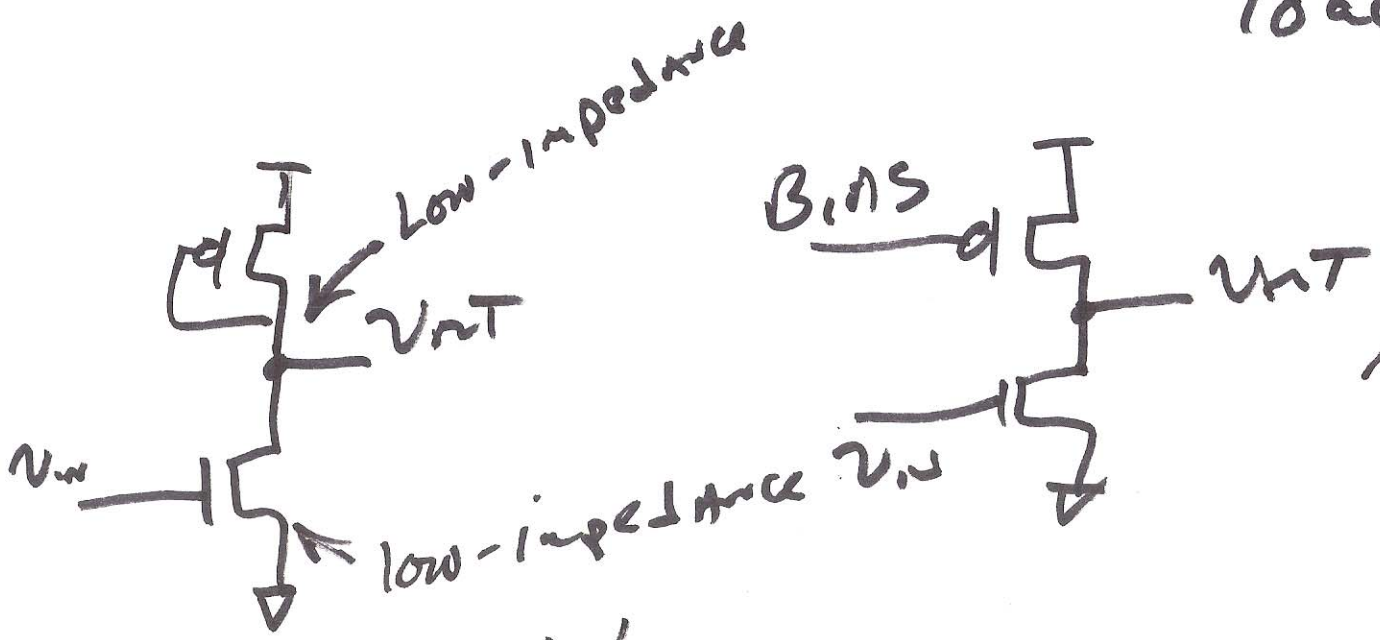
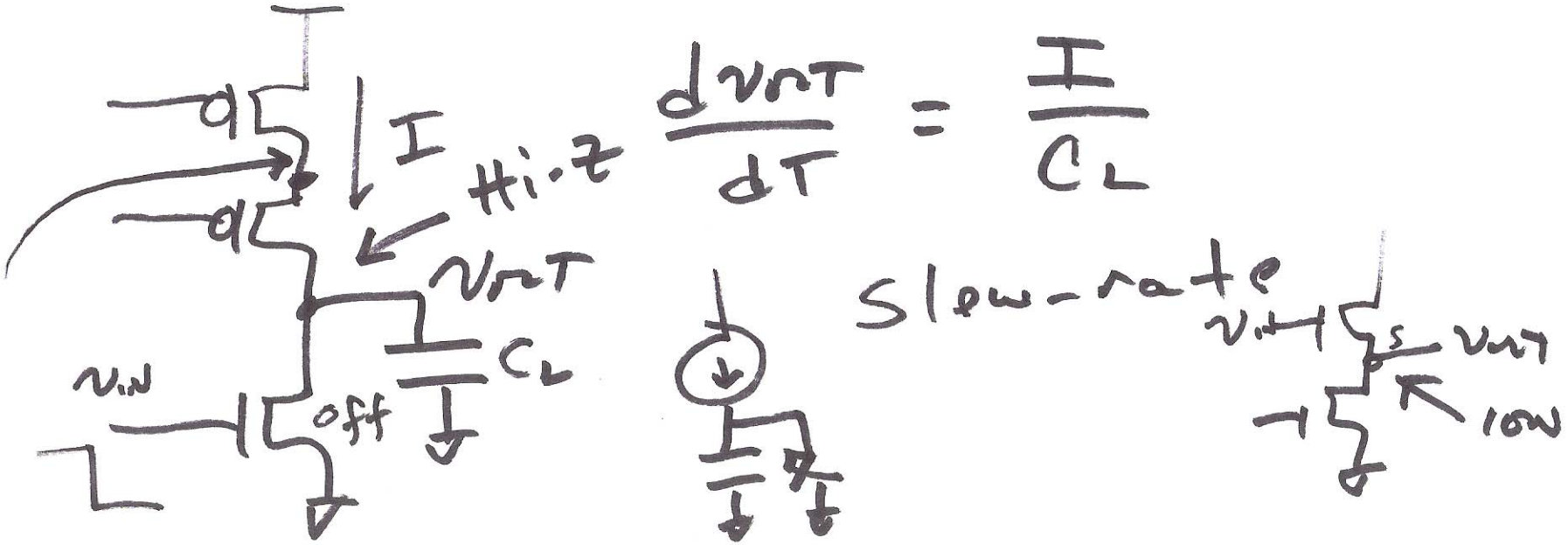
21.2 Current source loads



