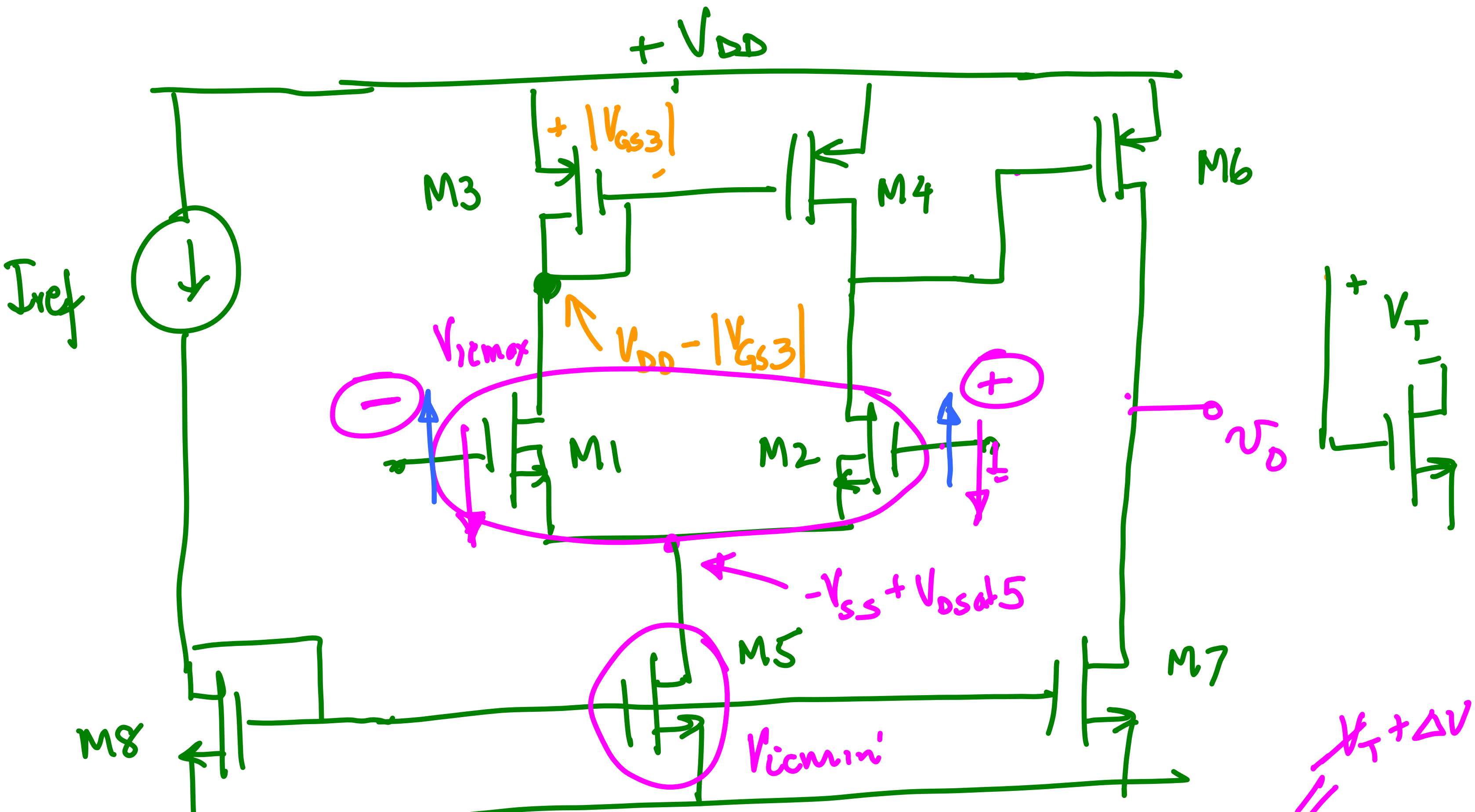


$V_{icmax} = V_{DD} - |V_{GS3}| + \cancel{V_T}$

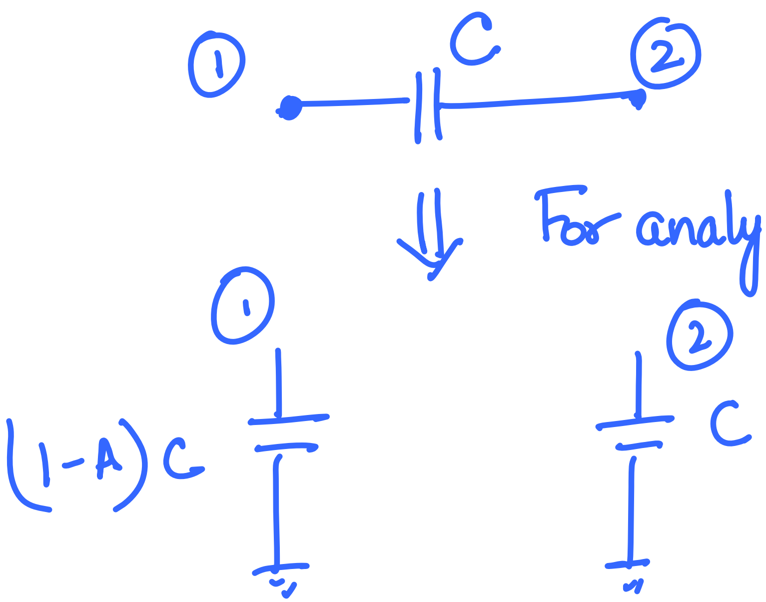
$V_{icmin} = V_{GS1} + V_{dsat5} - V_{SS}$

