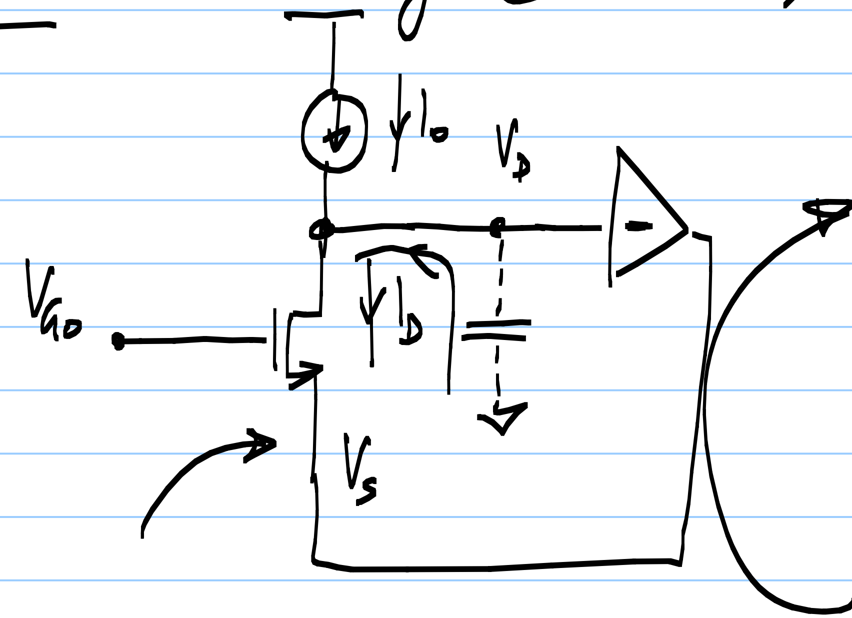
Lecture 20

Biasing @ I_0:

Sensing @ drain, FB to source



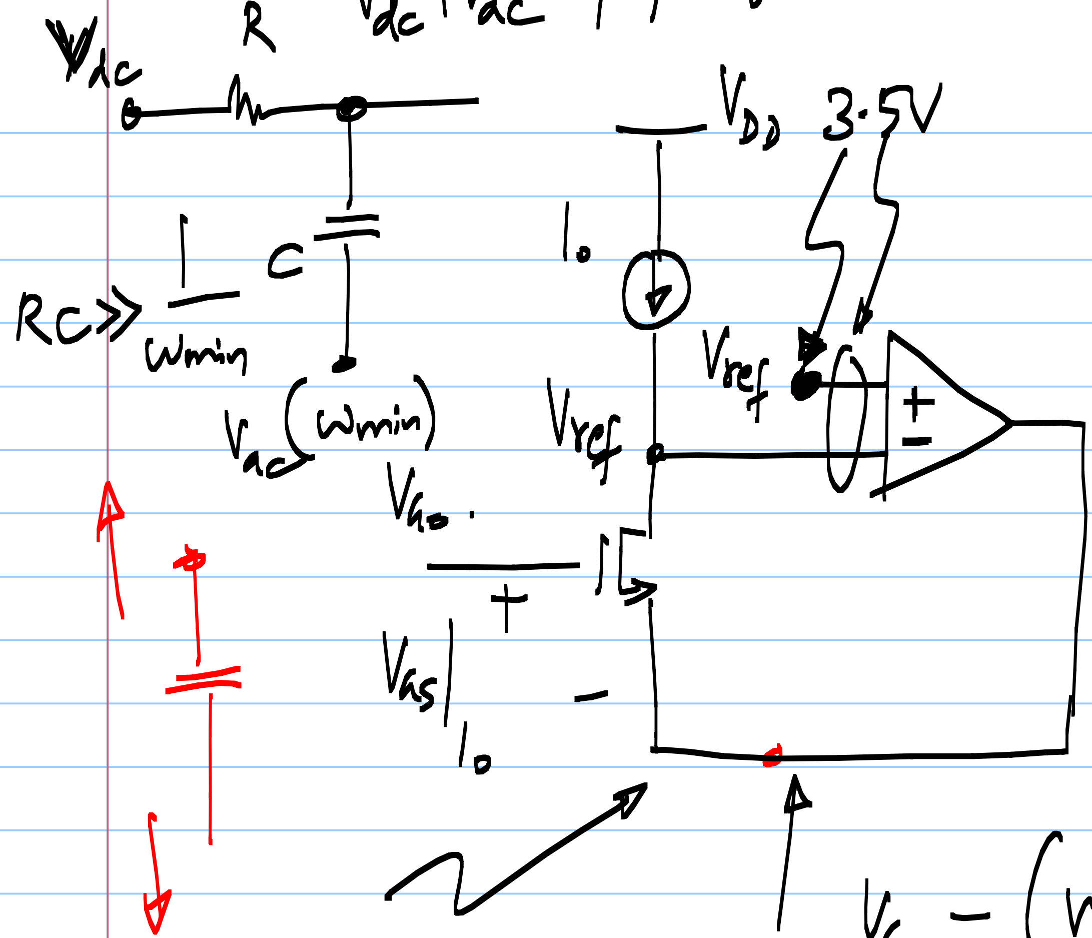
Feedback:

