26-9-12

Lec 25

Feedback

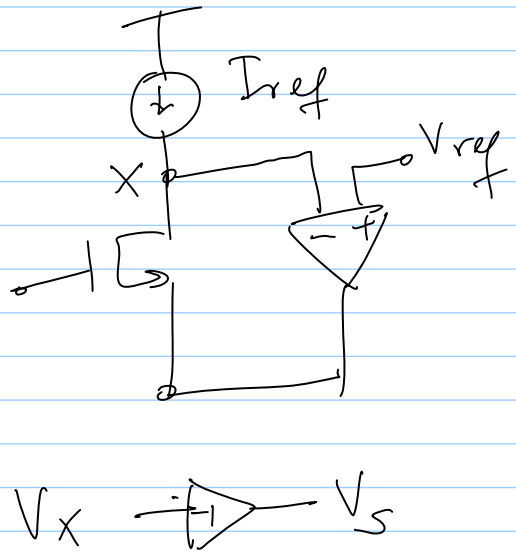
Sense → Control

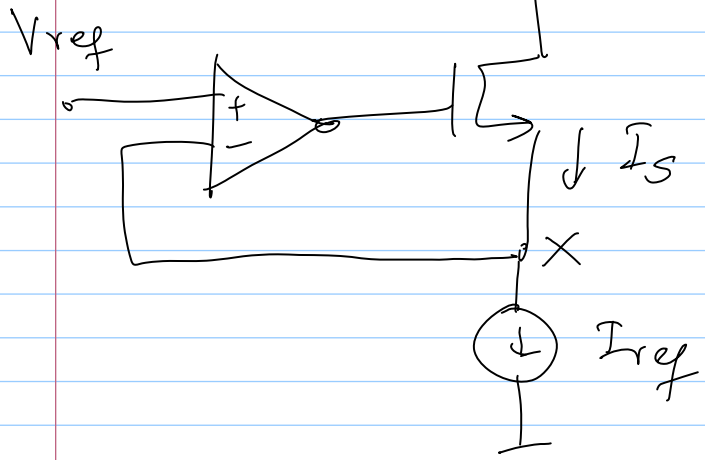
$I_D \rightarrow V_G$

$I_S \rightarrow V_S$

$I_D \rightarrow V_S$

$I_S \rightarrow V_G$





$V_{D_0} = V_{DD} - I_{ref} R$

$I_S > I_{ref} \Rightarrow V_x \uparrow \; (V_G \downarrow)$

$I_S < I_{ref} \Rightarrow V_x \downarrow \; (V_G \uparrow)$

$V_{D_Q} = V_{DD} - I_{ref} R$

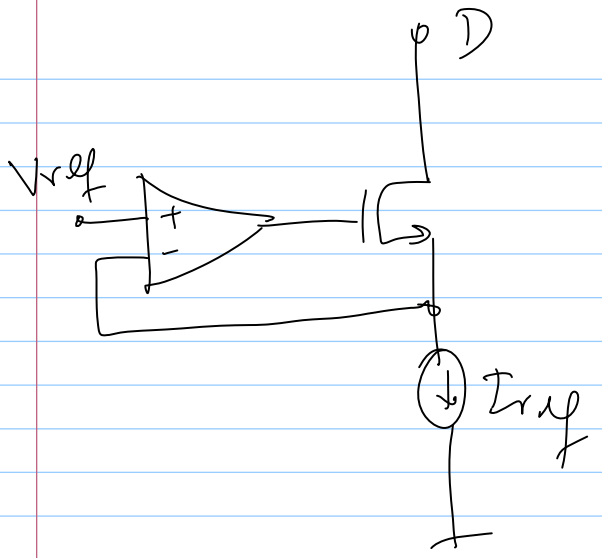
$V_{S_Q} = V_{ref}$

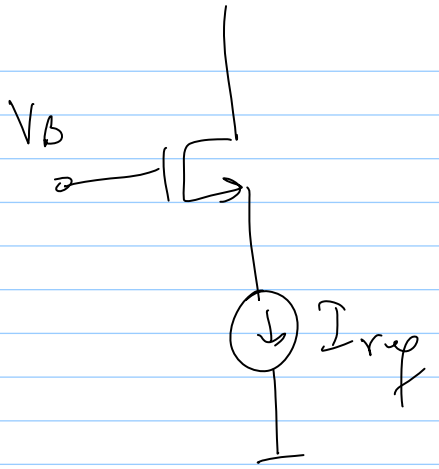
$V_{G_Q} = V_{ref} + V_T + \sqrt{\frac{2 I_{ref}}{\mu C_{ox} \left(\frac{W}{L}\right)}}$

