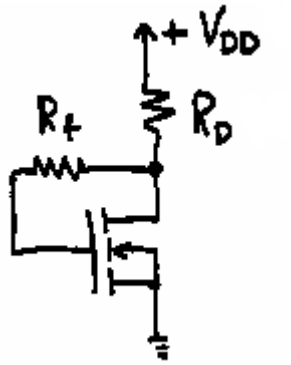
EE2032 Electronics Quiz#7

May 15, 2019

1. The n-channel MOSFET in the circuit has the following parameters:

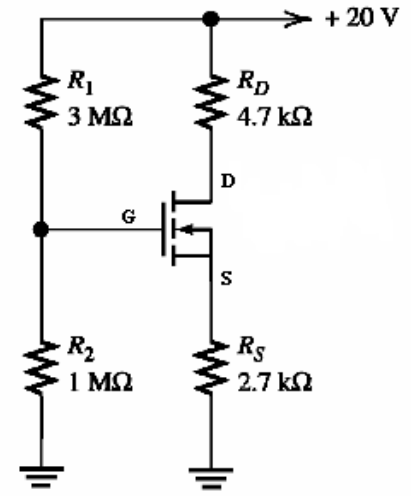


$K = 1\ mA/V^2$,
$V_{GS(Th)} = 2\ V$.

V_{DD}=10V and R_f = 1MΩ.

a) Draw the MOSFET characteristics and the load lines for R_D = 100Ω and 1KΩ on the same graph of I_D–V_{GS}.
b) For these cases, calculate the exact I_D and V_{GS} values.

2. The n-channel MOSFET in the circuit has the following parameters:

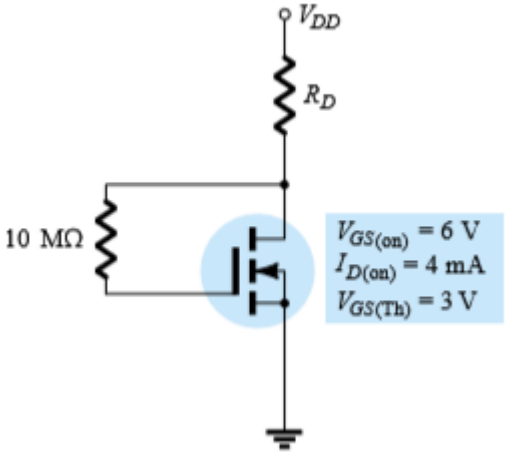


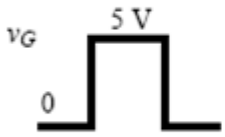
$K = 1\ mA/V^2$,
$V_{GS(Th)} = 2\ V$.

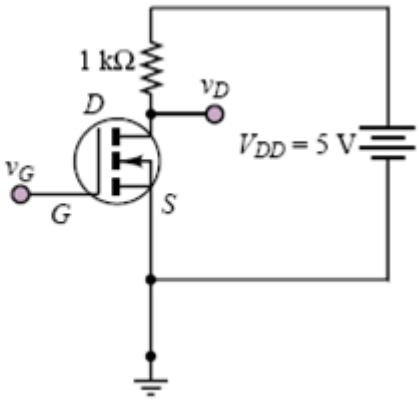
Find I_D and V_{DS}.

3) Example 6.17 p.287, Boylestad 7th

The levels of V_{DS} and I_D are specified as $V_{DS} = \frac{1}{2}V_{DD}$ and $I_D = I_{D(on)}$ for the network of Fig. 6.53. Determine the level of V_{DD} and R_D.



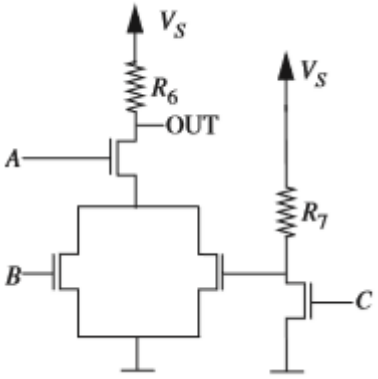




4) The NMOS transistor shown in the figure has V_T = 1.5 V, k = 0.4 mA/V^2. If v_G is a pulse with 0 V to 5 V, find the voltage levels of the pulse signal at the drain output.
(That is; find $\boldsymbol{v_D}$ for $\boldsymbol{v_G}$ = 0 and for $\boldsymbol{v_G}$ = 5 V)

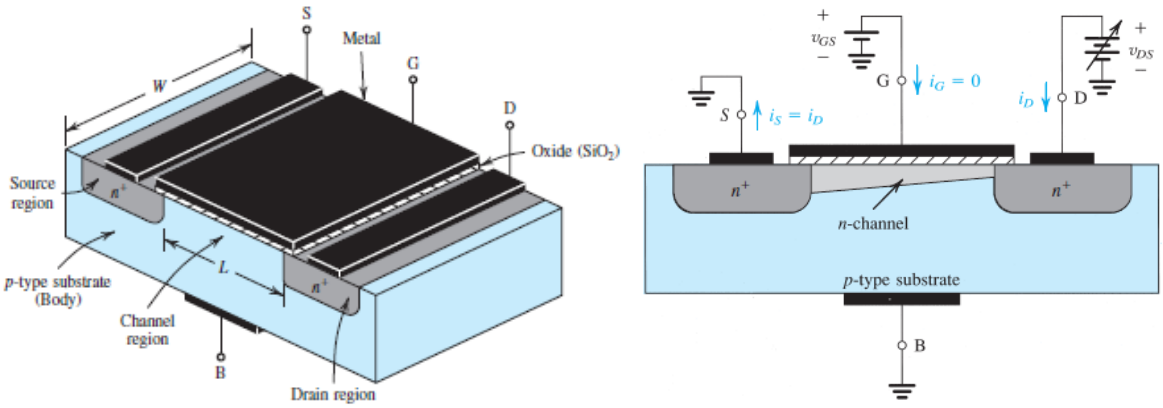
5) Using the MOSFET in Question 4, and resistors, design two input NOR and NAND gates.

