

MOSFET applications

Date: 22 October, 2018

Part 1: Simulation Exercise

1. We will perform the experiment with IC ALD1105 which has DUAL N-CHANNEL AND DUAL P-CHANNEL **MATCHED** MOSFET PAIRS. The internal arrangement of transistors is as shown in Fig. 1.

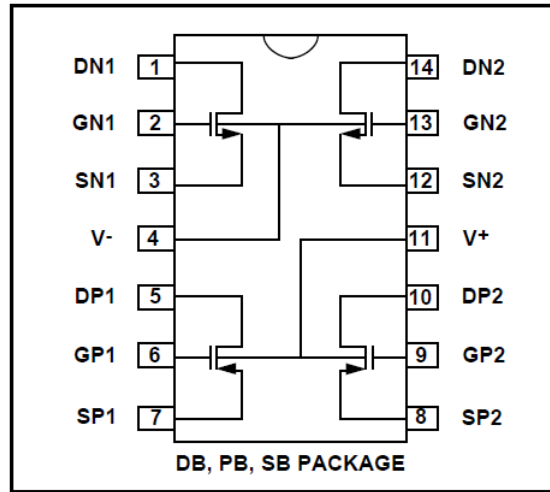


Figure 1: ALD1105 pin diagram

The model file for the transistors are:

```
.MODEL ALD1105N NMOS (LEVEL=1 CBD=0.5p CBS=0.5p CGDO=0.1p CGSO=0.1p GAMMA=.85  
+ KP=225u L=10E-6 LAMBDA=0.029 PHI=.9 VTO=0.7 W=20E-6)
```

```
.MODEL ALD1105P 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=-0.7 W=20E-6)
```

2. Choose any transistor (PMOS/NMOS). Write the ngspice netlist to measure the threshold voltage V_t when the transistor is biased in **linear region**.
3. **Show the plots and the value of V_t extracted to your TA.**
4. Write the ngspice netlist to obtain the transfer characteristics of the circuit shown in Fig. 2. Sweep V_{in} from 0 to 5V and measure the V_{out} .
5. Show the simulation result(plot) to your TA in the lab.

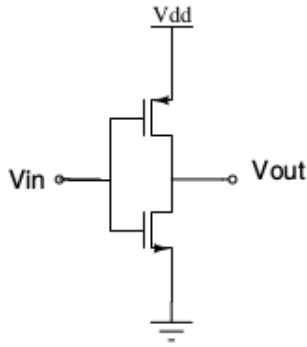


Figure 2: Circuit for measurement of transfer characteristic

Lab experiment: Part 1

1. Connect the circuit to measure V_t of the one of the transistors. You may choose P or N. All are matched transistors. **Bias the transistor in linear region with the appropriate device voltages.**
2. Extract the value of the threshold voltage V_t .
3. Connect the circuit shown in Fig. 2 to measure V_{out} v/s V_{in} characteristics.
4. Vary V_{in} voltage from 0 to 5 V in small steps to capture maximum points on the characteristics. You will need to use a potential divider arrangement using a potentiometer to obtain small steps of about 0.25V for V_{in} .
5. Plot the transfer characteristic.
6. From these readings calculate individual device voltages (V_{GS} and V_{DS} to determine the region of operation of individual transistor for each reading.
7. Divide characteristic depending on the region of operation of the transistors. Indicate them on the plot.

Note: Other sections of the lab experiment will be uploaded later.