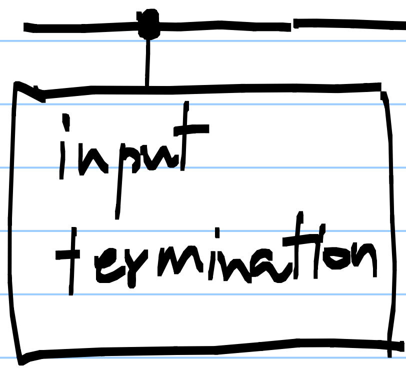
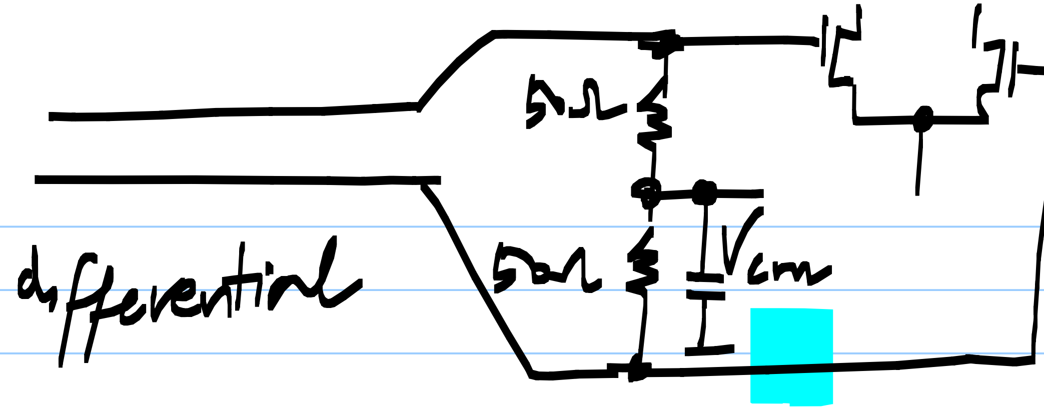
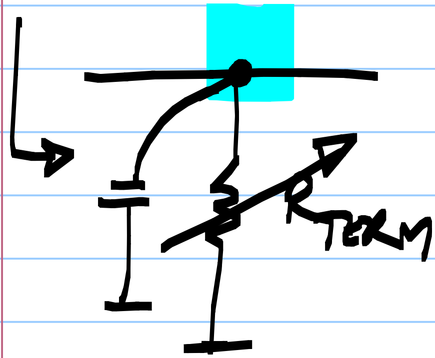
Reciever circuits:

in



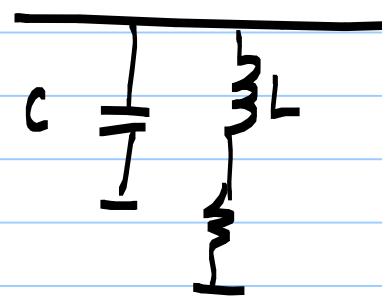


S_{11}



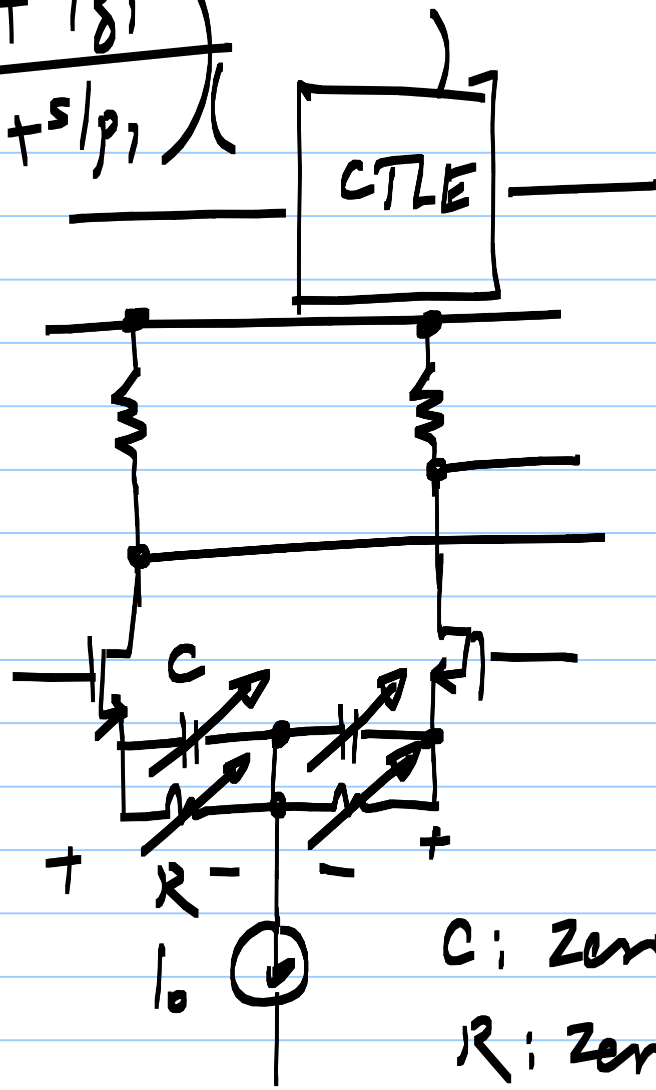
$|S_{11}| < -10dB$

or for broad band termination



Trim for right value

