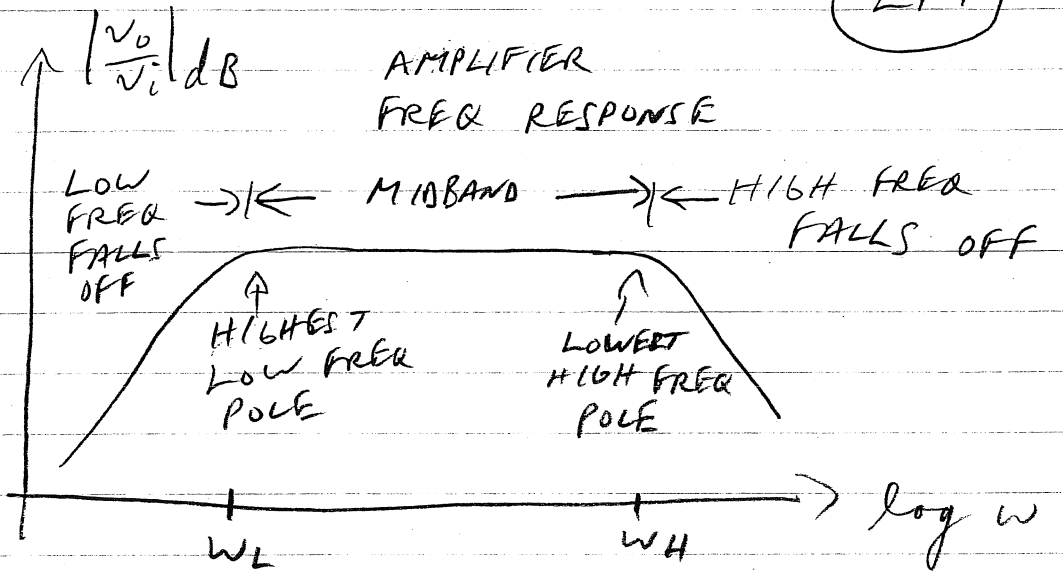
LOW FREQ RESPONSE

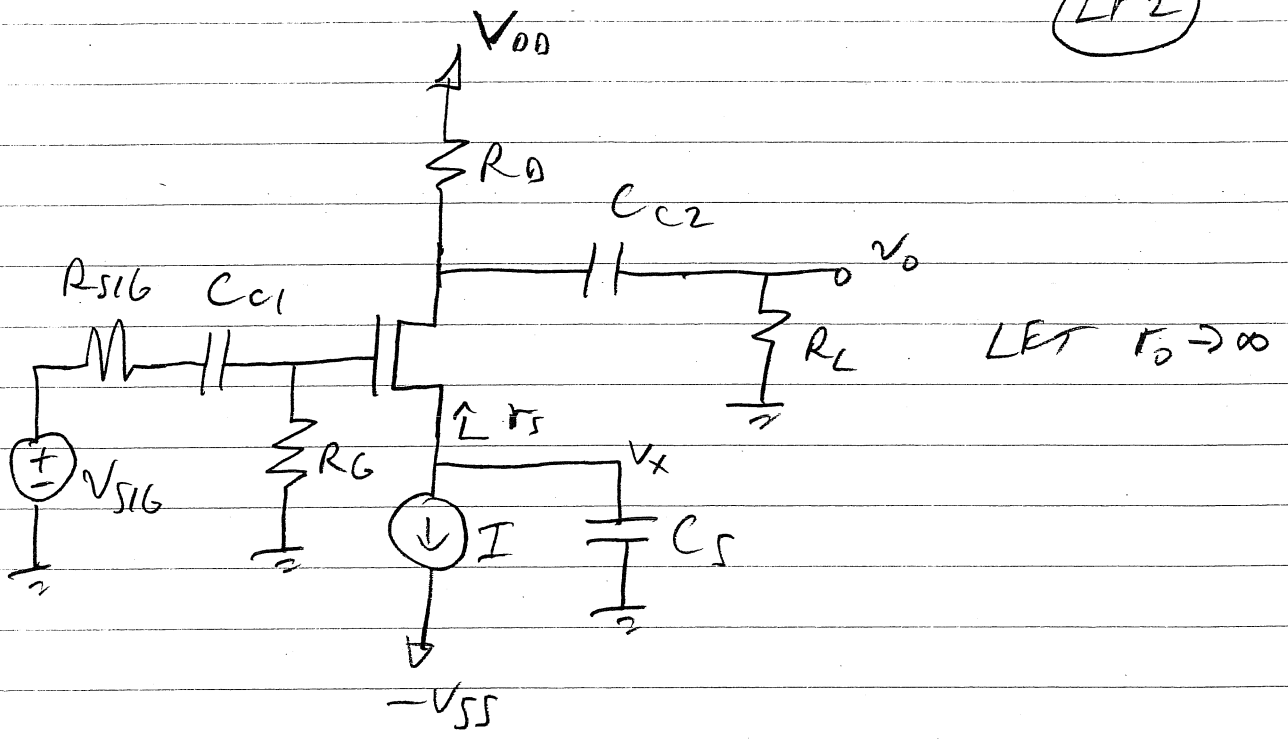
LF1



- LOW FREQ FALLS OFF DUE TO COUPLING CAPS AND BYPASS CAPS

- HIGH FREQ FALLS OFF DUE TO CAPACITORS INSIDE TRANSISTORS

(OR SOMETIMES ADDED CAPS TO LIMIT FREQ RESPONSE)



COUPLING CAPS $\Rightarrow$ C_{C1} & C_{C2}

BYPASS CAP $\Rightarrow$ C_S TO BYPASS CURRENT SOURCE SO V_x LOOKS LIKE SMALL-SIGNAL GROUND