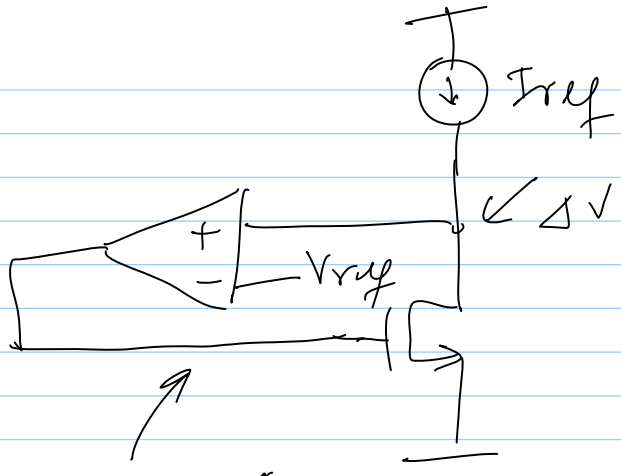
$V_{D_Q} \geq V_{G_Q} - V_T$

$\Downarrow$

condition on V_{ref}

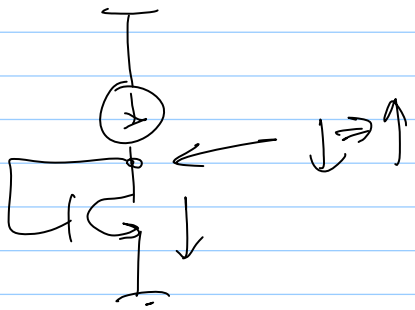


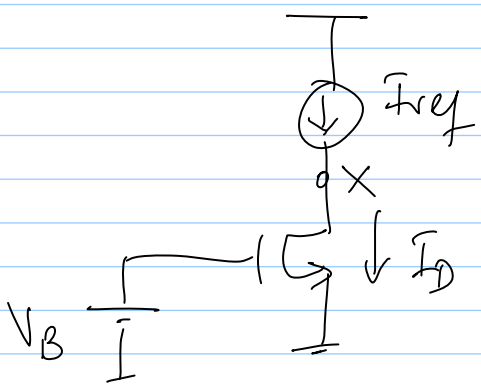


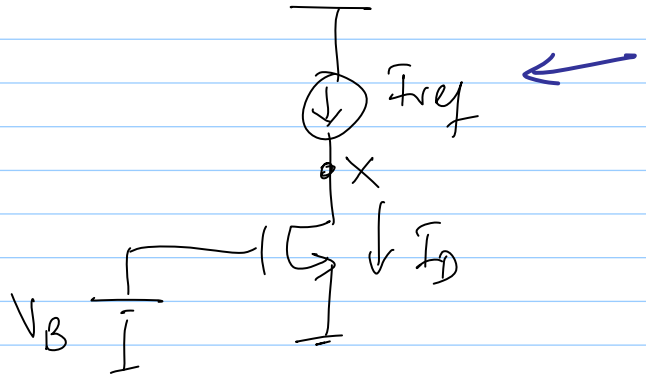


V_{ref}

$V_D \geq V_G - V_T$

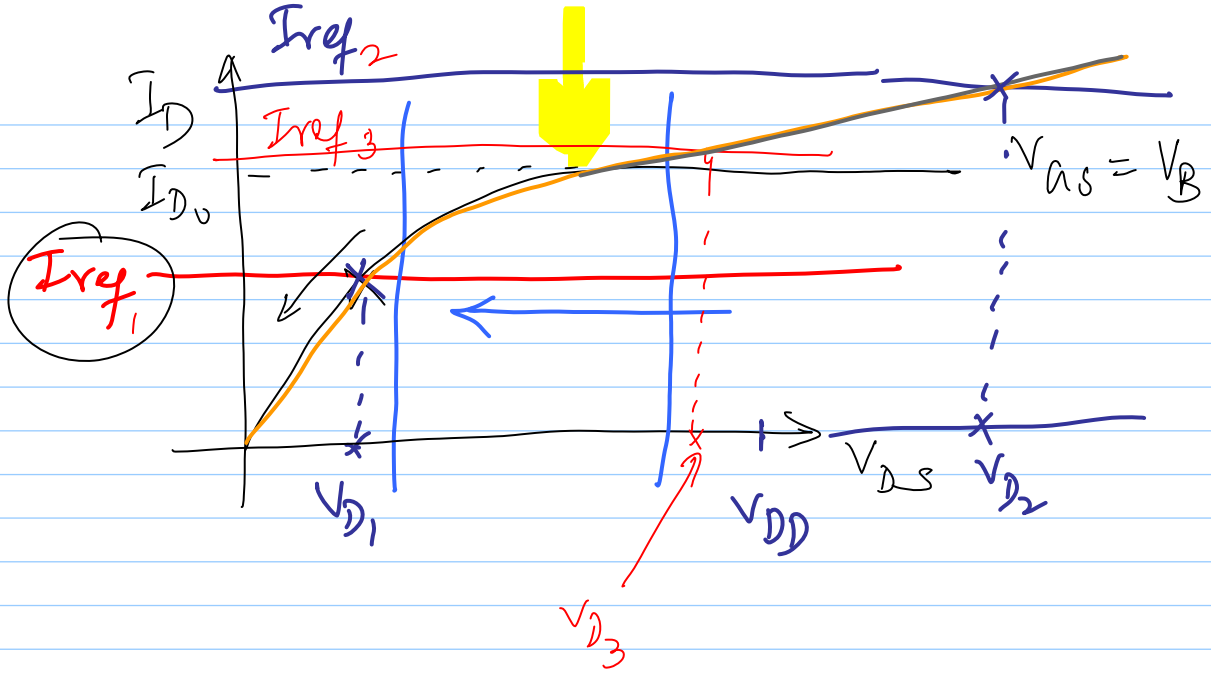


