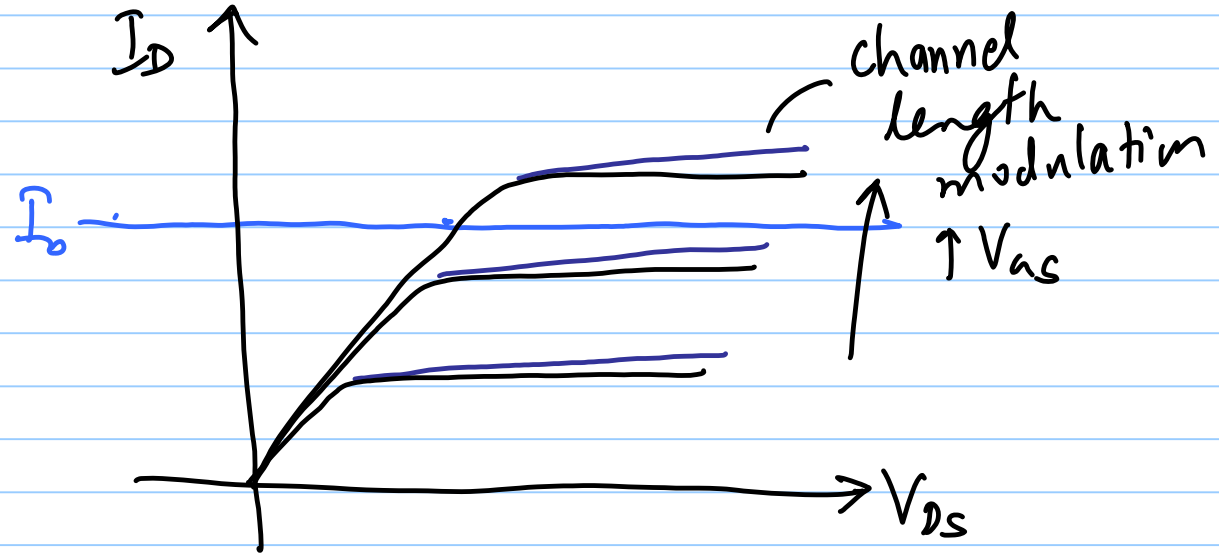
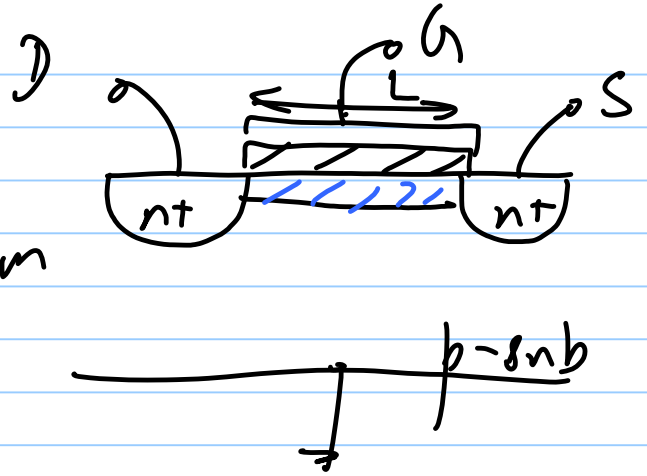
8/8/19

Lec 8





pinch off on D or S side? why?

In sat.

$$I_D = \frac{1}{2}\mu_n C_{ox}\left(\frac{W}{L}\right)\left(V_{GS}-V_T\right)^2\left(1+\lambda V_{DS}\right)$$

