

### 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  $V_{SB}=0$ V.
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  $\alpha$ .

\*\*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)