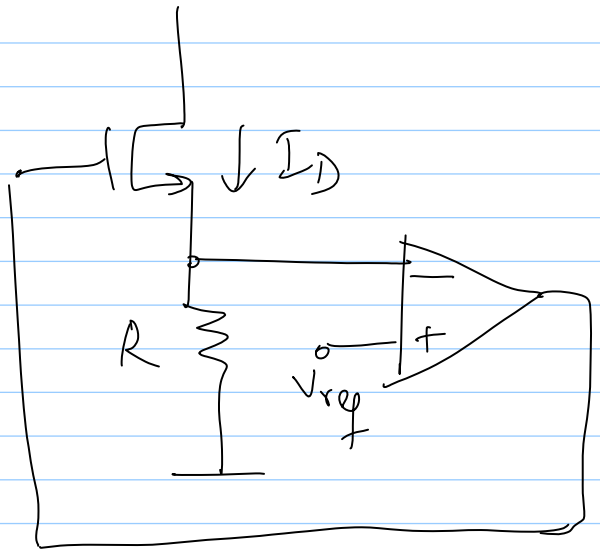




$I_D \neq I_{ref} \Rightarrow$ not possible

↑ sat. assumption wrong





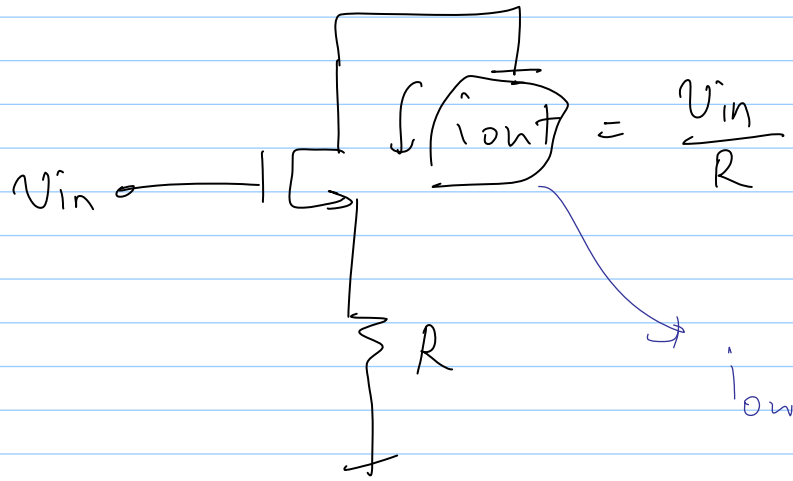
$$V_{ref} = I_D \cdot R$$

VCCS

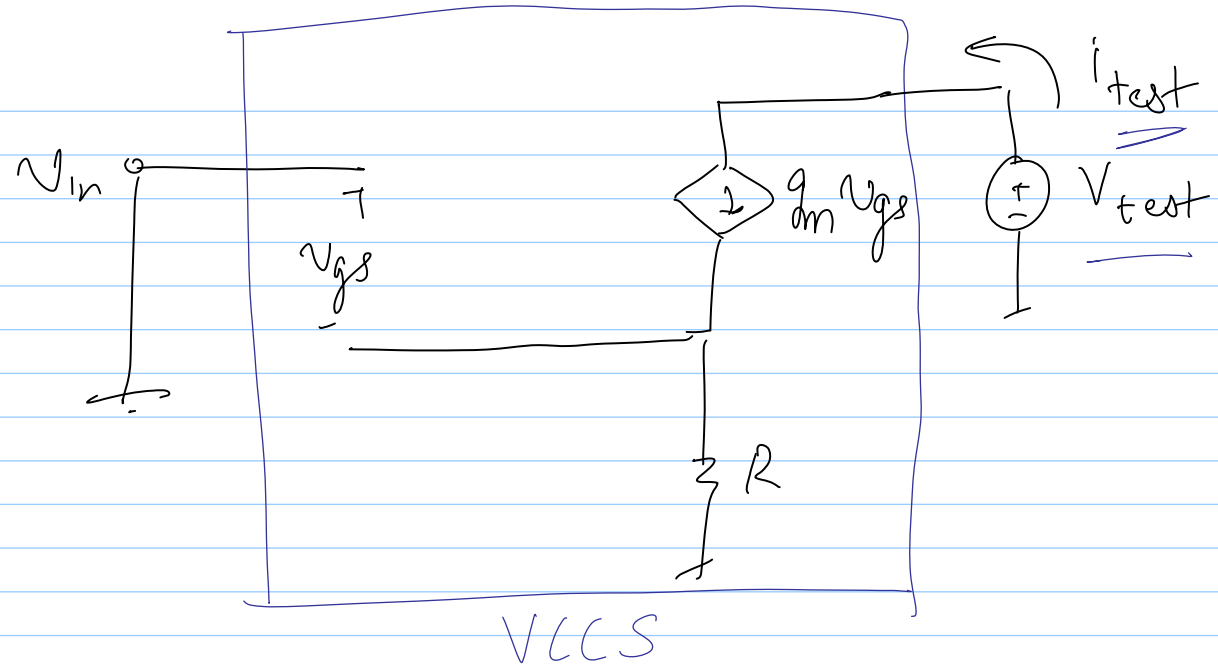
$Z_{in} = \infty$; $Z_{out} = \infty$

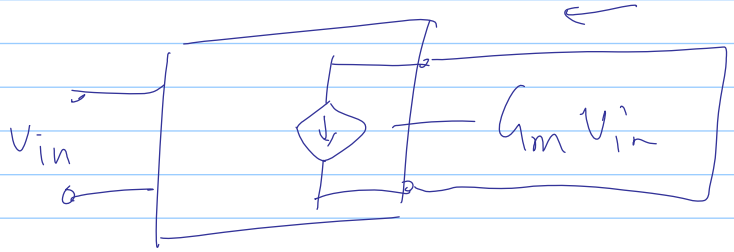
