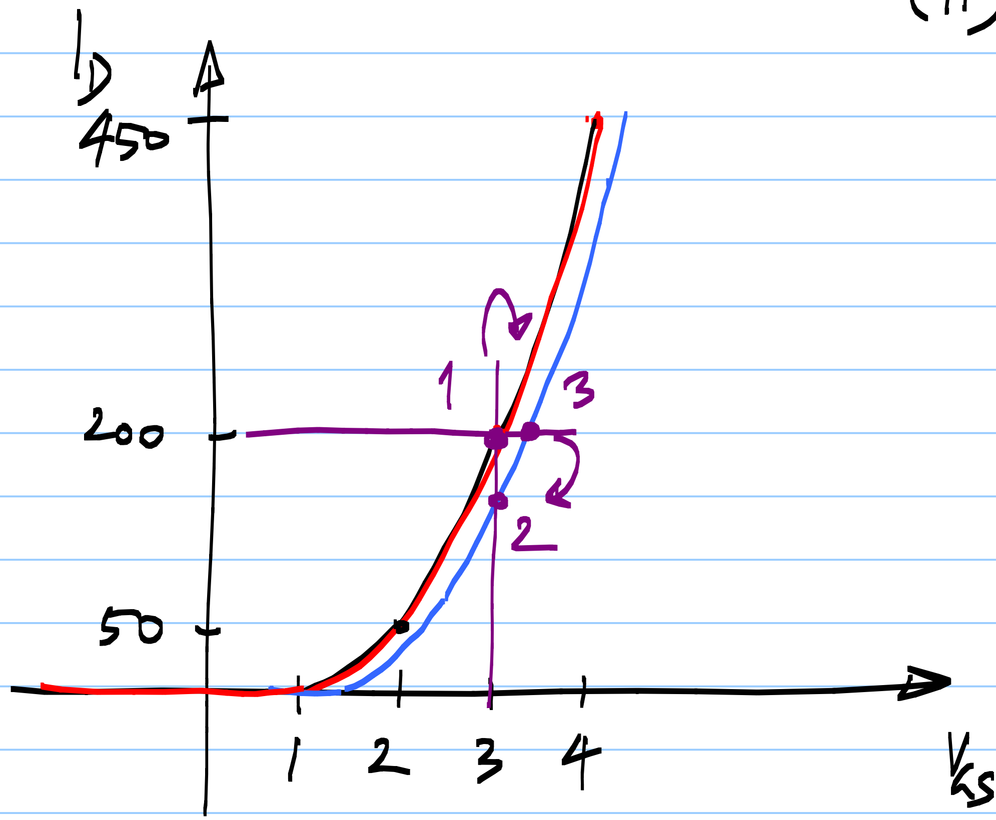
$\mu C_{ox} \frac{W}{L}$ & V_T change (i) with temperature

