File: G/coursesF15/303H/303HF15Midtrm.doc RWN 10/28/15

ENEE 303H Fall 2015 – Midterm Exam Th 10/29/15

Open book open notes but not open computers; 100 points total (75 minutes); if stuck go on to the next problem. Good luck

1. (35 points, 20 min)

Assume an organic Thin Film Transistor (=TFT) is characterized by

$$i_D = \begin{cases} 0 \text{ for } v_{GS} \le V_{th} \\ k(v_{GS} - V_{th})^2 (1 - e^{-v_{DS}/Vo}) \text{ for } V_{th} \le v_{GS} \end{cases}$$

where k, Vo, and V_{th} are positive material constants.

a) Give an expression for g_m at a bias point I_D, V_{GS}, V_{DS} simplified as much as possible in terms of I_D and the overdrive voltage $Vov=V_{GS}-V_{th}$.

b) For V_{th} =3V, Vo=60V, I_D=10uA, V_{GS}=23V and V_{DS}=120V determine k and give its units.

2. (35 points, 20 min)

Attached are (expanded) curves for the ALD1101 NMOS transistor for which the data sheet also gives VTO=0.7V and the output conductance g_o as 200uMho at ID=10mA.

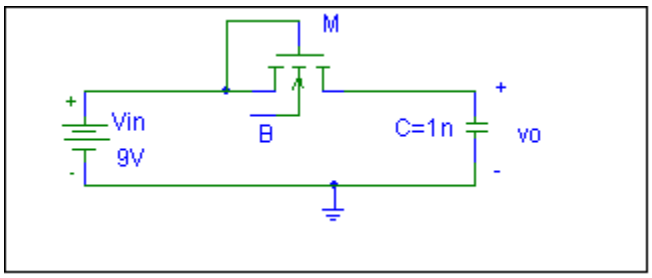
a) Give the range of utput resistance available for $0 \le V_{GS} \le 12V$ over $0 \le V_{DS} \le 160mV$(using the low voltage output characteristics).

b) Design a current sinking current source giving Isource = 80mA using two ALD1101s, a resistor and a 9V power supply (Vdd=9V, Vss=0).

c) What is the lowest voltage on the drain of the output transistor needed to maintain 80mA (ignore g_o)

3. (30 points, 20 minutes)

For the following circuit assume the capacitor is uncharged at t=0-.Assume the transistor has the Spice parameters VTO=1V, $KP/2=2x10^{-5}A/V^2$, W=L, LAMBDA=λ=0, GAMMA=γ=0.1, 2PHIf=$2\phi_f$=0.6 (the latter two for V_{th})



a) Give the connection of the bulk terminal, B, to insure that Vth=VTO.

b) Using that bulk connection set up the differential equation for the capacitor voltage, vo, for t>0, first symbolically using all the Spice parameters and then numerically using the above values of the Spice parameters.

c) Give the final value of the output voltage, vo at t=∞.

d) Discuss what changes with the other two possible connections of the bulk terminal.