$Z_{in} = \infty$

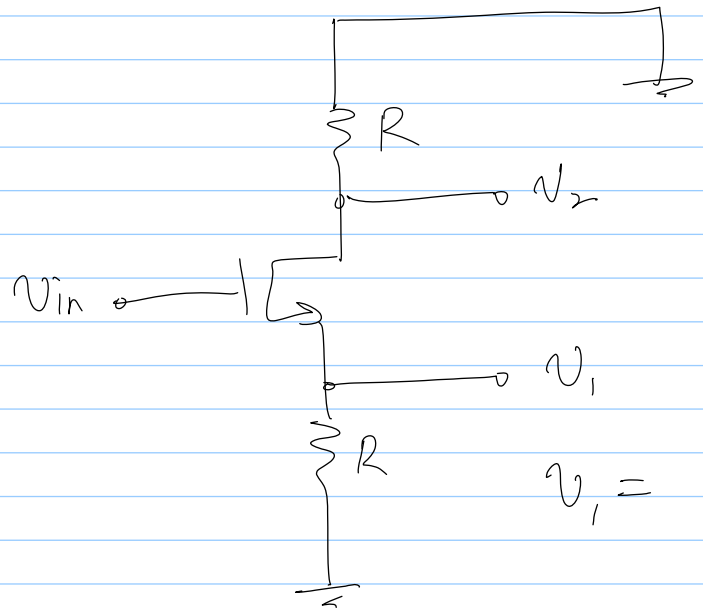
$Z_{out} = \infty$



$$i_{out} = \frac{g_m V_{in}}{1 + g_m R}$$







$$i_d = \frac{g_m}{1+g_m R} \cdot v_{in}$$

$$v_1 = \frac{g_m R}{1+g_m R} \cdot v_{in}$$

$$v_2 = \frac{-g_m R}{1+g_m R} \cdot v_{in}$$

$v_1 \simeq v_{in}$
$v_2 \simeq -v_{in}$) PHASE SPLITTER