(ii) From part to part



$V_T = 1V$; $\mu C_{ox} \frac{W}{L} = 100 \mu A / V^2$

$V_T = 1.1V$

$V_{GS} = 3V$, $I_D = 200\mu A$, $V_{DS} = 4V$

$V_{GS} = 3V$, $I_D \simeq 180\mu A$

g_m → $190\mu S$

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

$$\simeq \frac{\mu C_{ox}}{2} \frac{W}{L} (V_{GS} - V_T)^2 \rightarrow$$

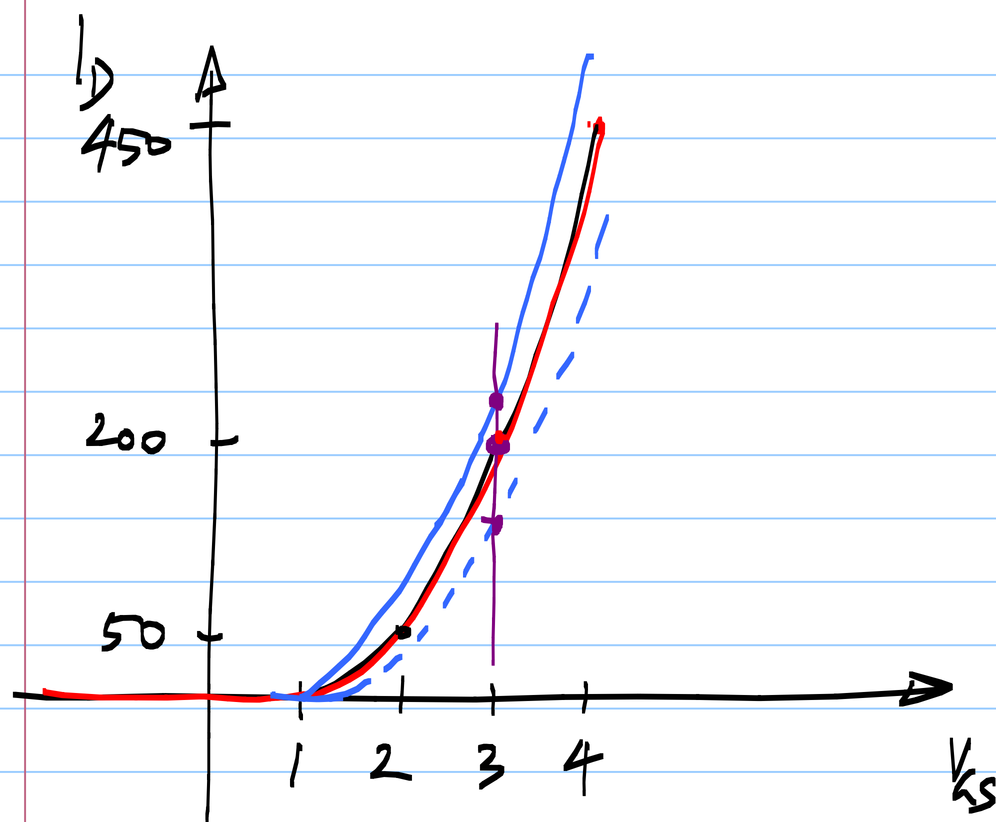
$$g_m = \frac{\partial I_D}{\partial V_{GS}} = \left(\mu C_{ox} \frac{W}{L}\right)(V_{GS} - V_T)$$

Constant V_{GS}: g_m changes with V_T

$$= \frac{2 \cdot I_D}{V_{GS} - V_T}$$

$$= \sqrt{2 \left(\mu C_{ox} \frac{W}{L}\right) \cdot I_D}$$

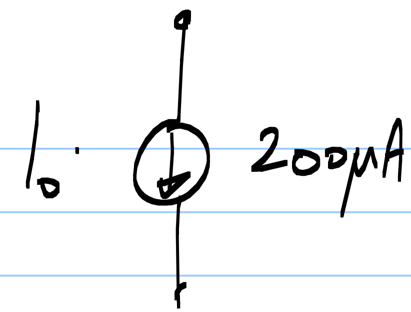
Constant I_D: g_m does not change with V_T

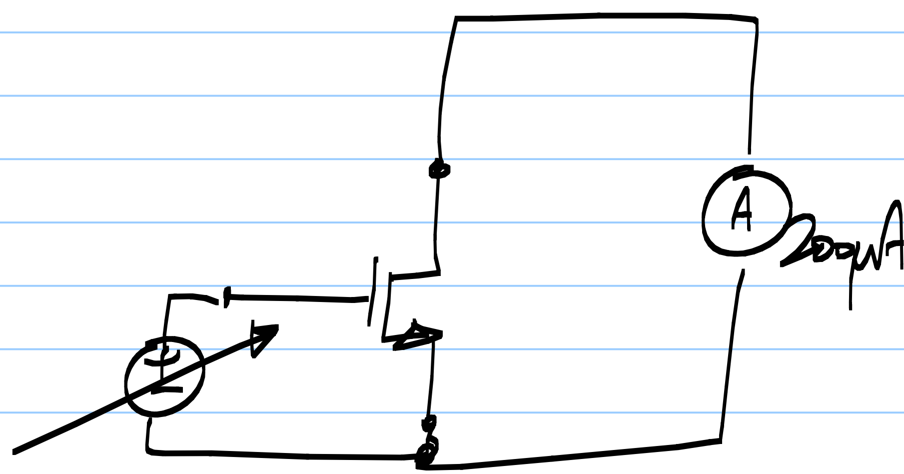


$\mu C_{ox} \frac{W}{L}$: $110 \mu A / V^2$

If $\mu C_{ox} \frac{W}{L}$ changes:

* Smaller change in g_m when I_D is fixed than when V_{GS} is fixed





V_{GS} controls I_D, not vice-versa

∴ Cannot "apply" a drain current

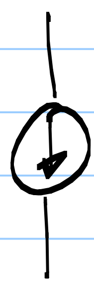
- Adjust V_{GS} until the drain current equals the desired value