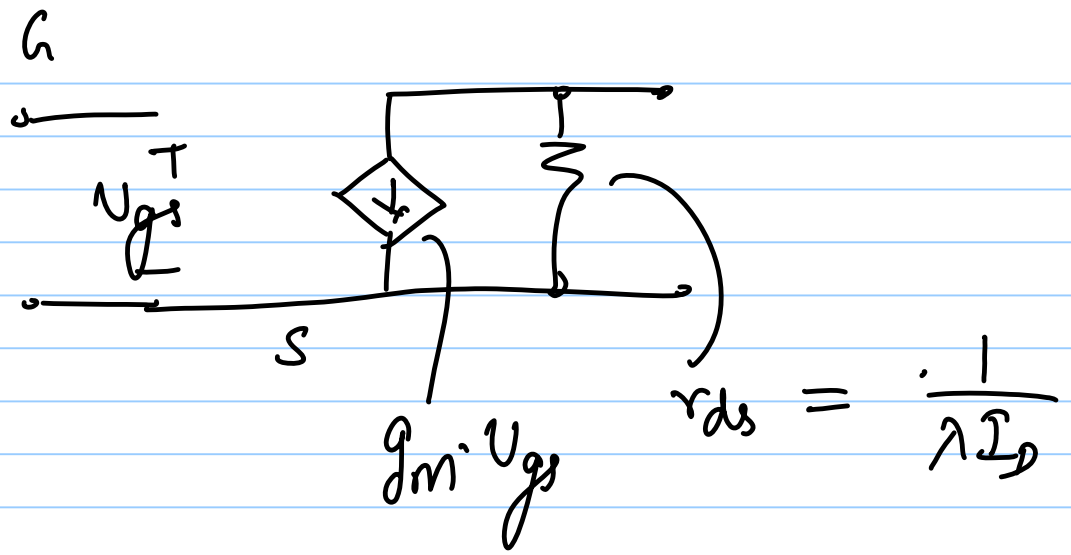
λ is small

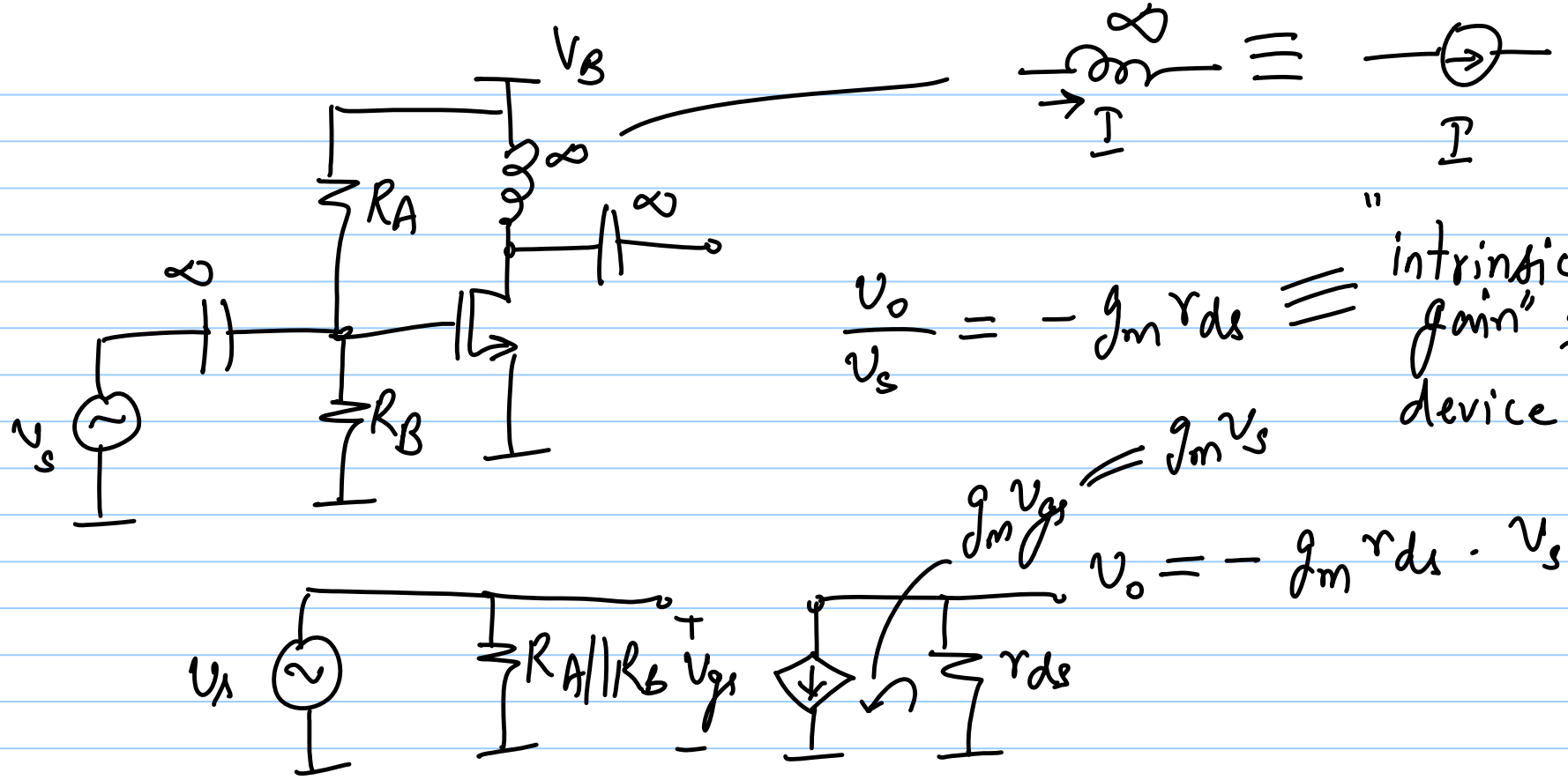
1) Assume $\lambda = 0$ for operating point calculations