$$\frac{v_{out}}{v_{in}} = -\frac{r_{o1} \| r_{op}}{1/g_{m1}}$$

$$= -g_{m1}(r_{o1} \| r_{op})$$

$$\frac{v_{out}}{v_{in}} = -\frac{1/g_{mp}}{1/g_{m1}} = -\frac{g_{m1}}{g_{mp}}$$



$$\frac{dv_{OUT}}{dt} = \frac{I}{C_L}$$

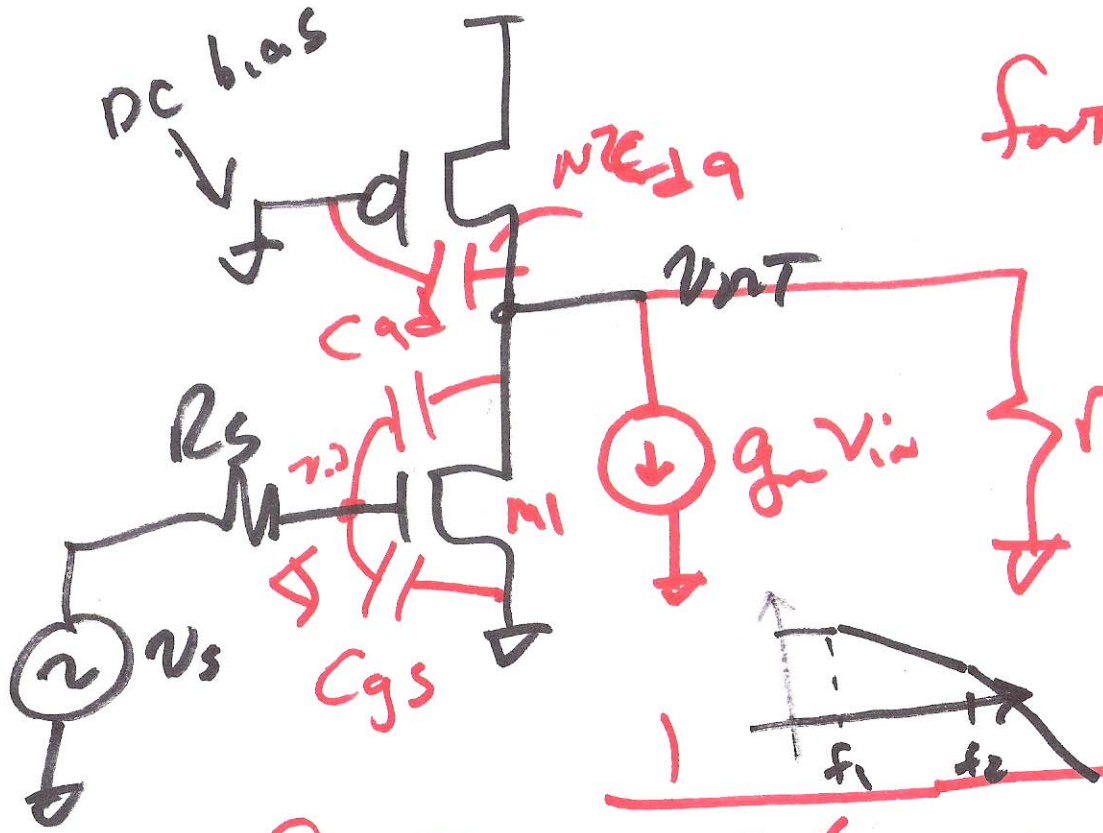
$$\frac{v_{OUT}}{v_{IN}} = -\frac{R_{on} \| r_{ON}}{1/g_{mN}} \simeq -g_{mN} r_{ON}$$

open ckt gain!