V_{icmin}, V_{icmax}

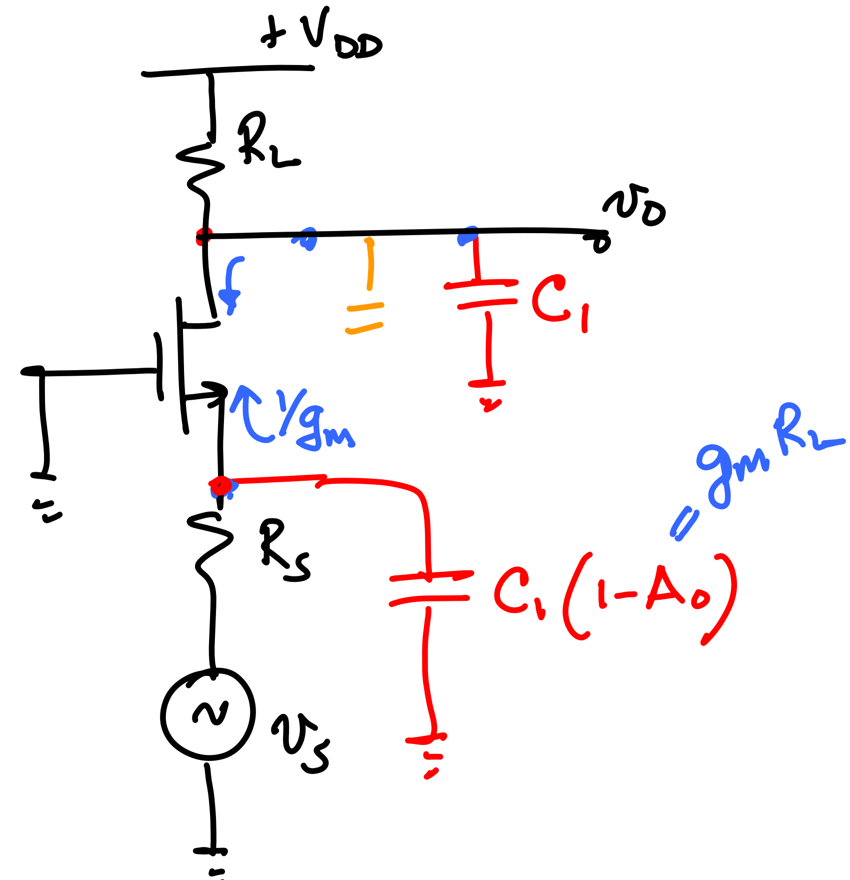
# of poles in a circuit

$\leq$ # of caps in the circuit

ONE POLE



For analysis only



$$\tau = \left(\frac{1}{g_m} \| R_s\right) C_1 (1 - g_m R_L) + C_1 R_L$$