3 LF (LOW FREQ) POLES

$$C_{C1} \Rightarrow \omega_{P1} = \frac{1}{C_{C1}(R_{SIG} + R_G)}$$

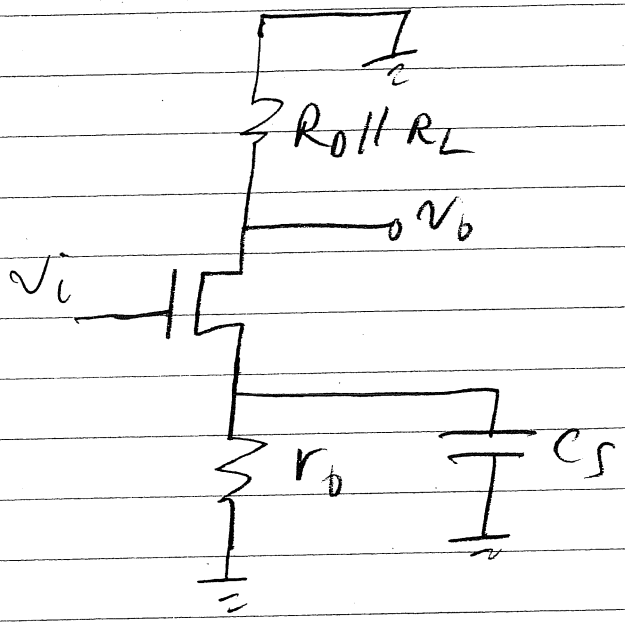
$$C_{C2} \Rightarrow \omega_{P2} = \frac{1}{C_{C2}(R_D + R_L)}$$

$$C_S \Rightarrow \omega_{P3} = \frac{1}{C_S(r_s)} = \frac{g_m}{C_S}$$

SINCE $r_s = \frac{1}{g_m}$

CONSIDER ONLY C_S

IF r_o FOR CURRENT SOURCE INCLUDED.