$$\frac{dv}{dt} = \frac{20\mu A}{1pF}\left(\frac{V}{s}\right) = \frac{20V}{1s}$$

$$= \frac{2V}{100ns}$$

C.S. Amp with current source load



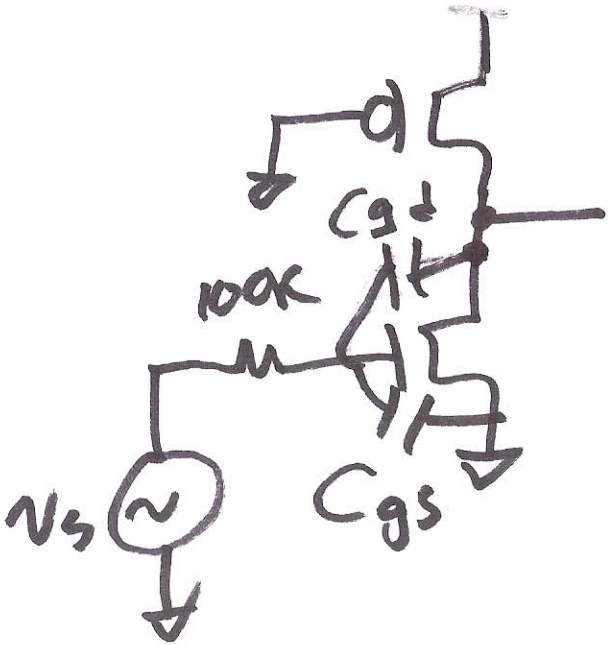
$$f_{out} = \frac{1}{2\pi r_{ds} \| r_{op} \left(C_{dg} + C_{gd}\left(1 + \frac{1}{A}\right)\right)}$$