$$\omega_p = 1/\tau$$

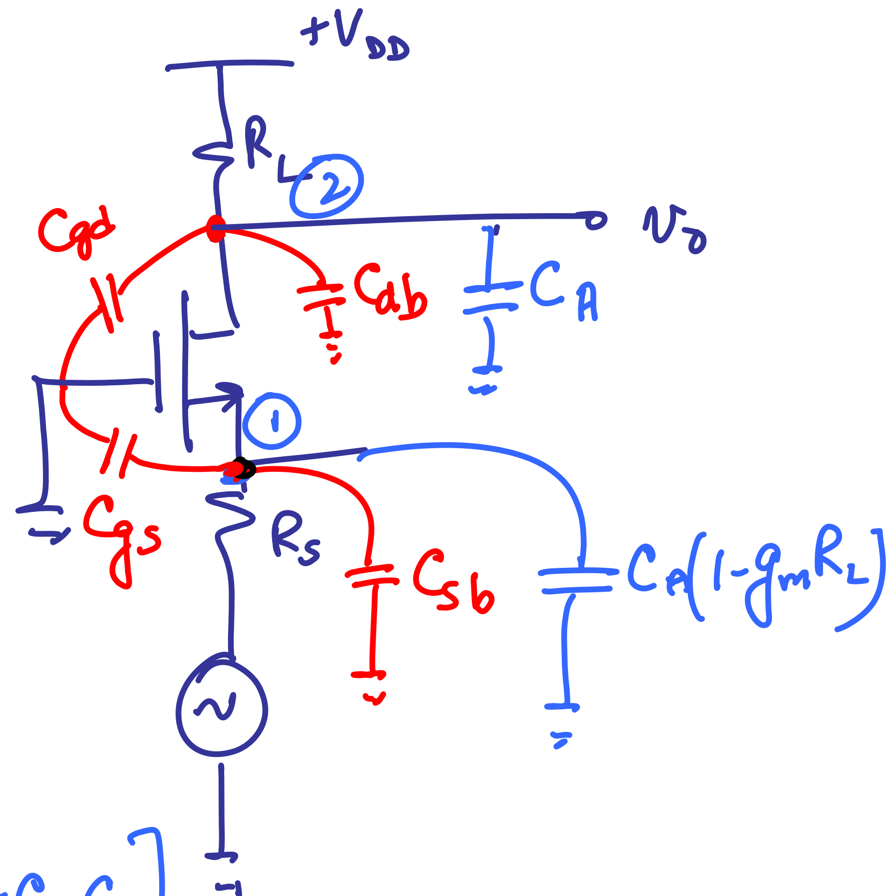
of poles 2

$$\tau = \left[C_{gs} + C_{sb} + C_A(1 - g_m R_L)\right] \frac{1}{g_m} \| R_s + \left(C_{gd} + C_{db} + C_A\right) R_L$$

