

$$Q = \frac{1}{2R_s \omega C_{gs}}$$

$$\omega_T = \frac{g_m}{C_{gs}}$$

$$\left. \begin{array}{l} Q = \frac{1}{2R_s \omega C_{gs}} \\ \omega_T = \frac{g_m}{C_{gs}} \end{array} \right\} \frac{Q \omega_T}{2R_s \omega C_{gs}^2} = \frac{1}{2R_s \omega C_{gs}^2}$$

$$\frac{Q}{\omega_T} = \frac{1}{2R_s \omega C_{gs}^2}$$

~~$\frac{Q}{\omega_T}$~~

~~g_m~~

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

$$C_{gs} = \frac{2}{3} C_{ox} \cdot W \cdot L$$

~~C_{gs}^2~~

$$\omega_T = \frac{\sqrt{2 \mu_n C_{ox} \frac{W}{L} \cdot I_D}}{C_{gs}}$$

$$= \frac{\sqrt{\mu_n \left(\frac{2}{3} C_{ox} \cdot W \cdot L \right) \cdot \frac{1}{L} I_D}}{C_{gs}}$$

$$= \frac{1}{L} \cdot \frac{\sqrt{3 \mu_n I_D}}{\sqrt{C_{gs}}}$$

$$= \frac{1}{L} \sqrt{3 \cdot \mu_n \cdot I_D} \cdot \sqrt{2 R_s W} \cdot \sqrt{Q}$$

$$= \frac{\sqrt{6 \mu_n R_s W I_D}}{L} \sqrt{Q} \rightarrow \omega_T \propto \sqrt{Q}$$

I_D will be set by "design specification"