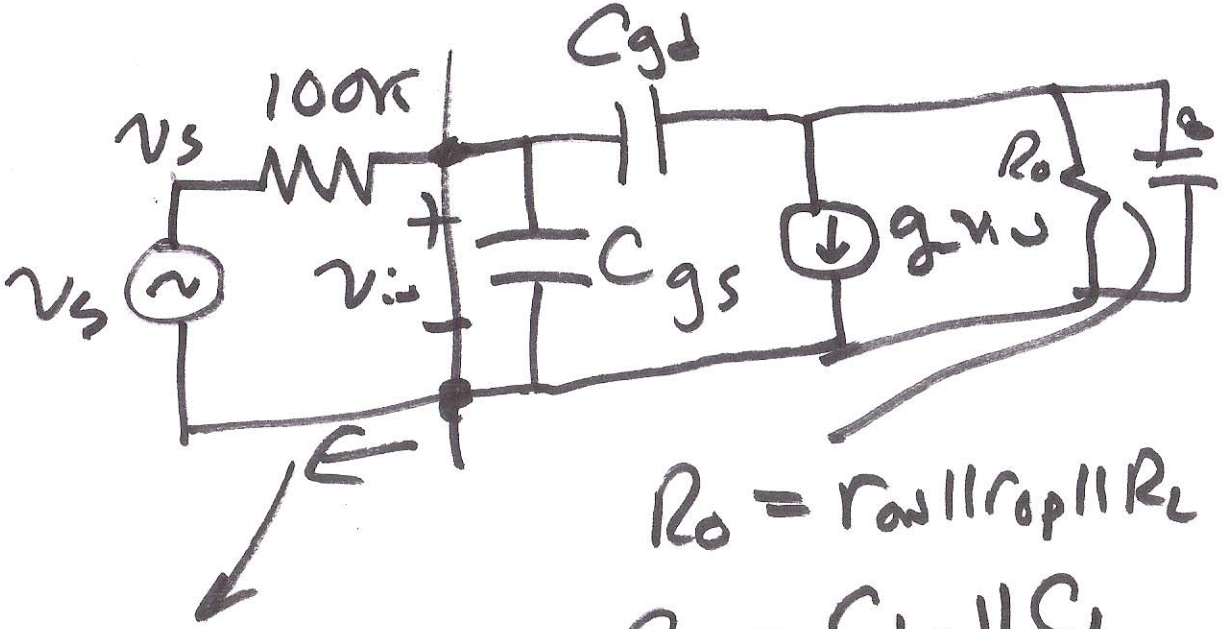
$$f_z = \frac{g_{m1}}{2\pi C_{gd1}}$$

$$f_{in} = \frac{1}{2\pi R_S \left(C_{gs} + (1 + |A|) C_{gd} \right)}$$

$|A| \rightarrow g_{m1} \cdot r_{ds} \| r_{op}$

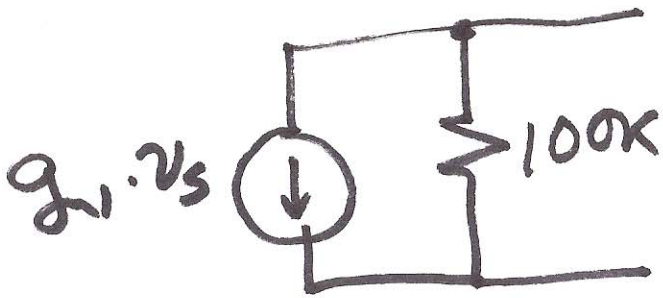
AC CKT





$R_o = r_{ON} \| r_{op} \| R_L$

$C_o = C_{dg} \| C_L$



$g_{m1} = \frac{1}{100K}$

$f_{UN} = \frac{g_{m1}}{2\pi C_c} = \frac{1}{2\pi(\frac{1}{g_m})C_c}$

$= \frac{150\mu}{2\pi\ 1PF}$

$= 25MHz$

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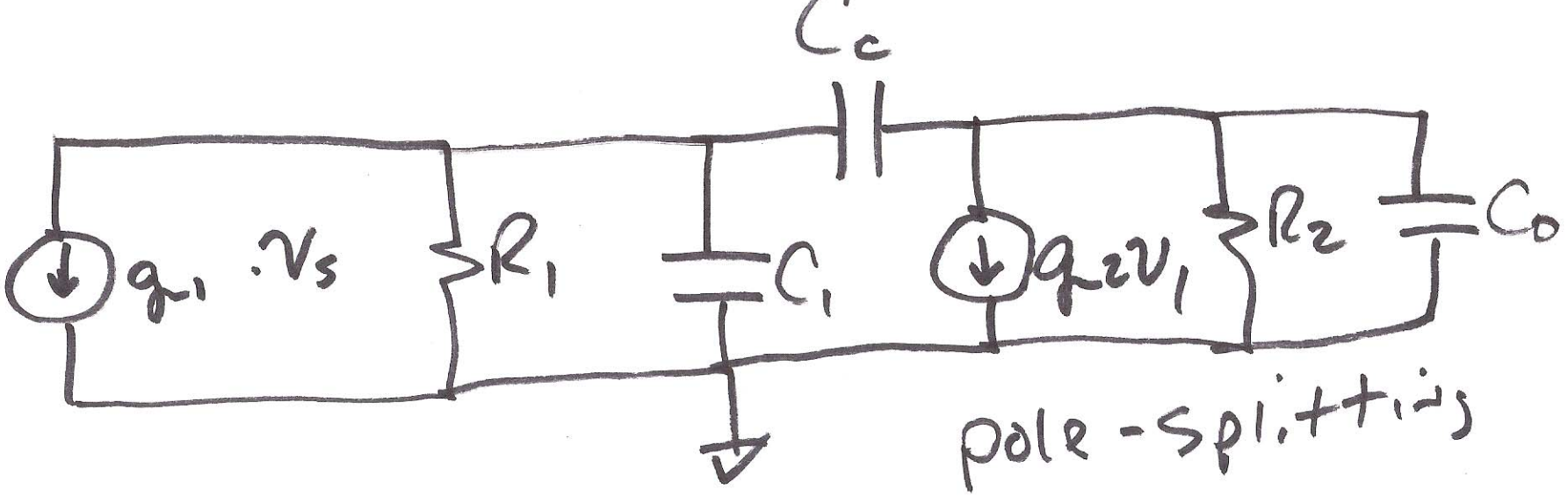
$$1 - s\frac{C_c}{g_{m2}} \qquad \left| s\frac{C_c}{g_{m2}} \right| = 1$$

$$\Rightarrow \frac{2\pi f \cdot C_c}{g_{m2}} = 1$$

$$f_z = \frac{g_{m2}}{2\pi C_c}$$

$$= \frac{1}{2\pi\left(\frac{1}{g_{m2}}\right)C_c}$$



pole-splitting

$$A_V(f) = \frac{v_{out}(f)}{v_{in}} = \frac{-g_m \cdot r_{ow} \| r_{op} \to 330}{1 + j\frac{f}{f_{3dB}}}$$

$f_{3dB} \to 4.8\,KHz$

$$f_{3dB} = f_1 = \frac{1}{2\pi \cdot R_S \cdot g_m r_{ow} \| r_{op} \cdot C_c}$$

$$\left|\frac{v_{out}}{v_{in}}\right| = 1 = \frac{330}{\sqrt{1 + \left(\frac{f_{UW}}{4.8KHz}\right)^2}}$$

$$\frac{g_m r_{ow} \| r_{op}}{2\pi R_S \cdot C_c}$$

$$1 + \left(\frac{f_{UW}}{4.8KHz}\right)^2 = \left(\frac{1}{330^2}\right)^{-1}$$

$$f_{UW} = \frac{1}{2\pi R_S C_c}$$

$$f_{UW} \simeq 330 \cdot 4.8KHz$$

$$= 1.58\,MHz$$

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