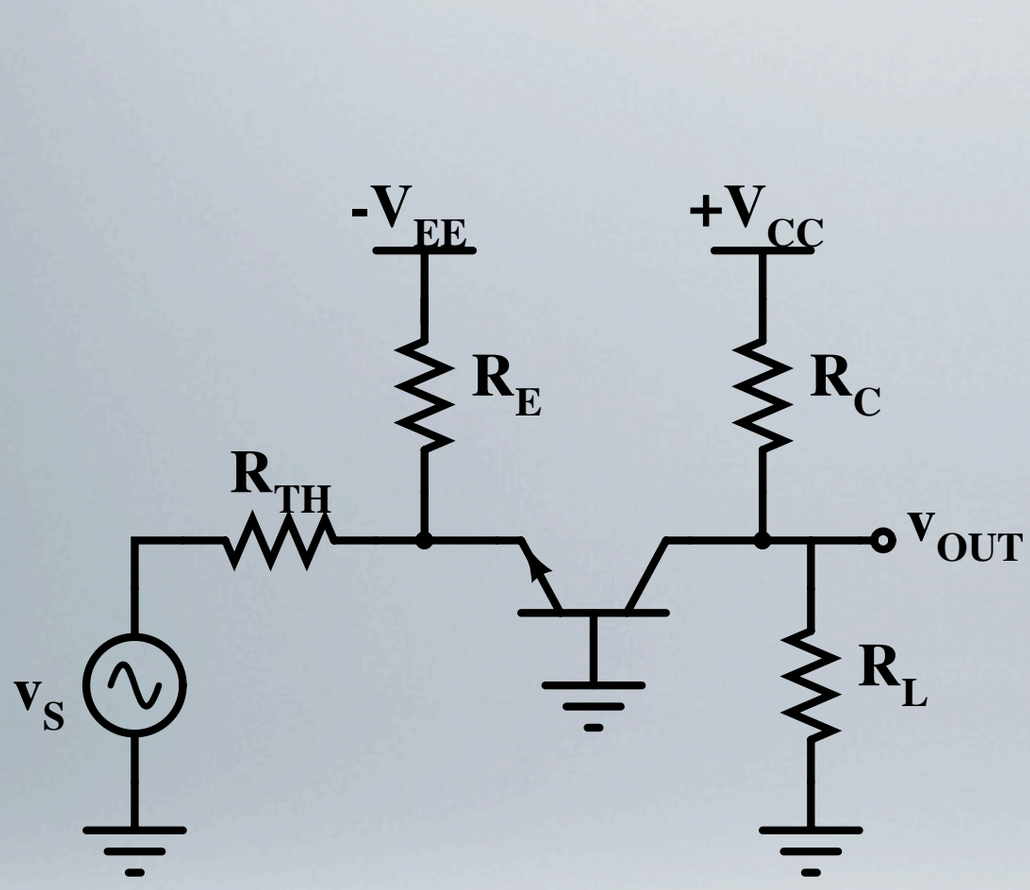
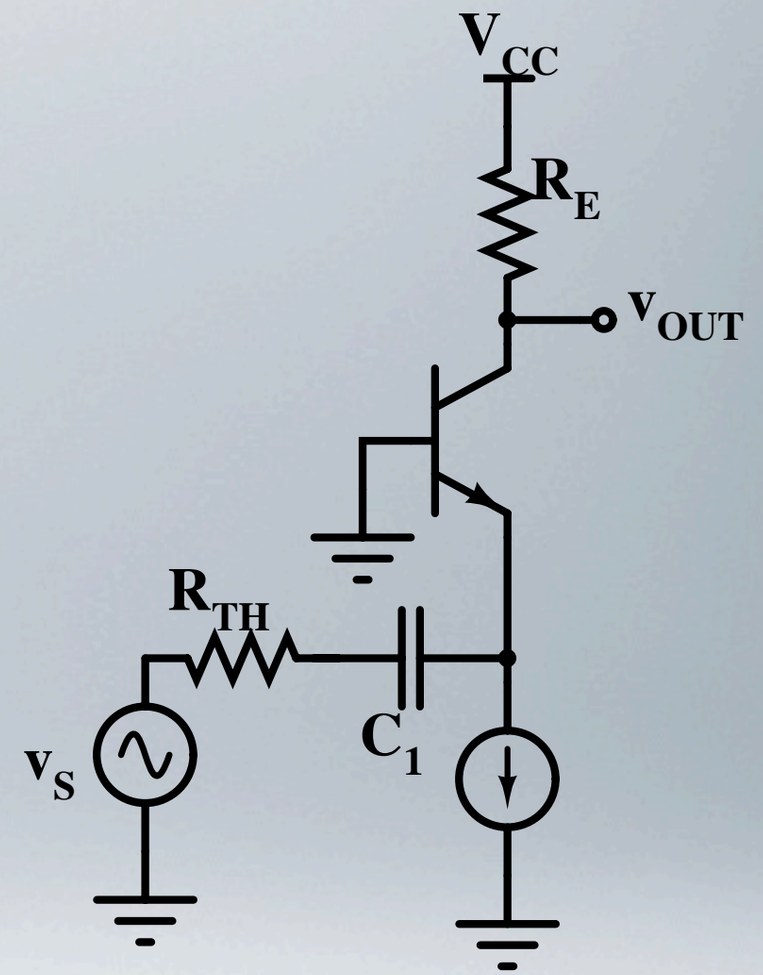
CB/CG AMPLIFIERS