$I_D > I_0$: V_S must increase

Sensing: (Drain)

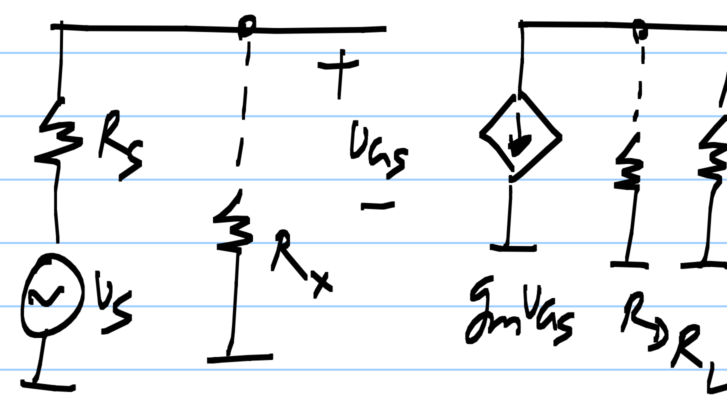
$I_D > I_0$: V_S ~~must~~ decreases

$V_{dc} + V_{ac}$ op-point

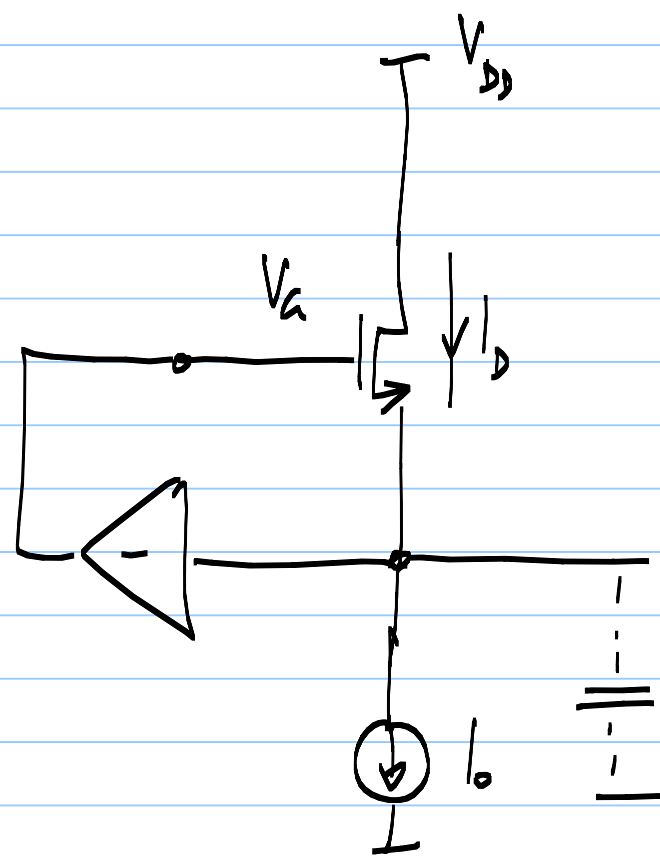


$$V_{G_o} - \left(V_T + \sqrt{\frac{2I_o}{\mu_n C_{ox} W/L}} \right)$$

signals (ac)