$$\left(\frac{1+s/z_1}{1+s/p_1}\right)$$

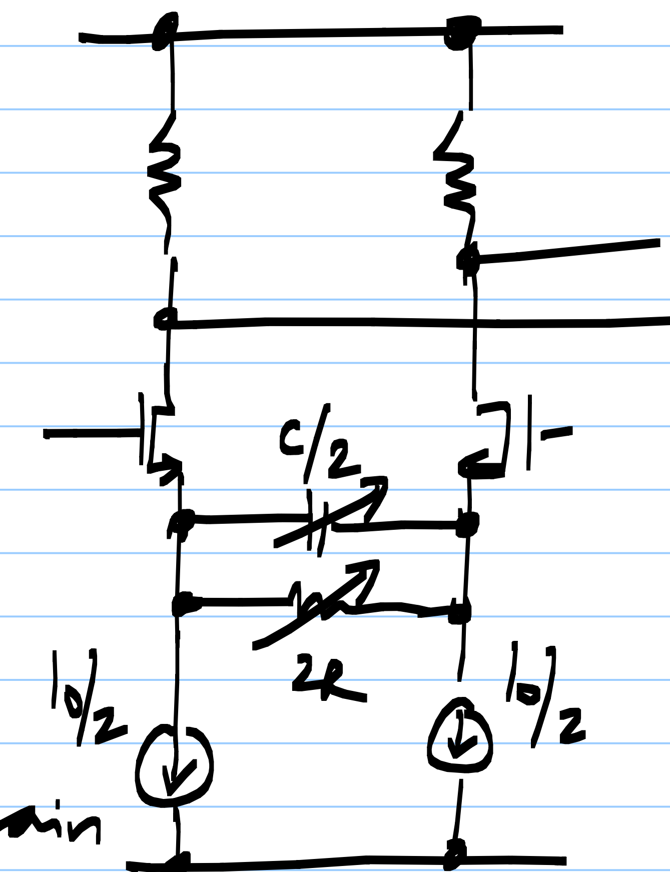


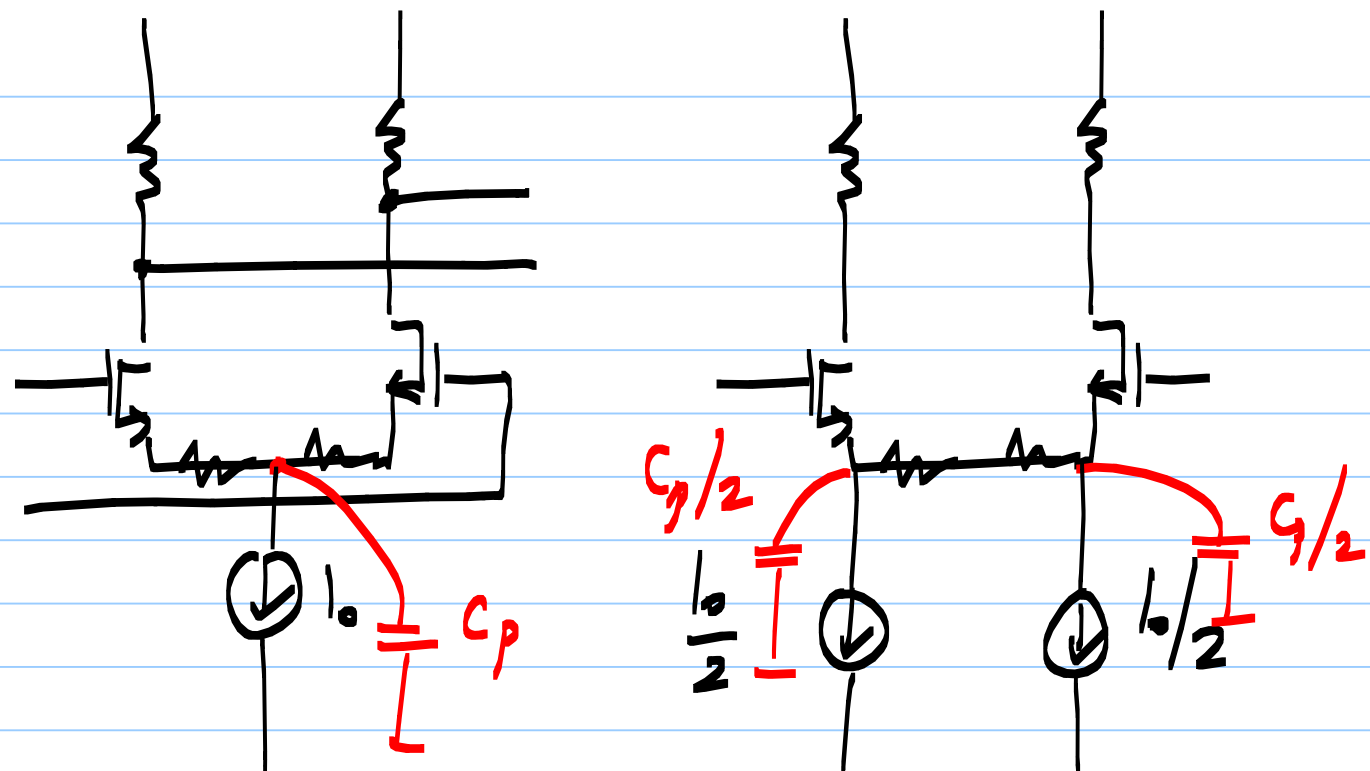
C: zero

R: zero, dc gain

Common mode drop across R

No common-mode drop across R

