

Nanyang Technological University
School of Electrical & Electronic Engineering
E2002 Analog Electronics – Tutorial 7

1. The gate resistor R_G in Figure 1 is said to be “bootstrapped” by the action of the source follower.
 - a. Assume that the MOSFET is operating with $g_m = 3.54 \text{ mS}$ and r_o can be neglected. Draw the small signal model and find the voltage gain, input resistance and output resistance for the amplifier if $R_G = 1 \text{ M}\Omega$, $R_S = 2 \text{ k}\Omega$, $R_L = 100 \text{ k}\Omega$ and $V_{DD} = V_{SS} = 10 \text{ V}$.
 (Ans: $A_v = 0.874$, $R_{in} = 7.94 \text{ M}\Omega$, $R_{out} = 247 \Omega$)
 - b. What would R_{in} be if A_v were exactly +1?
 (Ans: ∞)

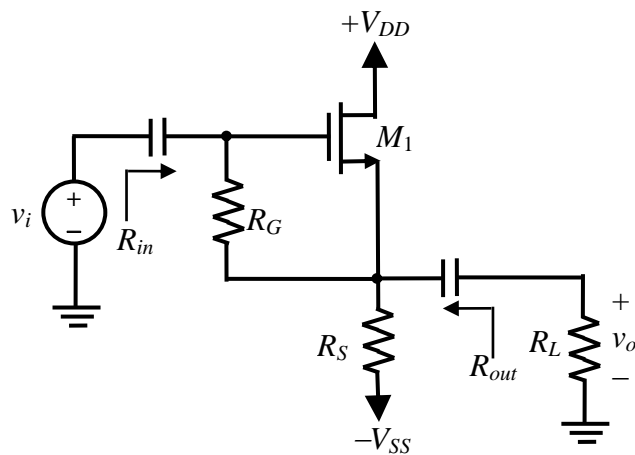


Figure 1

2. What are the midband voltage gain, input resistance and output resistance of the amplifier in Figure 2? Use $\beta = 100$ and $V_A = 70 \text{ V}$.
 (Ans: $A_v = 444$, $R_{in} = 73.6 \text{ k}\Omega$, $R_{out} = 18.8 \text{ k}\Omega$)

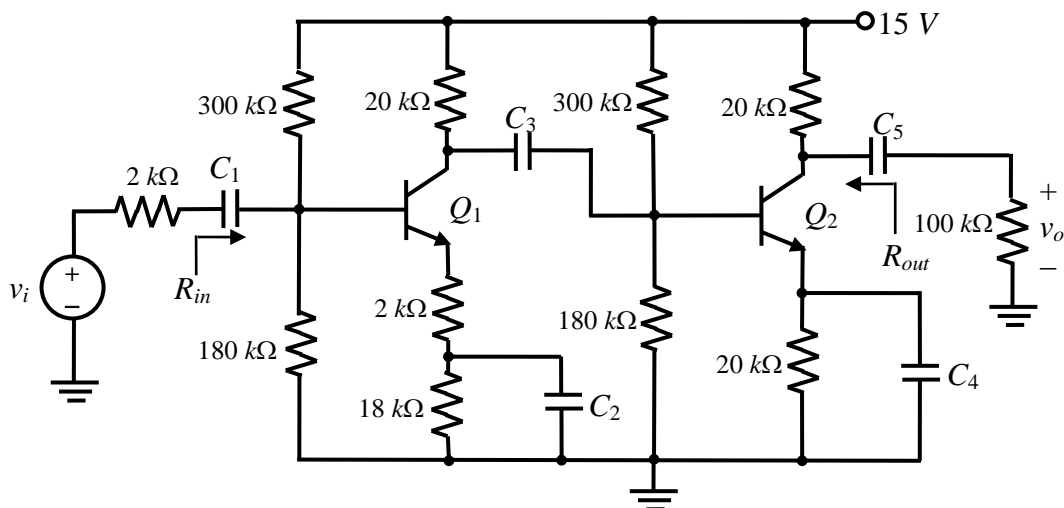


Figure 2

3. Figure 3 shows a three-stage amplifier. Find the midband voltage gain, input resistance and output resistance of this amplifier. What is the input signal range for this amplifier? Use $\beta = 100$, $V_A = 70\text{V}$, $K_n = 1\text{ mA/V}^2$, $V_{TN} = 1\text{ V}$ and $\lambda = 0.02\text{ V}^{-1}$ for all BJT and n -MOS transistors.
(Ans: $A_v = 607$, $R_{in} = 7.18\text{ k}\Omega$, $R_{out} = 434.6\text{ }\Omega$, $v_i \leq 280\text{ }\mu\text{V}$)

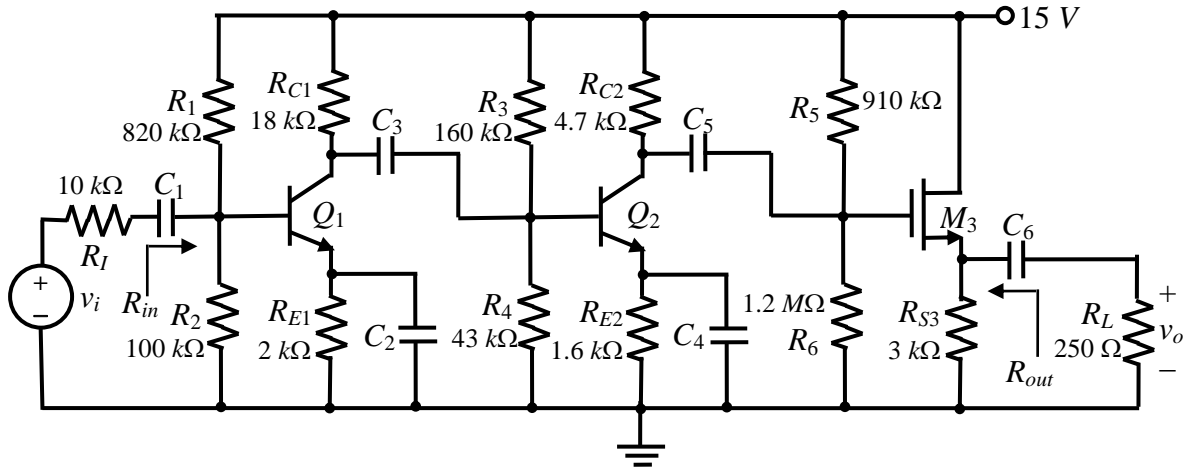


Figure 3