Sensing @ source, feedback to the gate

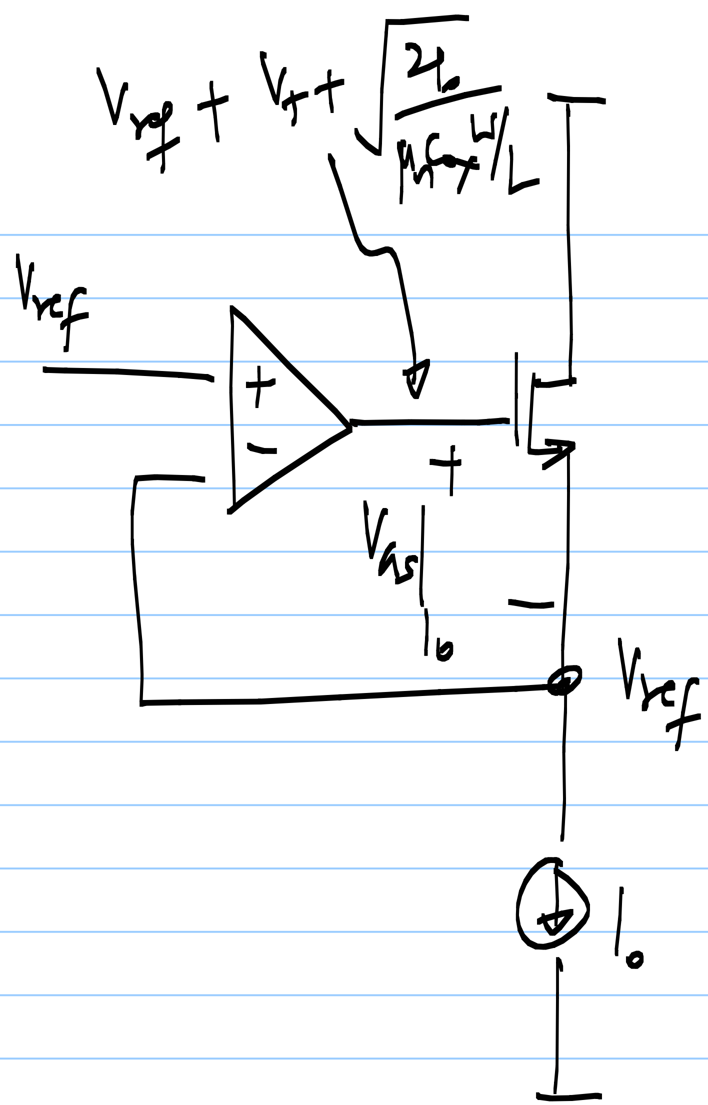


Feedback:

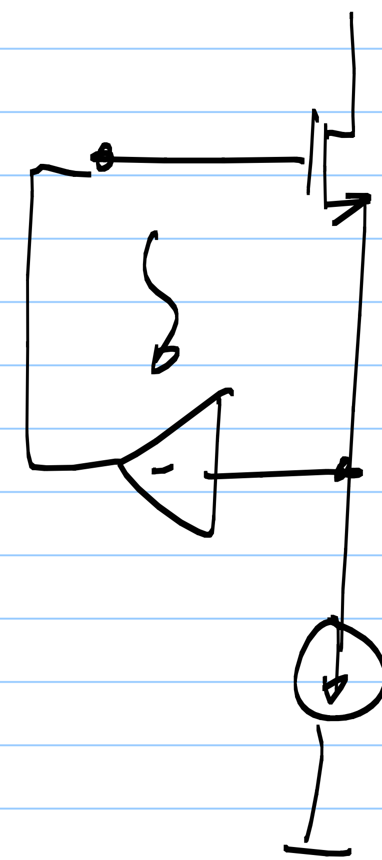
$I_D > I_0$: V_G must decrease

Sensing

$I_D > I_0$: V_S increases



$V_{ref} + V_T + \sqrt{\frac{2I_0}{\mu_n C_{ox} W/L}}$
V_{ref}
+
−
+
V_{GS}
−
I_0
V_{ref}
I_0



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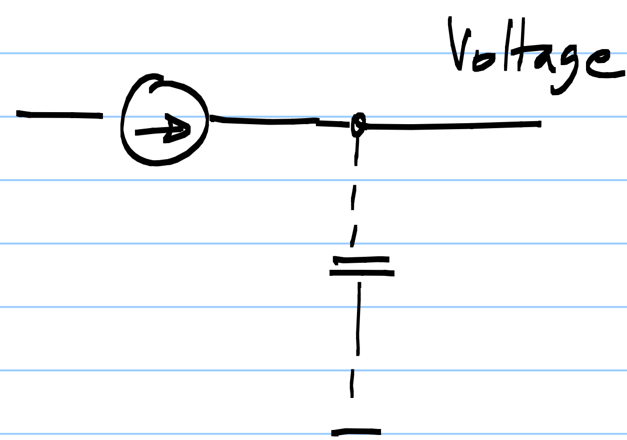
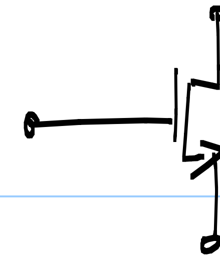
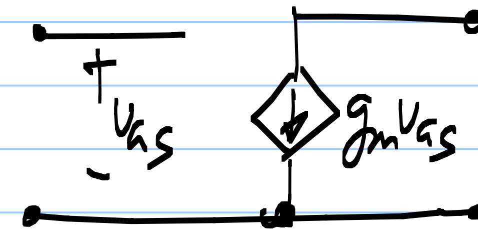
Controlled sources : VCVS