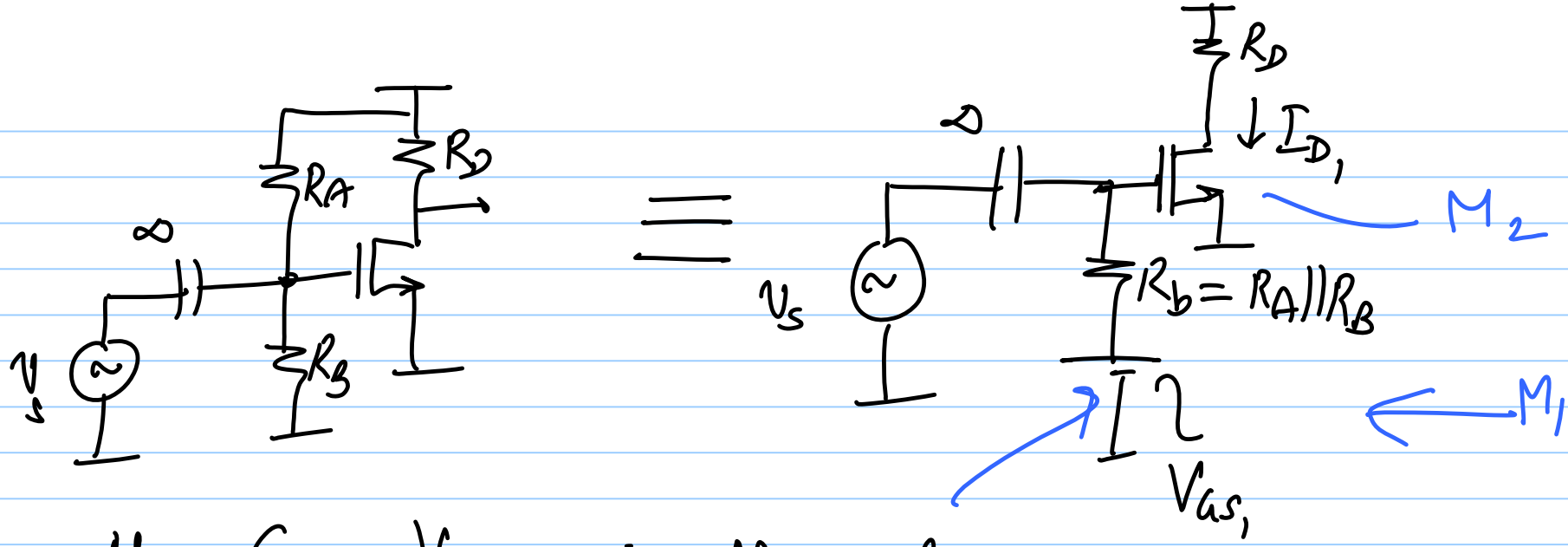
2) $y_{22} = \left.\frac{\partial I_D}{\partial V_{DS}}\right|_{\text{bias point}} = \frac{1}{2}\mu_n C_{ox}\left(\frac{W}{L}\right)(V_{GS}-V_T)^2(\lambda)$