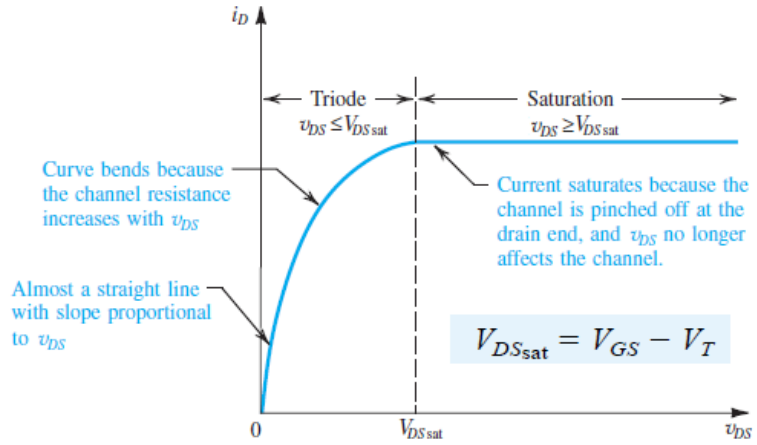
6) What is the logic function implemented by the circuit given.

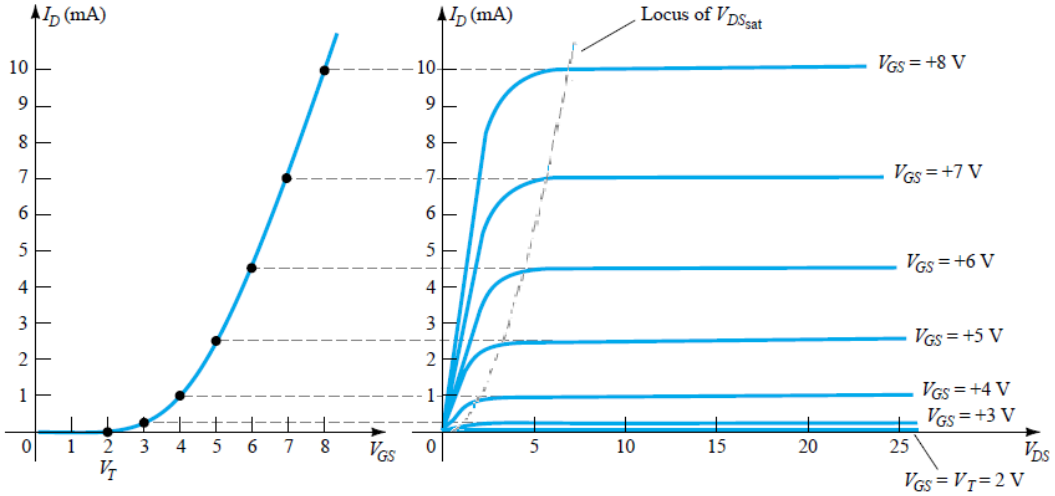


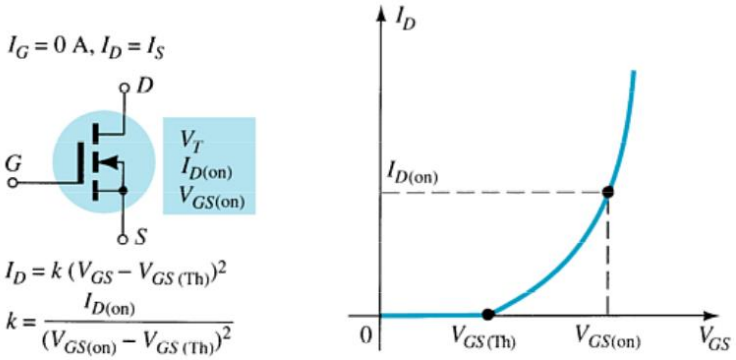
7) How can we make a (1-bit) memory cell using MOSFETs?

Enhancement-Type MOSFETs









- If $V_{GS}<V_{GS(Th)}$, the NMOS is in cut-off, $I_D=0$. Otherwise:
- If $V_{DS}<V_{GS}-V_{GS(Th)}$, the NMOS is in Triode (Ohmic) region, in this case:

$$I_D = k\left[2\left(V_{GS} - V_{GS(Th)}\right)V_{DS} - V_{DS}^2\right]$$

- If $V_{DS}>=V_{GS}-V_{GS(Th)}$, the NMOS is in Saturation region, in this case:

$$I_D = k\left(V_{GS} - V_{GS(Th)}\right)^2$$