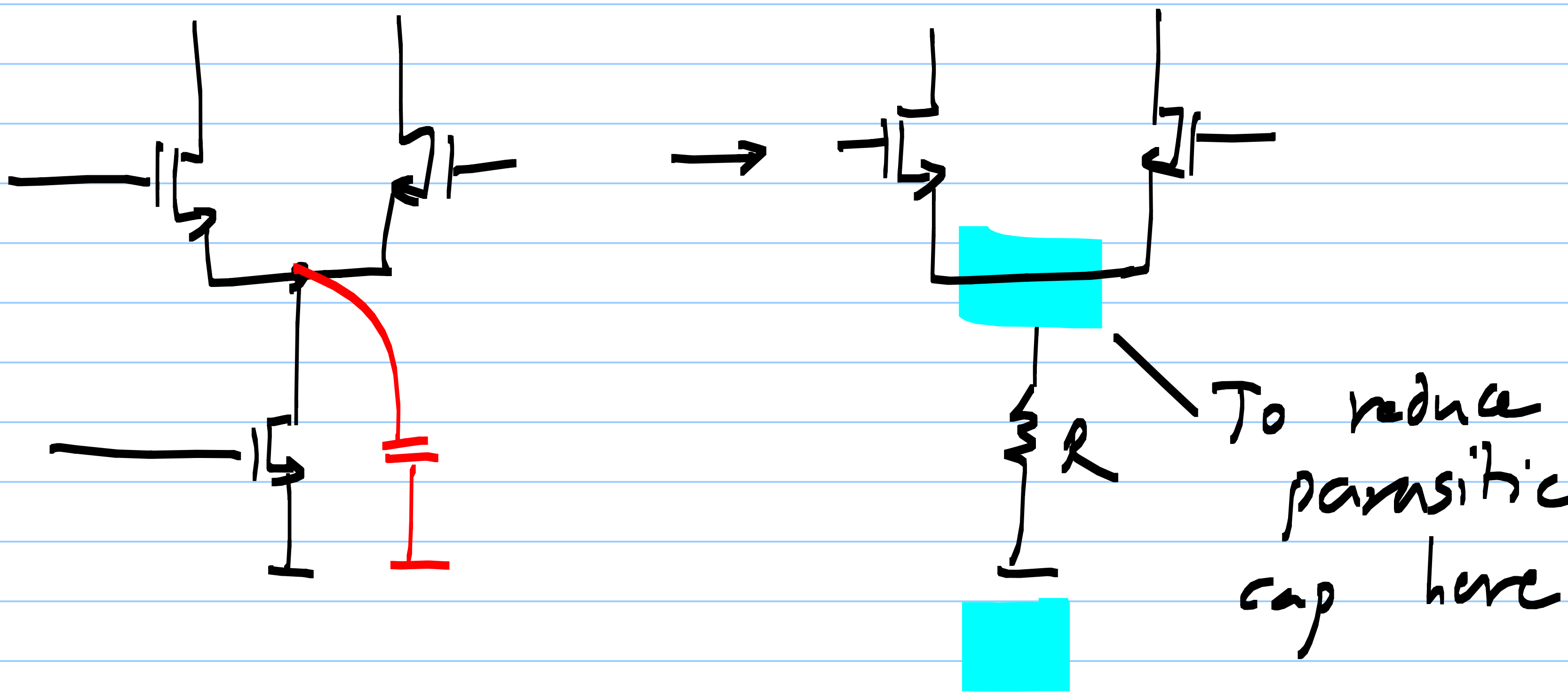




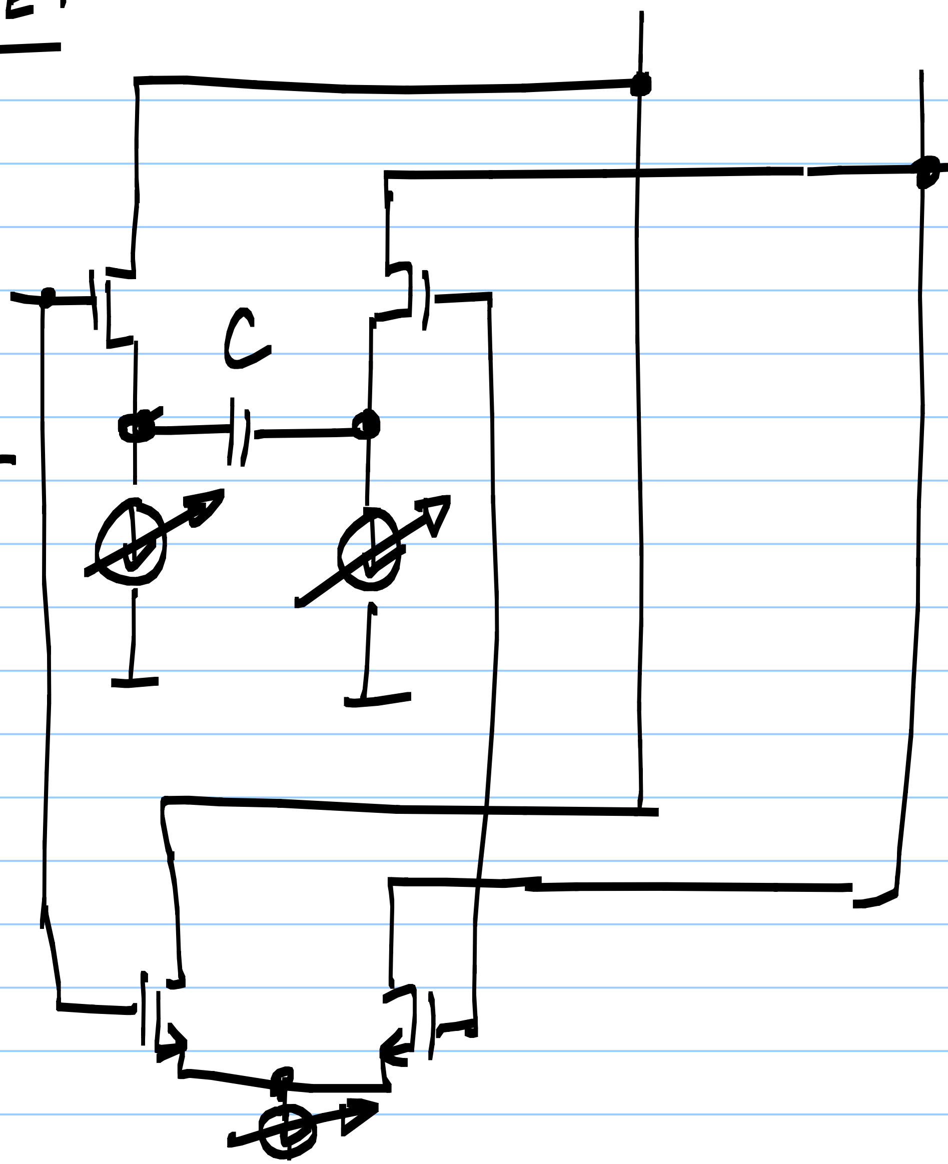
- Noise from I_o does not appear in the diff. o/p
- C_p does not affect diff freq. resp.

