Lab 9: Power Amplifers
U.C. Davis Physics 116A

INTRODUCTION

The purpose of this first lab is to become familiar with the various classifications of power amplifiers and their performance characteristics.

1. Class A Amplifier

Make the amplifier shown in figure 1. Use the following components:

- $V_{CC} = +5V$
- $R_C = 1k\Omega$
- $R_E = 1k\Omega$
- $R_1 = 10k\Omega$
- $R_2 = 1k\Omega$
- $C_{in} = 10\mu F$
- $C_{out} = 10\mu F$
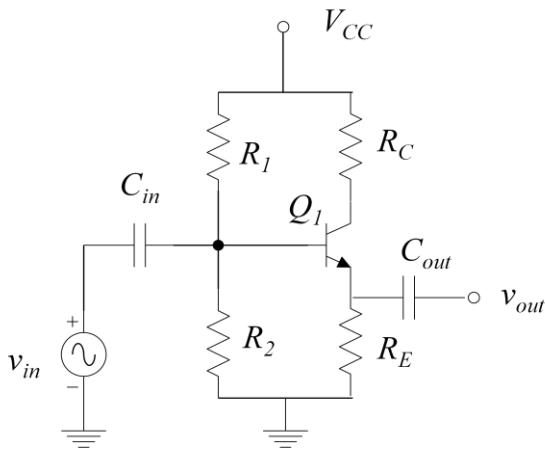- $v_{in} = 1$ kHz, 2 V_{pp}
- Q_1 is a 3904

Figure 1: Class A BJT Amplifier

Detemine the voltage gain and the phase shift of the output. Sketch the input and output waveform. Determine the Q point for this configuration.

2 . Class B Amplifier

Remove R_1 from the previous circuit. What is V_B? Determine the Q point for this configuration and sketch the waveform. Determine the region of linearity, the gain for that region, and discuss the non-linearities observed.

3. Class A-B Amplifier

Replace R1 in the circuit shown in figure 1. Now adjust V_{CC} while monitoring V_B. Adjust V_{CC} to get V_B values of 1.0, 0.5 and 0.25 V. Sketch the waveforms, discuss the regions of linearity, the gain for those regions, and how circuit should be classified for each setting.

4. Push-Pull Amplifier

Make the amplifier shown in figure 2. Use the following components:

- $V_{CC} = +/-5V$
- $R_C = 1k\Omega$
- $R_1 = 10k\Omega$
- $R_2 = 1k\Omega$
- $C_{in} = 10\mu F$
- $C_{out} = 10\mu F$
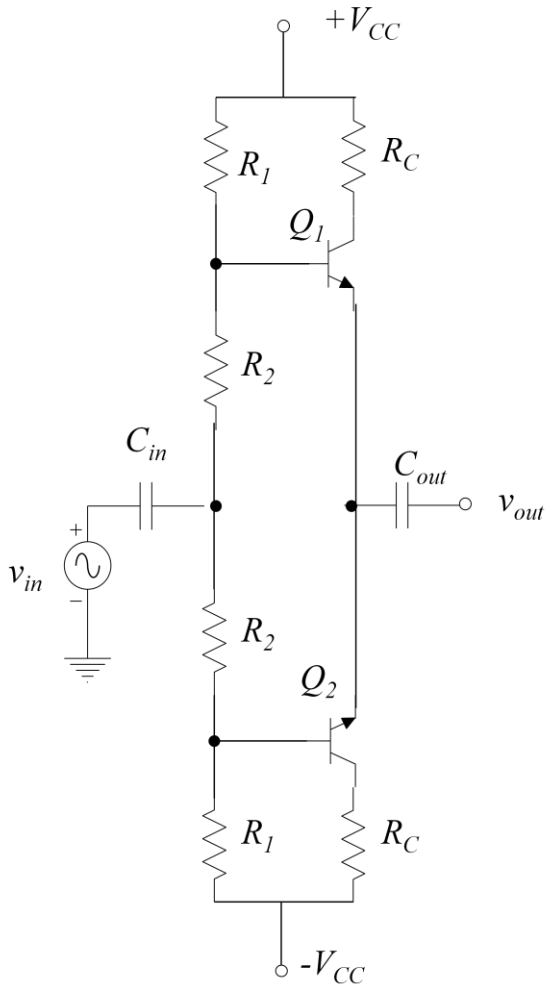- $v_{in} = 1$ kHz, 2 V_{pp}
- Q_1 is a 3904 npn
- Q_2 is a 3906 pnp

Figure 2: A Push-Pull Amplifier

$C_{in} = 10\mu F$
$C_{out} = 10\mu F$
$v_{in} = 1$ kHz, 100 mV$_{pp}$
Q_1 is a 3904 npn
Q_2 is a 3904 npn

Determine the voltage gain. Now hook up the speaker. Does this give more volume that the previous setup?

Sketch the input and output waveforms. Determine the Voltage gain and comment about the regions of linearity.

Plug the output into input 1 of the speaker on the project board. Ground input 2 of the speaker.

5. Darlington Pair Configuration (Optional)

Wire two npn transistors in a common collector Darlington pair configuration. Be careful not to blow out these transistors. The second transistor is drawing a bit a power. Use the following components:

- $V_{CC} = +5$V
- $R_C = 0$ – no collector resistor
- $R_E = 100$ Ω
- $R_1 = 10$kΩ
- $R_2 = 1$kΩ