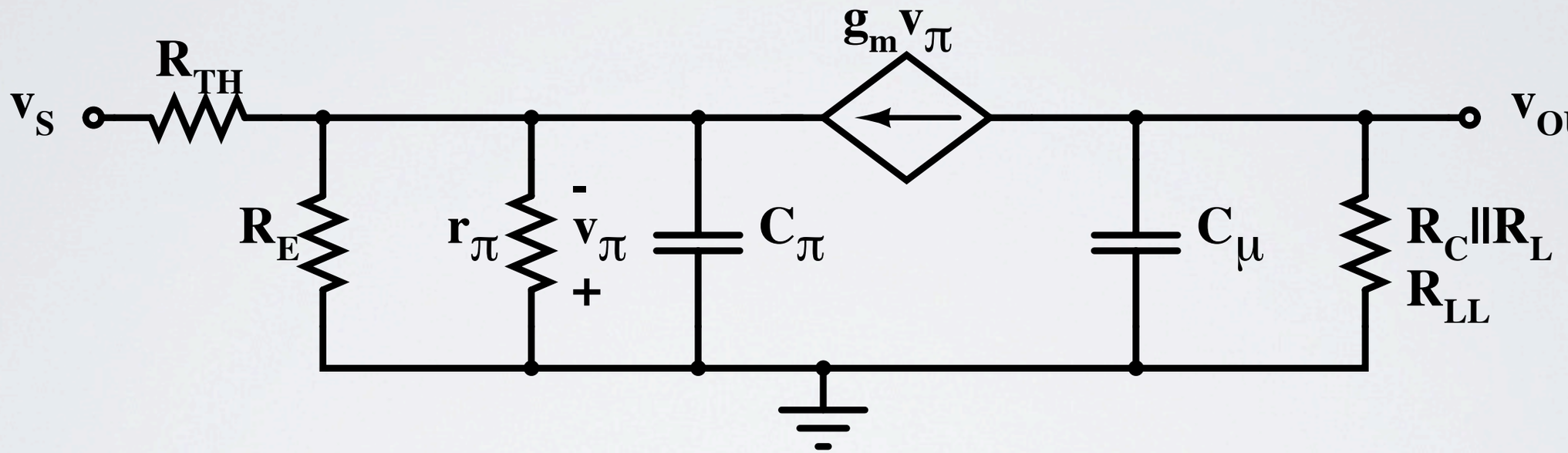
INEL 4202 - Fall 2012





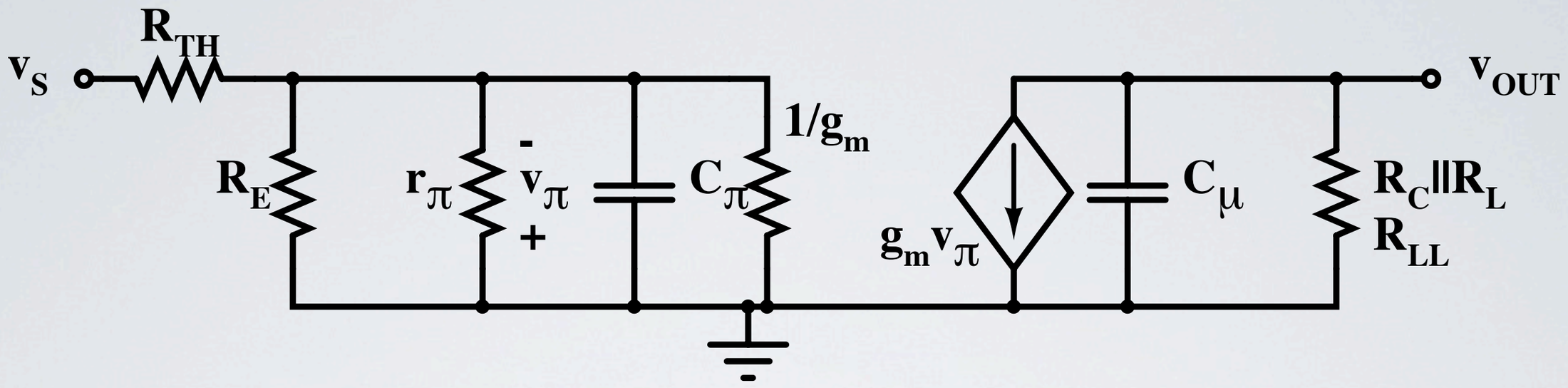
Two biasing configurations

High frequency equivalent circuit, left configuration:



No Miller effect!

Dependent source transformation



Poles at:

