 PMOS (LEVEL=1 CBD=0.5p CBS=0.5p CGDO=0.1p CGSO=0.1p GAMMA=.45
+ KP=100u L=10E-6 LAMBDA=0.0304 PHI=.8 VTO=-0.82 W=20E-6)