- Noise from I_o does appear in the diff. o/p
- $C_p/2$ influences diff freq. response

poly-Si resistor typically has a smaller parasitic capacitance than a transistor



CTLE:



$$\sim \frac{s/\omega_p}{1+s/\omega_p}$$

$$\sim 1$$

Linear combination

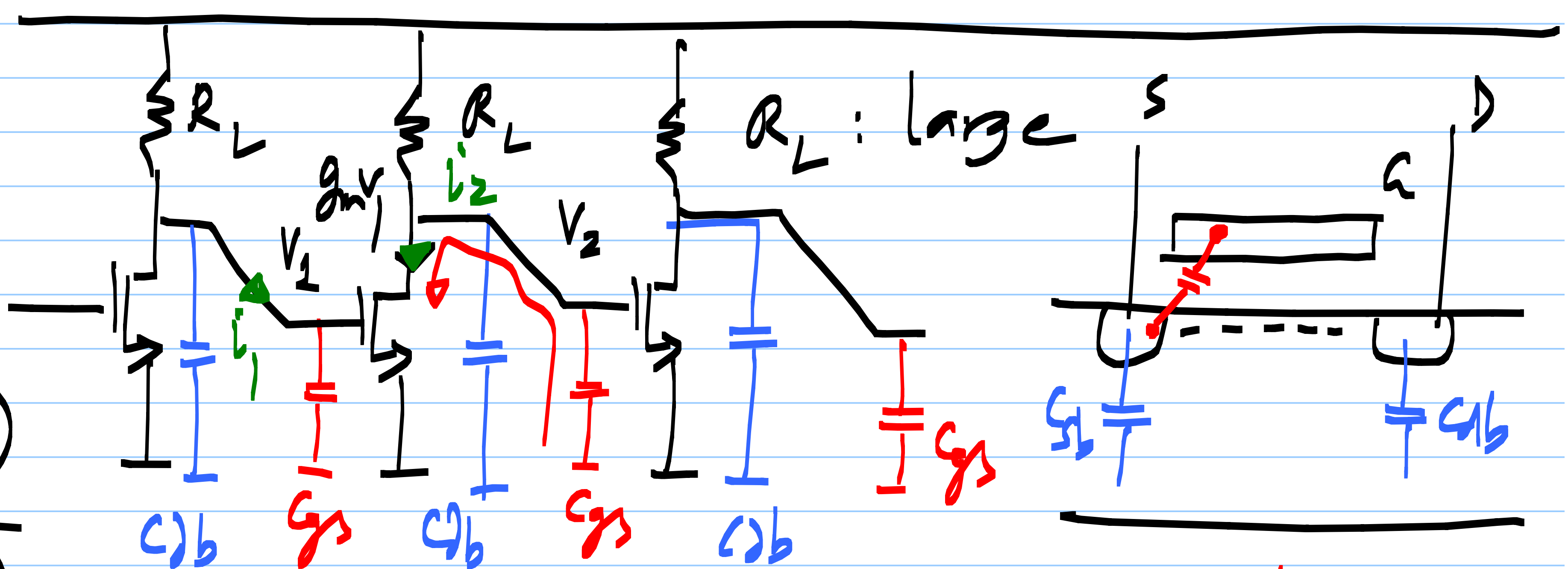
$$\alpha + \beta \cdot \frac{s/\omega_p}{1+s/\omega_p}$$

$$\sim \frac{1+s/\omega_z}{1+s/\omega_p}$$

Transistors biased at high current densities $\left(\frac{I}{W}\right)$

~ Min. length transistors

$\frac{I_2(s)}{I_1(s)}$



$\frac{V_2(s)}{V_1(s)}$

Chain of identical amplifiers

Cgs : intrinsic

$$\frac{V_2(s)}{V_1(s)} = -\frac{g_m}{sC_{gs}} \qquad \left|\frac{V_2}{V_1}\right|_{s=j\omega} = 1 \ @ \ \omega = \frac{g_m}{C_{gs}}$$

$$\omega_T = \frac{g_m}{C_{gs}} = \frac{\mu C_{ox}\frac{W}{L}(V_{GS}-V_T)}{\frac{2}{3}C_{ox}WL} = \frac{3}{2}\mu \cdot \frac{V_{GS}-V_T}{L^2}$$