$$\omega_{H1} = \frac{1}{C_\pi R_\pi}$$

$$R_\pi = R_{TH} \,||\, R_E \,||\, r_\pi \,||\, 1/g_m \approx 1/g_m$$

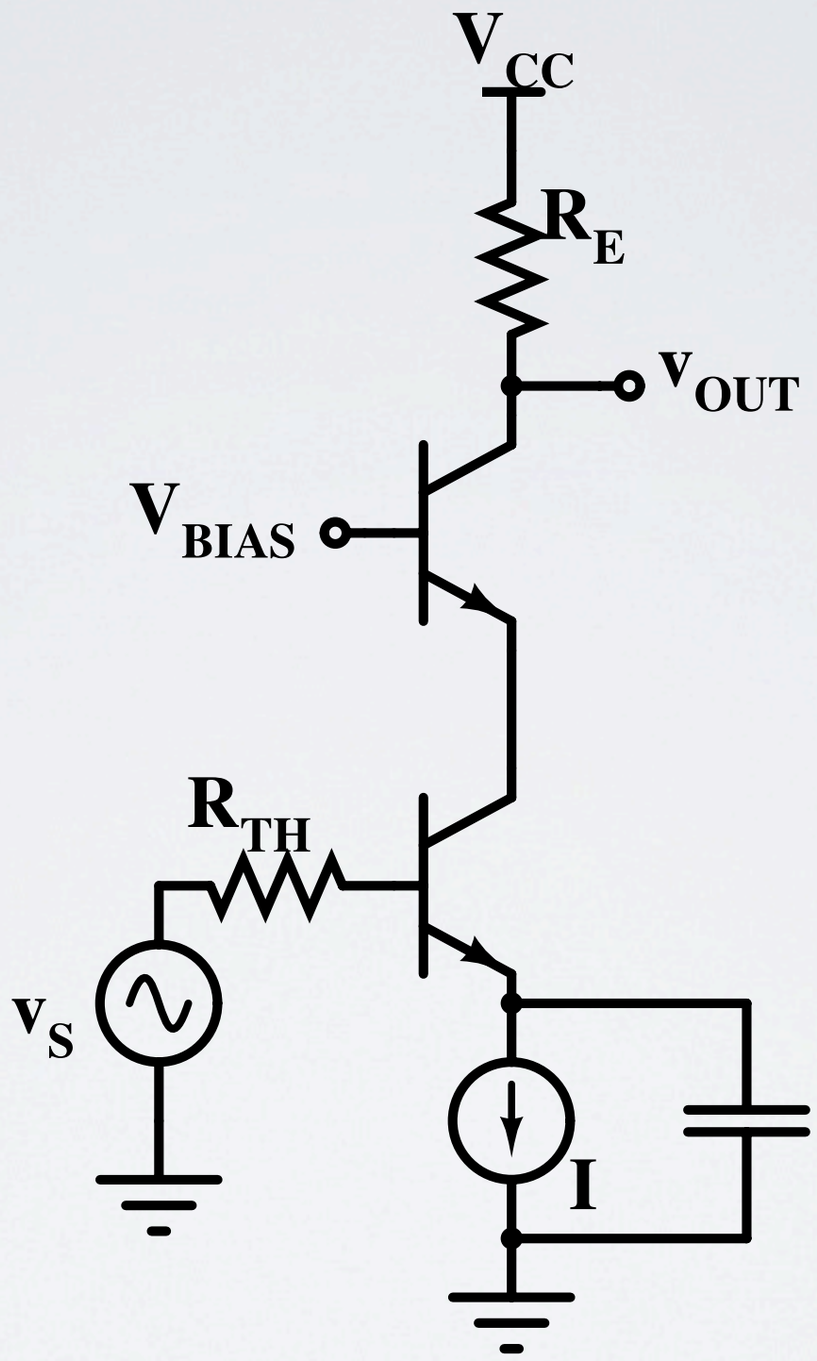
$$\omega_{H2} = \frac{1}{C_\mu R_{LL}}$$

6.86 A CG amplifier is specified to have

$$C_{gs} = 2\text{pF}, C_{gd} = 0.1\text{pF}, C_L = 2\text{pF},$$
$$g_m = 5\text{mA/V}, R_{sig} = 1\ \text{k}\Omega, \text{ and } R_L' = 20\ \text{k}\Omega$$

