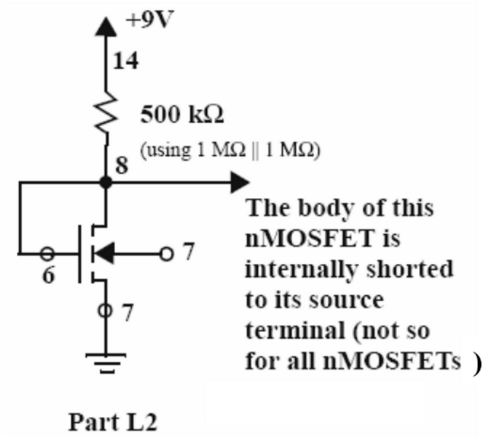
Lab 3

March 6, 2023 9:48 PM

PREPARATION:

Assume device parameters: K_n = 0.6 mA/V2 =K_p, V_{TN} = 1.5 V, V_{TP} = -1.5 V.

P1. For the circuit of **L2**, calculate the numeric value of V_8.



Part L2

n-channel E-mosfet

$k_n = 0.6\,mA/V^2$

$V_{TN} = 1.5\,V$

$V_{TP} = -1.5\,V$

$V_{GS} = V_{DD} - I_D R_D$

① $V_{GS} = 9\,V - I_D\,500k\Omega$

$I_D = \frac{k_n}{2}(V_{GS} - V_{TN})^2$

$\left(\frac{2I_D}{k_n}\right) = (V_{GS} - V_{TN})^2$

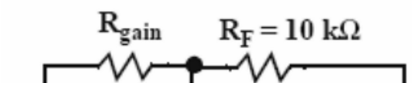
$\frac{I_D}{0.3} = (9 - I_D\,500k - 1.5)^2$

$I_D = (7.5 - I_D\,500k)^2 \times 0.3$

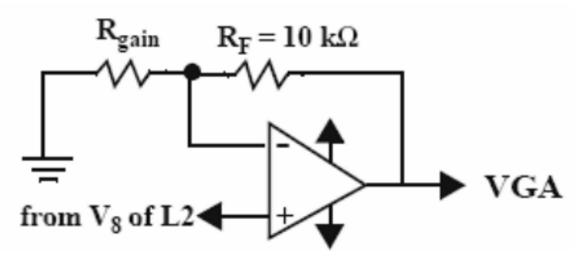
$I_D = 1.5\mu A$

$V_8 = I_D R_D = 0.75\,V$

P2. For the circuit of **L4**, calculate the numeric value of **VGA** for case (ii).



$I^+ = I^- = 0$



$I^+ = I^- = \emptyset$

$V^+ = V^- = V_8$

$I_{Rgain} + I_{Feedback} + \cancel{I^-}^{\emptyset} = \emptyset$

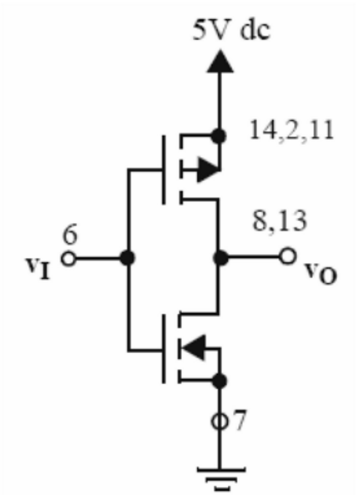
$$\emptyset = \frac{V_8 - \emptyset}{R_{gain}} + \frac{V_8 - V_{GA}}{R_F}$$

$$\emptyset = \frac{V_8}{R_{gain}} + \frac{V_8}{R_F} - \frac{V_{GA}}{R_F}$$

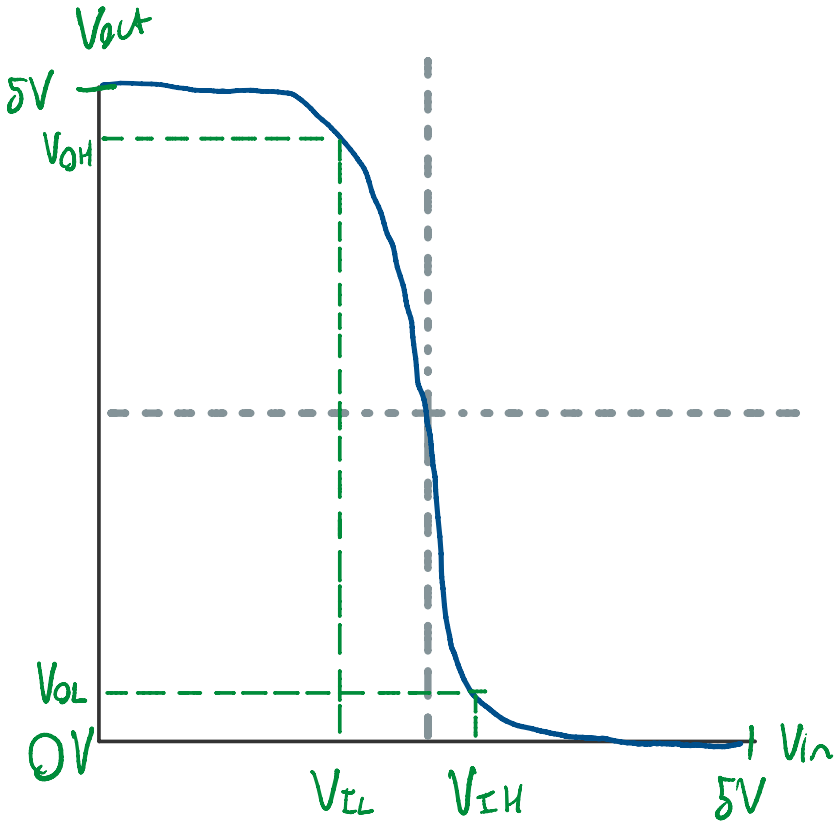
$$V_{GA} = V_8 (1 + R_f/R_{gain})$$

$V_{GA} = 0.75\,(1 + 10k\Omega/10k\Omega)$
$= 1.5V$

P3. For the circuit of **L8,** *neatly* plot the voltage transfer characteristic.



$V_{DD} = 5V$



0V V_{IL} V_{IH} 5V