$\approx \lambda I_D$ ← bias current

$g_{ds} = \frac{1}{r_{ds}}$


G
T
v_{gs}
S
$g_m \cdot v_{gs}$
$r_{ds} = \frac{1}{\lambda I_D}$

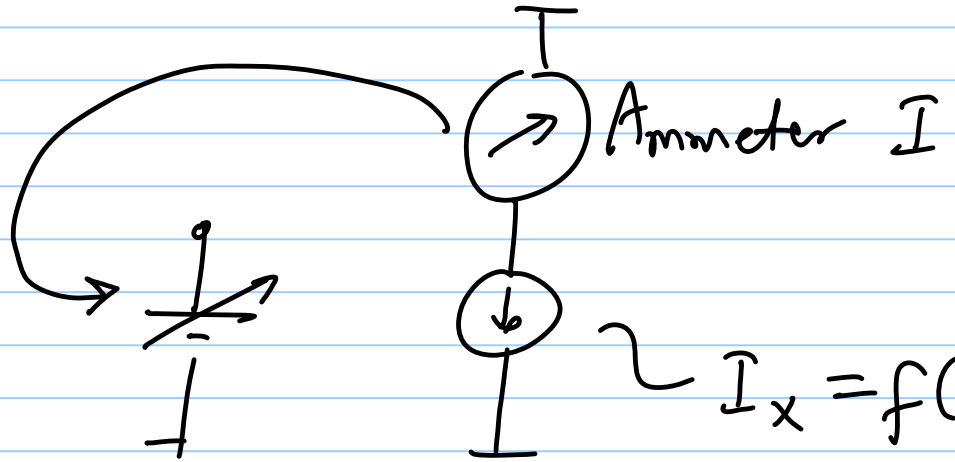

V_B
R_A
R_B
v_s
∞
∞
∞
∞
I
I
$\equiv$
$\frac{v_o}{v_s} = -g_m r_{ds}$ $\equiv$ "intrinsic gain" of device
$= g_m v_s$
$g_m v_{gs}$
$v_o = -g_m r_{ds} \cdot v_s$
v_i
$R_A \| R_B$
v_{gs}
r_{ds}



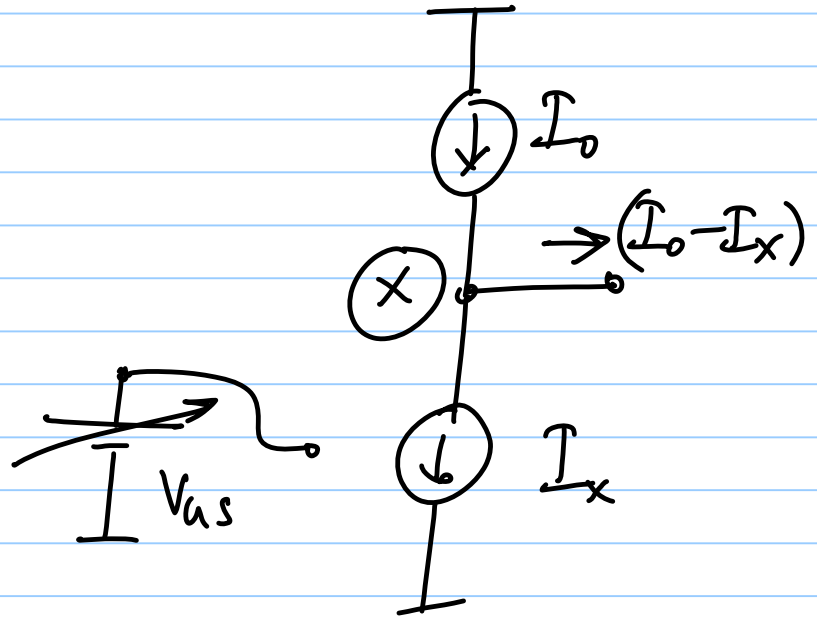
μ_n, C_{ox}, V_T $\longrightarrow$ vary from device to device

