

ELE339, Electronics I Laboratory

LAB 8 - Common Collector (or Emitter Follower) Amplifier

Pre-Lab

Objective:

In this lab, we investigate a typical BJT output stage (or driver stage), the common collector or emitter follower amplifier. This circuit does not provide any voltage gain, but it combines high input impedance with low output impedance, which translates into a high current gain.

Tasks:

1. Figure 1 shows a common collector circuit that employs bipolar supplies. This not only eliminates an expensive (i.e., large) input capacitor (why?), but also considerably increases the input resistance. Find the Q-point values I_{CQ} and V_{CEQ} of this circuit if $R_E = R_L = 100$ (assume V_S to be an ideal ac voltage source).
2. Determine the theoretical values of R_{in} and R_{out} by replacing the emitter follower by a linear equivalent circuit.
3. Use Pspice to verify your values of R_{in} and R_{out} .
4. Use Pspice to record the resulting output waveforms of circuit 1 for a 1 kHz sinusoidal input sources of 2V and 4V amplitudes and explain your observation.
5. Use PSpice to determine the total power dissipated by the emitter follower as well as the power dissipated by R_L only. What is the power efficiency of this circuit?
6. Find an approximate expression for the equivalent input resistance R_{in} in the circuit of Fig. 2.
7. Simulate circuit 2 with PSpice. Carry out a time domain (transient) analysis for a 1kHz sinusoidal input signal with amplitude values of 2V to 4V. Observe V_{out} , V_{B1} , V_{B2} and the two supply currents I_{CC} (positive) and I_{EE} (negative). How much power does this circuit dissipate and what fraction of this power does the load resistor R_L consume?

Experimental

8. Verify your values of R_{in} and R_{out} by actual measurements on the board. To do so, set up a circuit such that enables you to determine the resistor values by measuring voltages only.
4. Record the experimental resulting output waveforms of circuit 1 for a 1 kHz sinusoidal input sources of 2V and 4V amplitudes and compare to the results to the simulations in task 4 of the Pre-Lab.
7. Build the circuit depicted in figure 2 on your board (use the MPQ6002N quad transistor chip and select $R_E = R_L = 33$) and record its response to a 1kHz sinusoidal input of 2V and 4V amplitude, respectively.

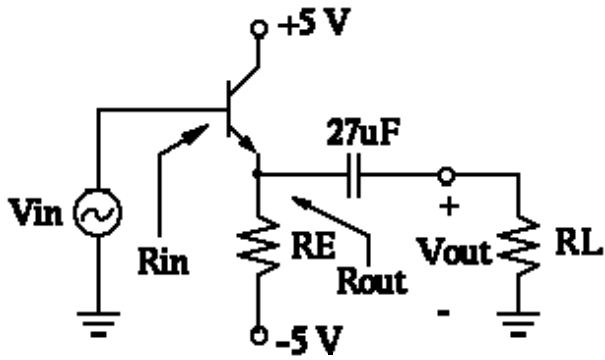


Figure 1: Common collector amplifier with bipolar supply voltages.

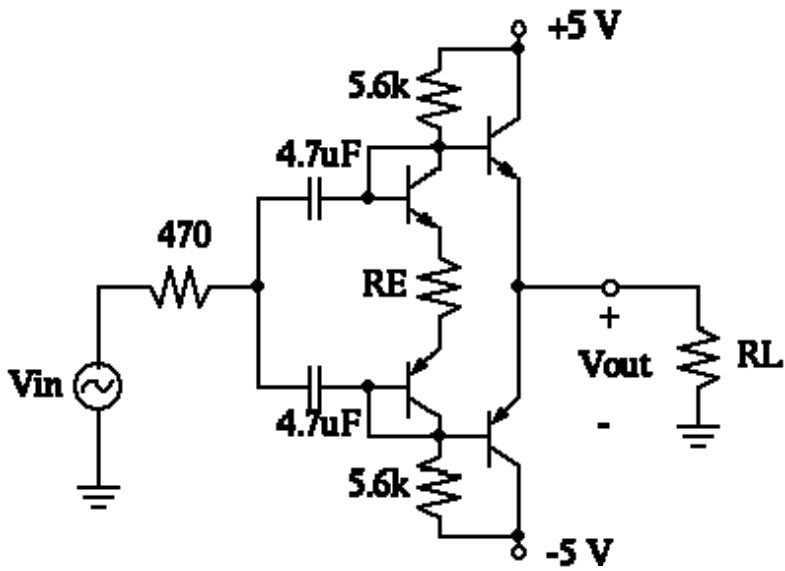


Figure 2: Push-Pull power amplifier with bipolar supplies.