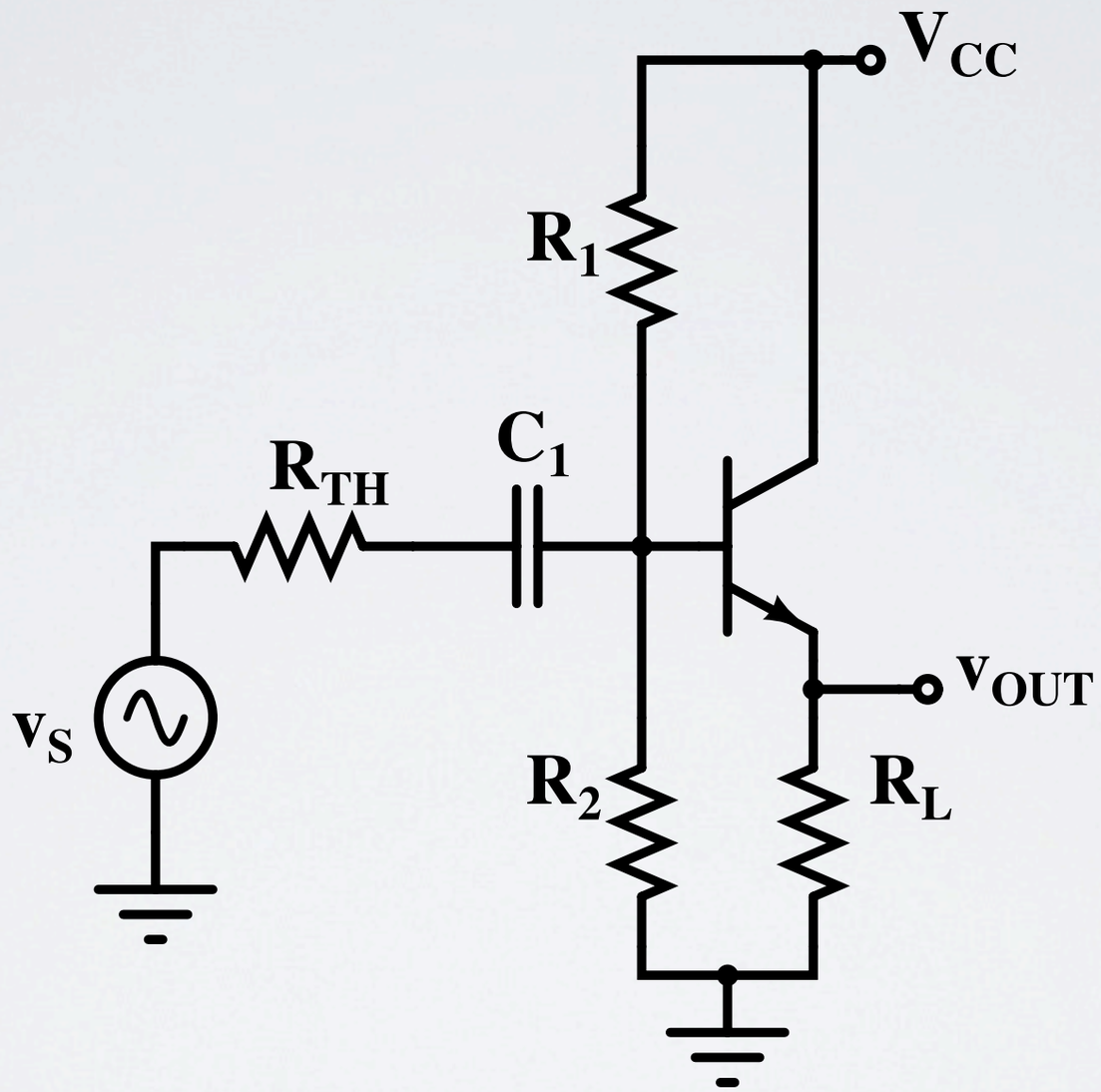
Neglecting the effects of r_o, find the low-frequency gain v_o/v_{sig}, the frequencies of the poles f_{P1} and f_{P2}, and hence an estimate of the 3-dB frequency f_H.