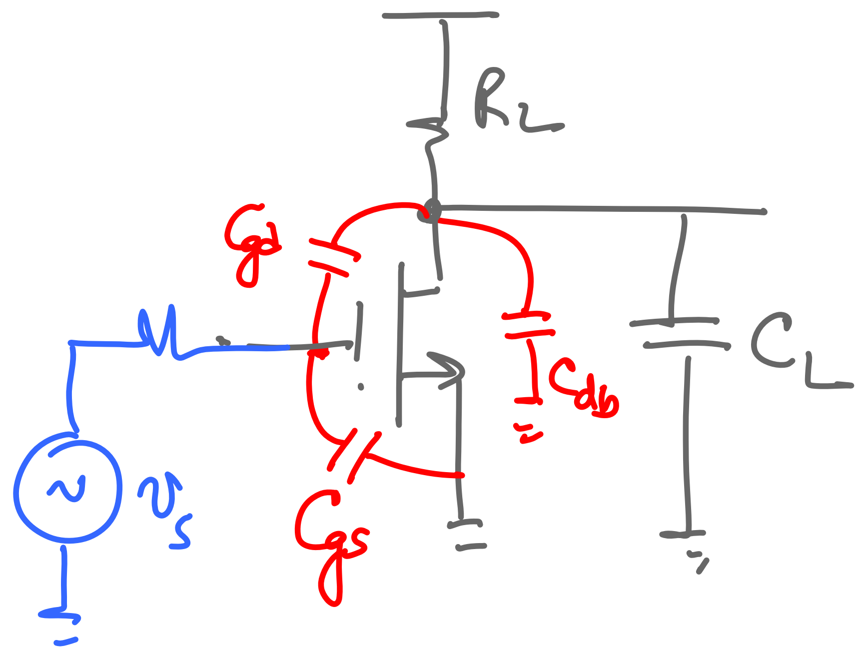
$$\omega_p = \frac{1}{\tau_1}$$

$$\tau_1 \tau_2 = R_1 R_2 \left[C_1 C_2 + C_A C_1 + C_A C_2\right]$$

$$\tau_2 = \frac{[\quad]}{\tau_1}$$



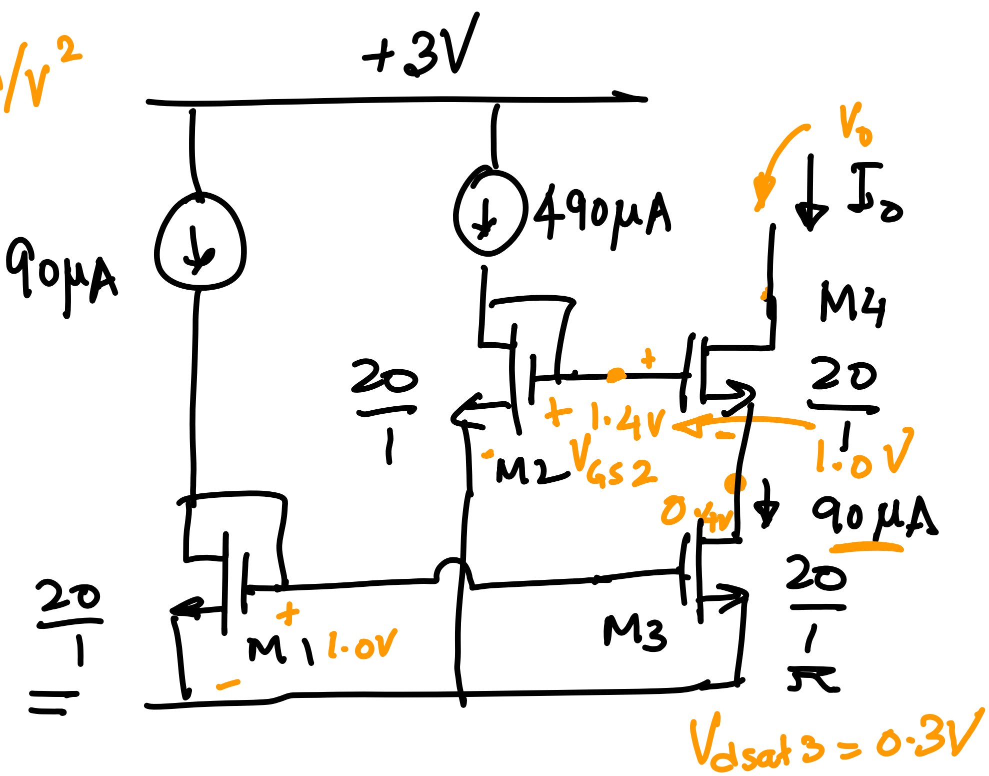
ONE



Find I_o ✓, V_{omin}

R_{out}.