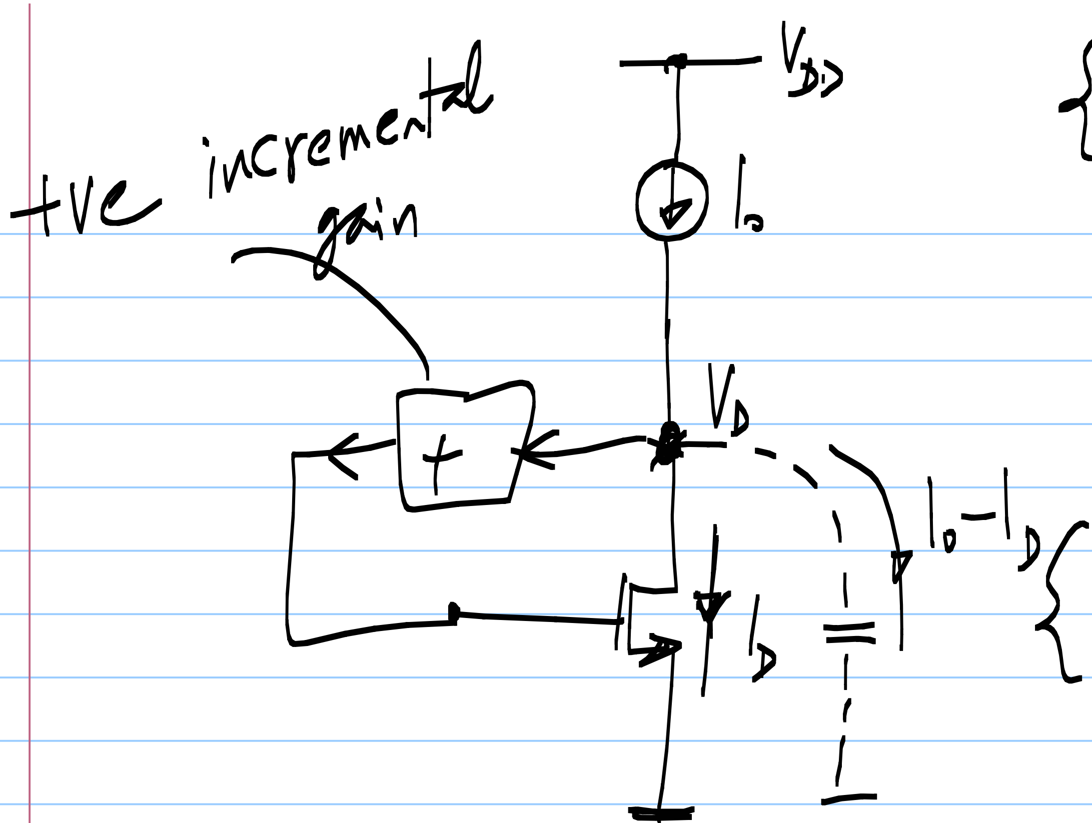
Sense I_D

Adjust V_{gs}

@ drain	@ source	@ drain	@ source
V_s : fixed	V_g : fixed	V_g : fixed	V_s : fixed
adjust V_g	adjust V_s	adjust V_s	adjust V_g
✓			

I_o



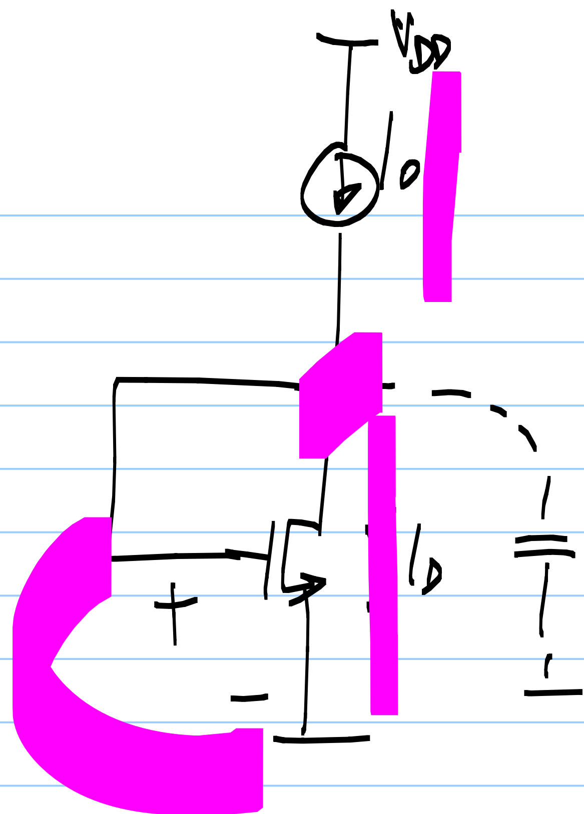


$\{ I_D < I_o$: V_D increases

V_G must increase

$\{ I_D > I_o$: V_D reduces

V_G must decrease



$$V_{GS} = V_t + \sqrt{\frac{2I_D}{\mu C_{ox} W/L}}$$