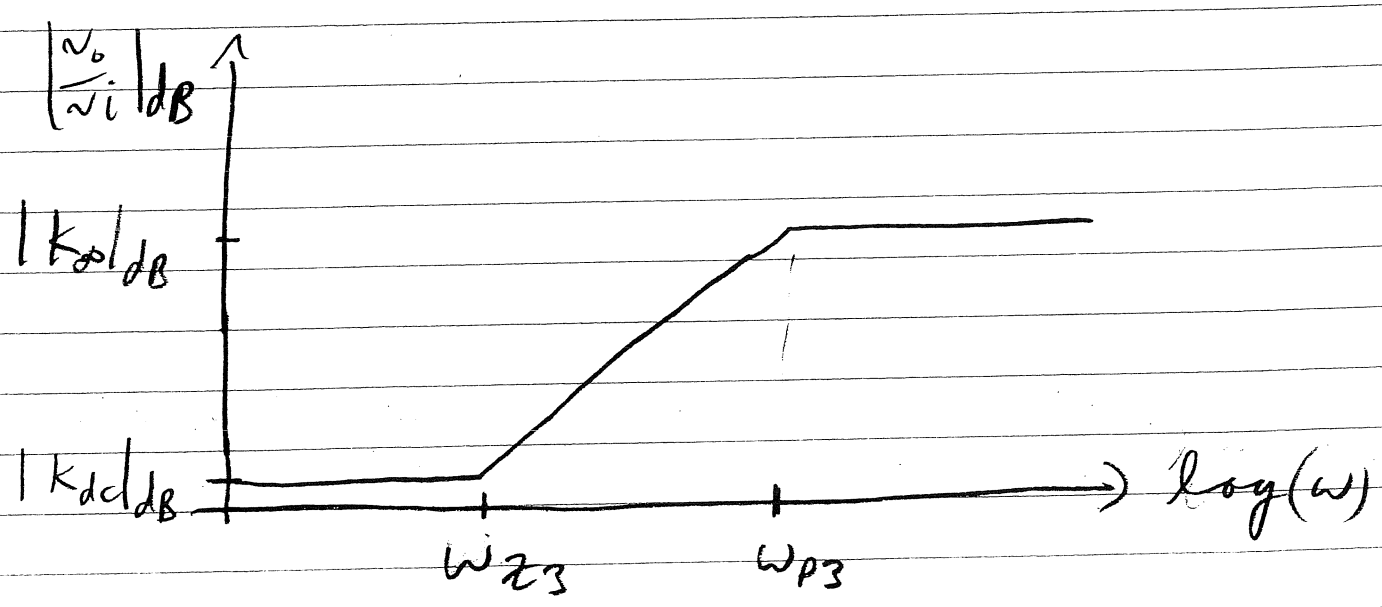


SMALL-SIGNAL CIRCUIT.

$$r_s = \frac{1}{g_m}$$

AT dc $$\frac{V_o}{V_i} = -\frac{R_O \| R_L}{r_s + r_o} \equiv k_{dc}$$

AT $\omega \to \infty$ $$\frac{V_o}{V_i} = -\frac{R_O \| R_L}{r_s} \equiv k_\infty$$



LF2B

$$\omega_{z3} = \frac{1}{C_C r_o}$$

$$\omega_{p3} = \frac{1}{C_C (r_5 \| r_o)}$$

ASSUMING FOR ω_{p_1} ω_{p_2} & ω_{p_3},

THE HIGHEST IS MUCH HIGHER THAN OTHERS (SAY 5→10 TIMES HIGHER)

THEN LF CUTOFF IS HIGHEST ω_{p_i}

EX GIVEN $R_G = 4.7M$ $R_D = R_L = 15K$
$R_{SIG} = 100\,K\Omega$ & $g_m \equiv 1mA/V$

SELECT C_{C_1} C_{C_2} & C_S SO $f_L \equiv 100Hz$

SOLN SINCE $r_s = \frac{1}{g_m} = 1K\Omega$

BEST TO CHOOSE $\omega_{p_3} = 2\pi \times 100Hz$
TO MINIMIZE CAPACITOR SIZES.

$$\omega_{p_3} = \frac{g_m}{C_S} = 2\pi \times 100Hz \Rightarrow C_S = \underline{1.6\,\mu F}$$

NOW LET $\omega_{p_1} = \omega_{p_3} = \frac{\omega_{p_3}}{10} = 2\pi \times 10$

$$\omega_{p_1} = \frac{1}{C_{C_1}(R_{SIG} + R_G)} = 2\pi \times 10 \Rightarrow C_{C_1} = \underline{3.3\,mF}$$

$$\omega_{p_2} = \frac{1}{C_{C_2}(R_D + R_L)} = 2\pi \times 10 \Rightarrow C_{C_2} = \underline{0.53\,\mu F}$$