CE-CB cascode circuit

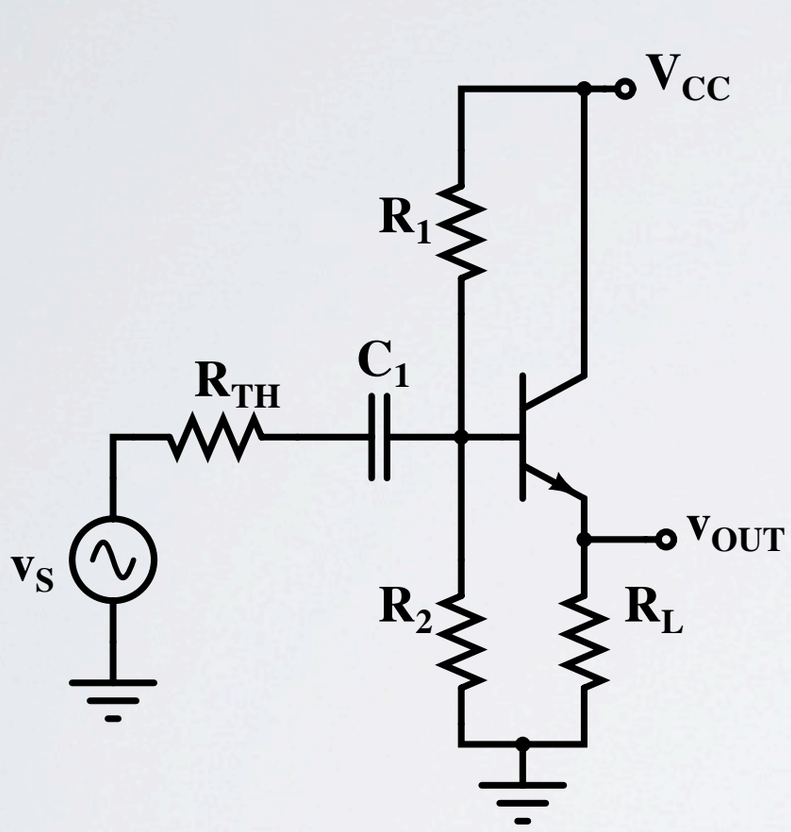


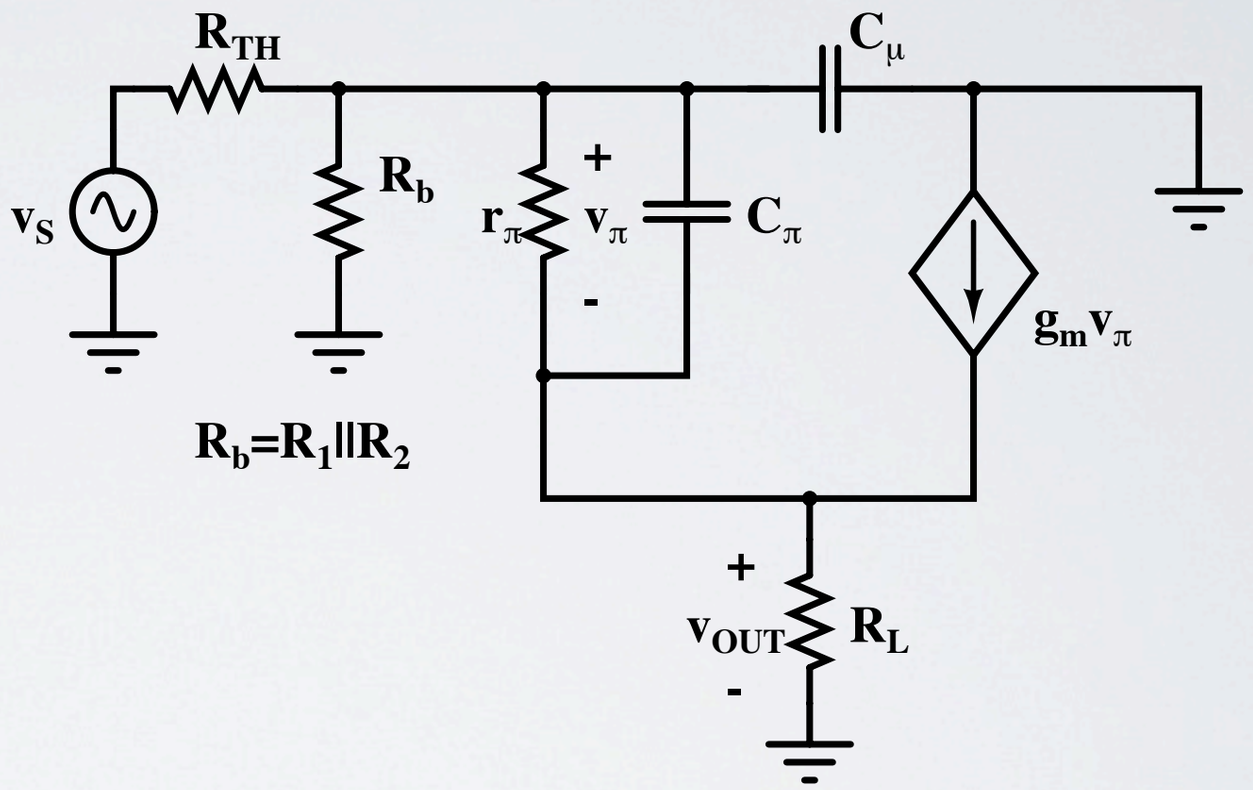
Find the dc gain and the 3-dB frequency of a MOS cascode amplifier operated at g_m=1mA/V and r_o = 50 kΩ. The MOSFETs have C_{gs}=30fF, C_{gd}=10fF, and C_{db}=10fF. The amplifier is fed from a signal source with R_{sig}=100kΩ and is connected to a load resistance of 2MΩ. There is also a load capacitance C_L of 40fF.