$k' = 100\ \mu A/V^2$



$I_o = 90\ \mu A$, ~~$490\ \mu A$~~

~~$\frac{490-90}{2}\ \mu A$~~

$R_{out} \simeq g_{m4}\, r_{o4}\, r_{o3}$

$V_{omin}\ ? = 1.4 - 0.7$

$= 0.7\ V$

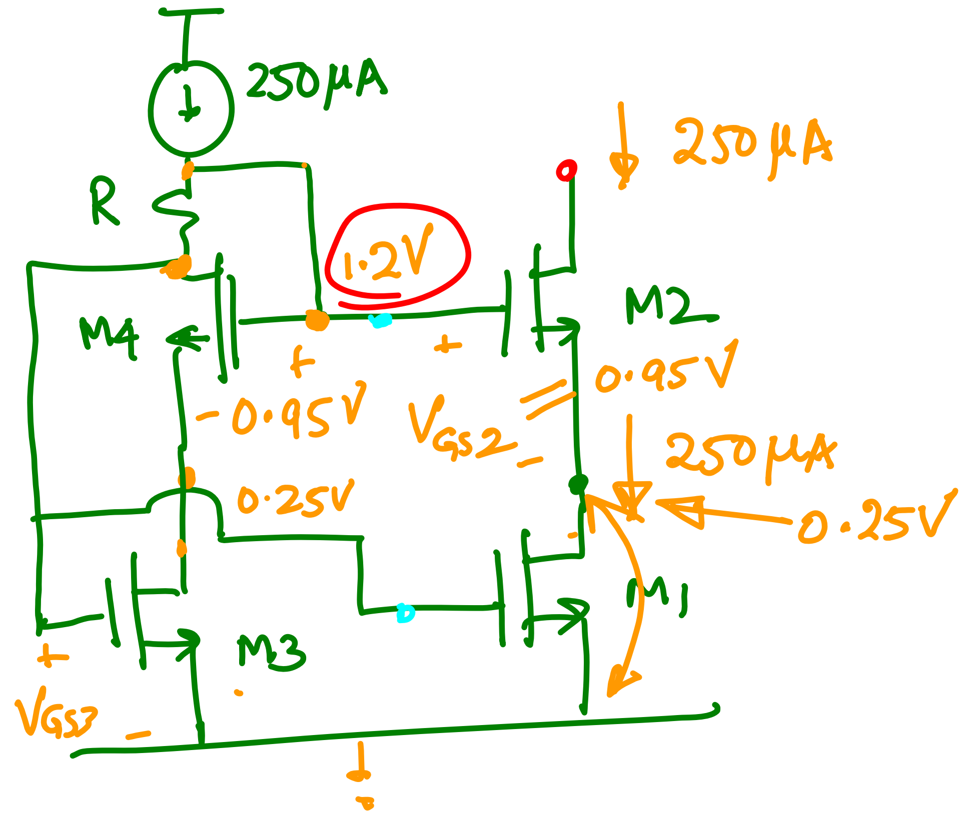
$$V_{GS1} = 0.7 + \sqrt{\frac{2 \times 90}{100\left(\frac{20}{1}\right)}}$$

$$= 0.7 + 0.3 = 1.0\ V$$

$$V_{GS2} = 0.7 + \sqrt{\frac{2 \times 490}{100\,(20/1)}} \quad 1.4V$$

$\frac{W}{L} = \frac{80}{1}$ $V_{T0} = 0.7V$

R = ? M1 is biased with $V_{ds} = V_{dsat}$



$$V_{GS3} = 0.7 + \sqrt{\frac{2 \times 250}{100\left(\frac{80}{1}\right)}}$$

$$= 0.7 + \frac{5}{20} = 0.95V$$

$$R = \frac{1.2 - 0.95}{250\mu A} = 1k\Omega$$

$R_{out} = g_{m2} r_{o2} r_{o1}$