(Realized using negative feedback)







Voltage controlled voltage source

$v_o = k \cdot v_i$

$\boxed{v_o = v_i}$ $k = 1$

v_i

Sense v_o

Control v_o

v_o

$v_i - v_o > 0$

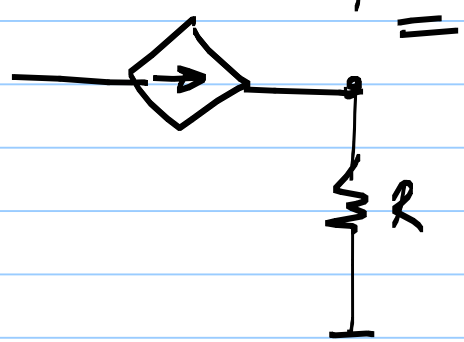
$v_o < v_i$:

* ~~larger~~ current must be pushed into the o/p node

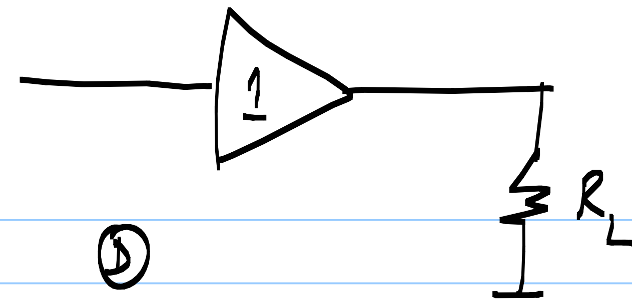
$\Rightarrow v_{GS}$ must increase

Current source — increase the voltage @ certain node

increase i_{push}

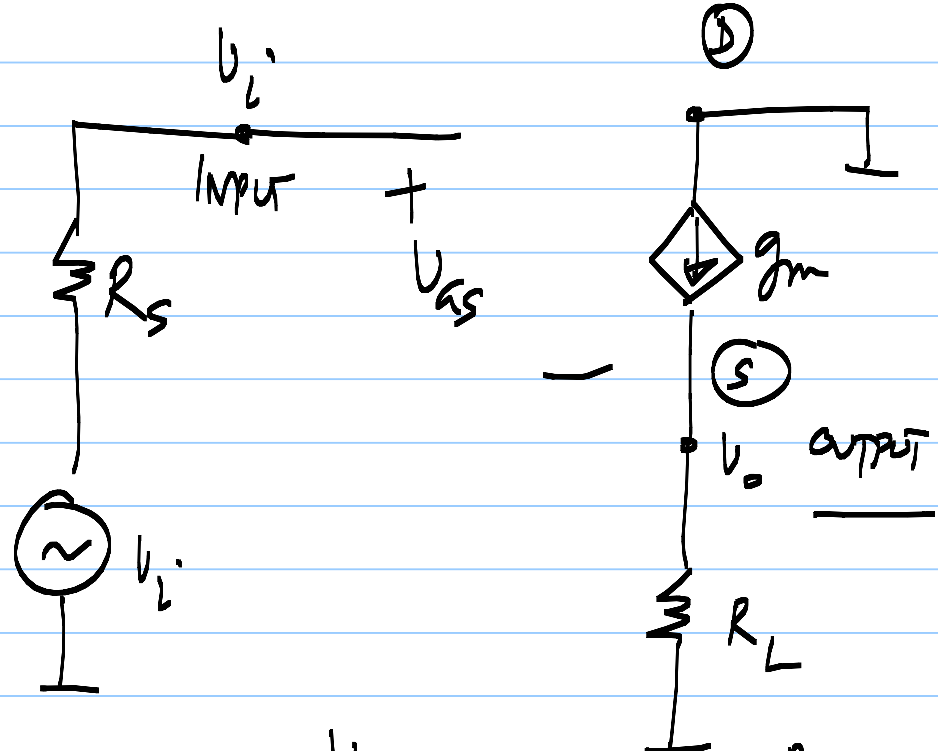


VCVS



$v_o = v_i$

$(v_o - v_i) = 0$



$v_i - v_o > 0$

Make $v_{gs} = (v_i - v_o)$ to have the right sense of feedback

$$\frac{v_o}{v_i} = \frac{g_m R_L}{1 + g_m R_L} \simeq 1$$

$g_m \gg \frac{1}{R_L}$