CC/CD (Emitter/Source follower)



CC/CD (Emitter/Source follower)





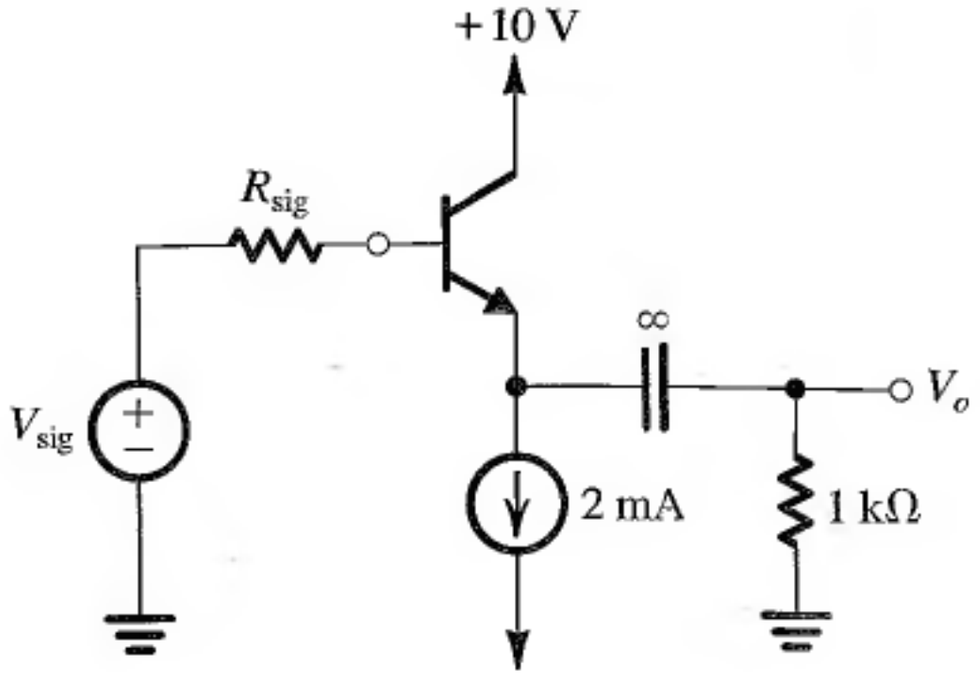


FIGURE P6.121

Prob. 6.121 For the emitter follower shown in Fig. P6.121, find the low-frequency gain and the 3-dB frequency f_H for the following three cases:

(a) R_{sig} = 1 kQ.
(b) R_{sig} = 10 kQ.
(c) R_{sig} = 100 kQ.

Let β = 100, f_T = 400 MHz, and C_μ = 2 pF.