(transit frequency)

$$f_T = \frac{g_m}{2\pi C_{gs}}$$

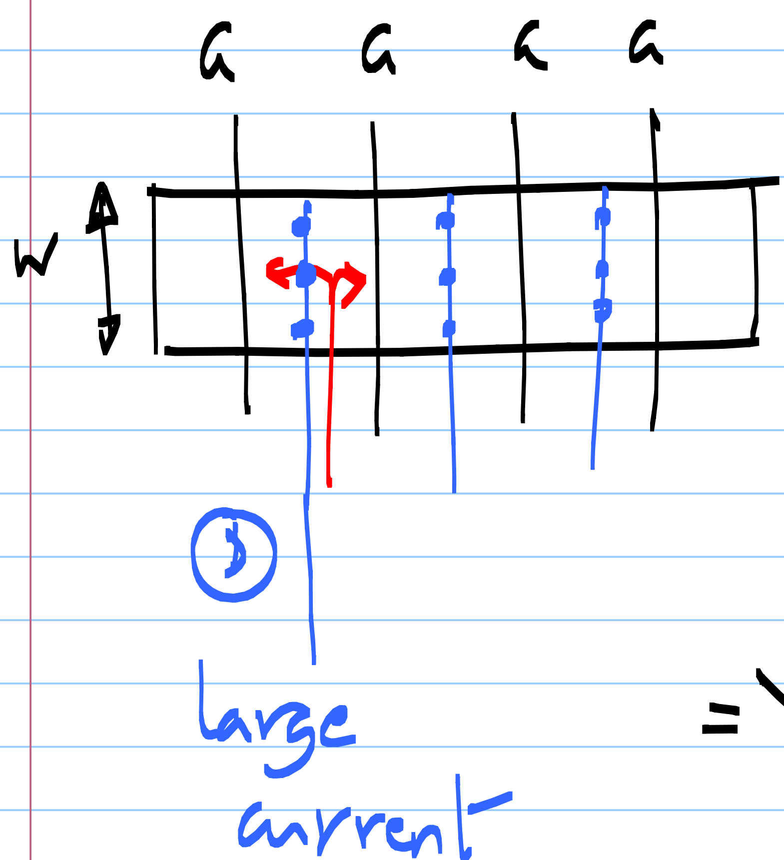
Measure of inherent speed of transistors

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

$$(V_{GS} - V_T) = \sqrt{\frac{2 I_D}{\mu C_{ox} W/L}}$$

$$\propto \sqrt{\frac{I_D}{W}}$$

current density



$$\text{dc gain} = g_m / g_{ds}$$

$$= \frac{\sqrt{2 \mu C_{ox} \frac{W}{L} \cdot I_D}}{\lambda I_D} \propto \frac{1}{\sqrt{I_D / W}}$$

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

$$= \underbrace{\mu \cdot \underbrace{\frac{V_{GS}-V_T}{L}}_{E}}_{\text{velocity}} \cdot \underbrace{\frac{C_{ox}W(V_{GS}-V_T)}{2}}_{\text{Charge}}$$

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

$$\omega_T = \frac{3}{2}\mu\left(\frac{V_{GS}-V_T}{L^2}\right)$$

$$I_D = k\cdot W(V_{GS}-V_T)\cdot v_{sat}$$

$$C_{gs} = k' C_{ox} W L$$

$$g_m = k\cdot W\cdot v_{sat}$$

$$\frac{g_m}{C_{gs}} = \frac{k\cdot W v_{sat}}{k' C_{ox} W L}$$

$$= \frac{k}{k' C_{ox}}\left(\frac{v_{sat}}{L}\right)$$

High-speed circuits:

* operate at high current densities
  - Short L, large $V_{GS} - V_T$
    → poor dc gain
  → High current density in wires
    - parasitic voltage drops