Bias @ constant I_D

Set V_{GS} so that $I_X = I_0$



* Measure I_X
* Compare with I_0
* Set V_{GS} so that $I_X = I_0$



MOSFET

If $I_o > I_x$, $V_x \uparrow$

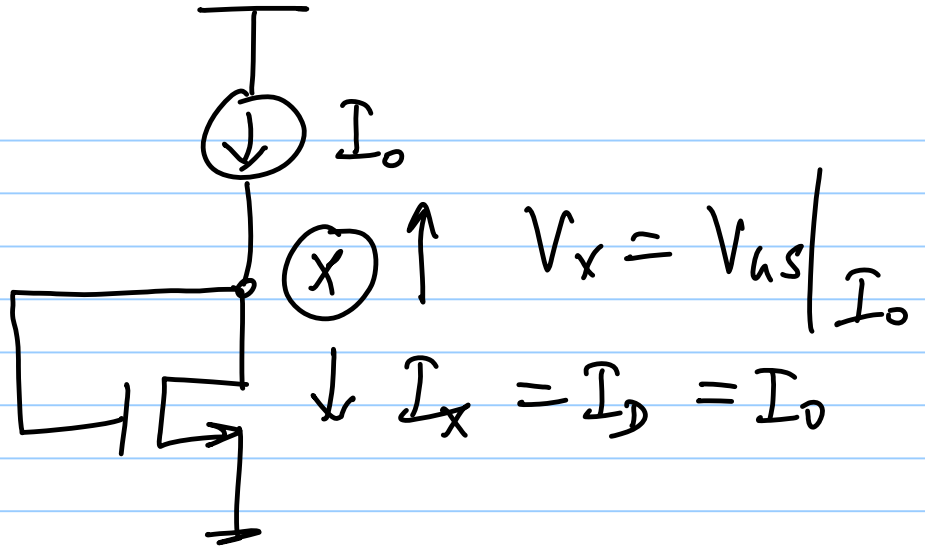
(we want to $\uparrow V_{as}$)

If $I_o < I_x$, $V_x \downarrow$

(we want to $\downarrow V_{as}$)

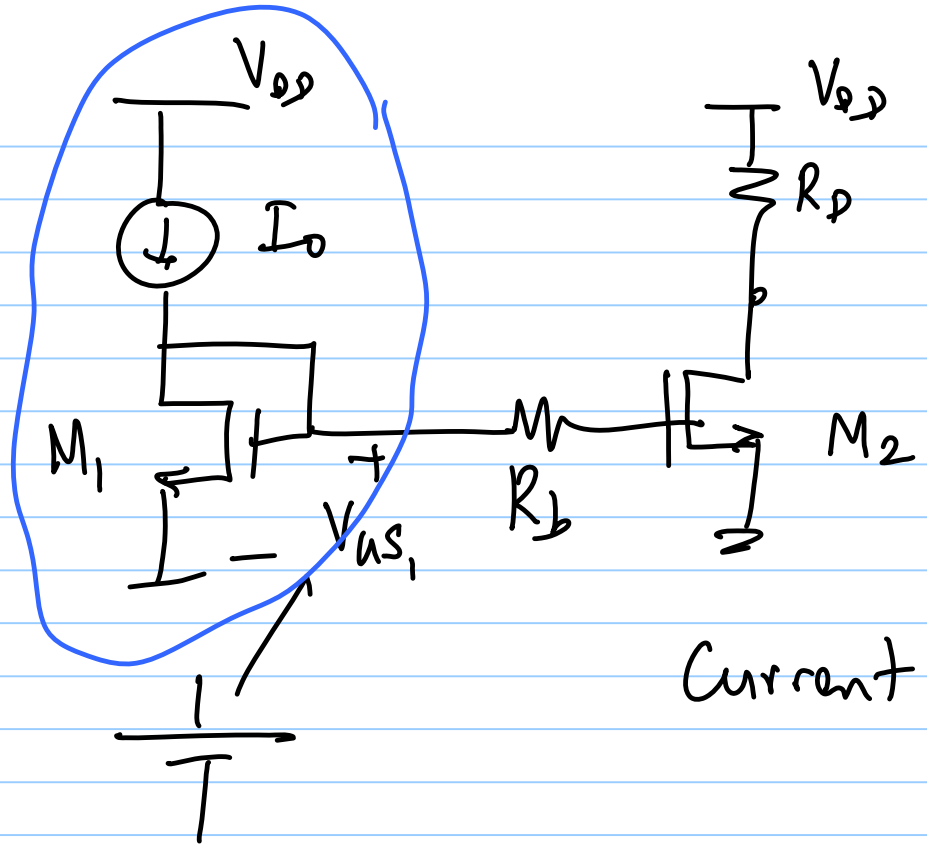
If $I_o = I_x$, V_x constant

(we want constant V_{as})



Negative feedback circuit that sets V_{GS} so that $I_D = I_0$

$V_{DS} = V_{GS} = V_{GS_1}$ Device is in saturation



Current Mirror