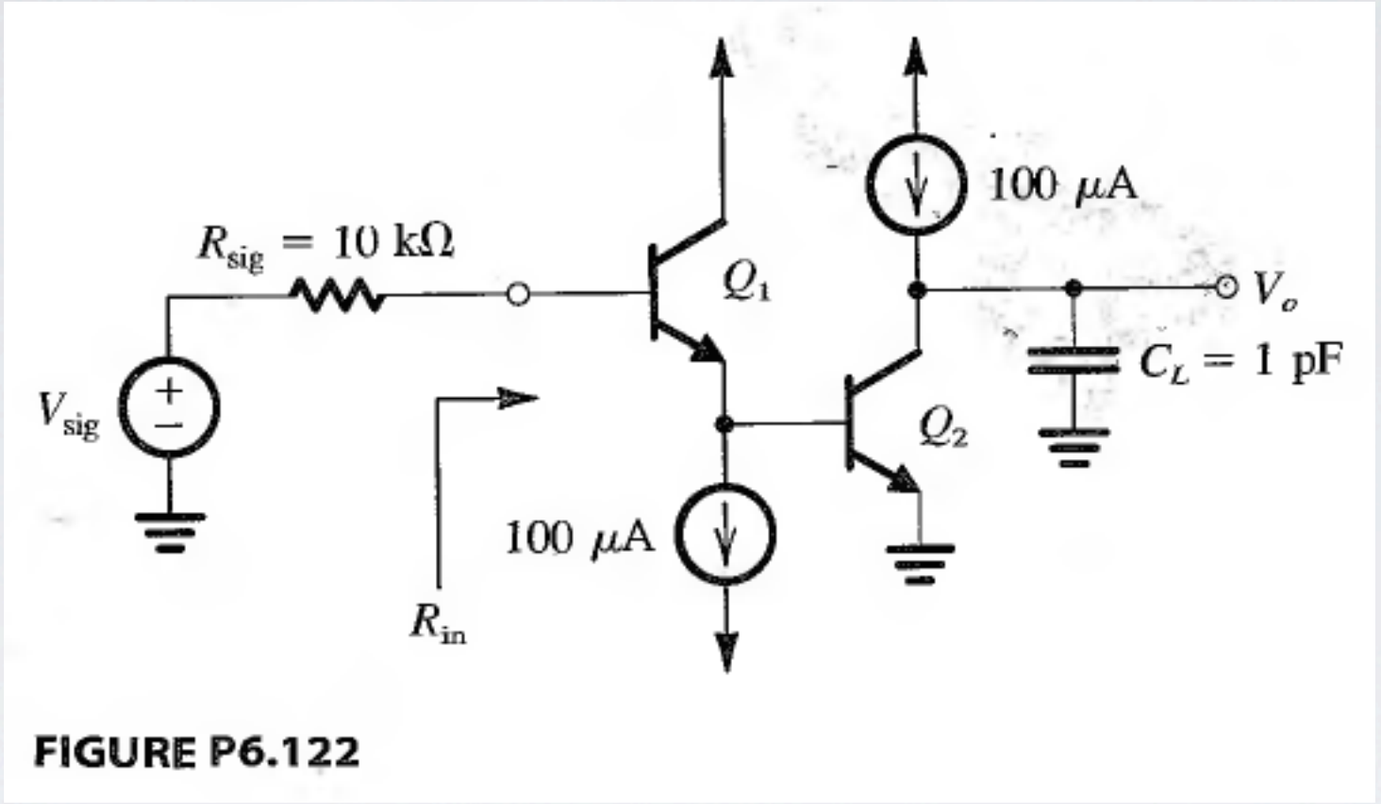


FIGURE P6.122

P6.122 The transistors in the circuit of Fig. P6.122 have $\beta = 100, V_A = 100$ V, $C_\mu = 0.2$ pF, and $C_{je} = 0.8$ pF. At a bias current of 100μA, $f_T = 400$ MHz. (Note that the bias details are not shown.)

(a) Find R_{in} and the midband gain.

(b) Find an estimate of the upper 3-dB frequency f_H. Which capacitor dominates? Which one is the second most significant?

(c) What are the effects of increasing the bias currents by a factor of 10?