UNIVERSITY OF CALIFORNIA AT BERKELEY
College of Engineering
Department of Electrical Engineering and Computer Sciences

EE105 Lab Experiments

Report 8: Multi-stage Amplifiers

Solutions

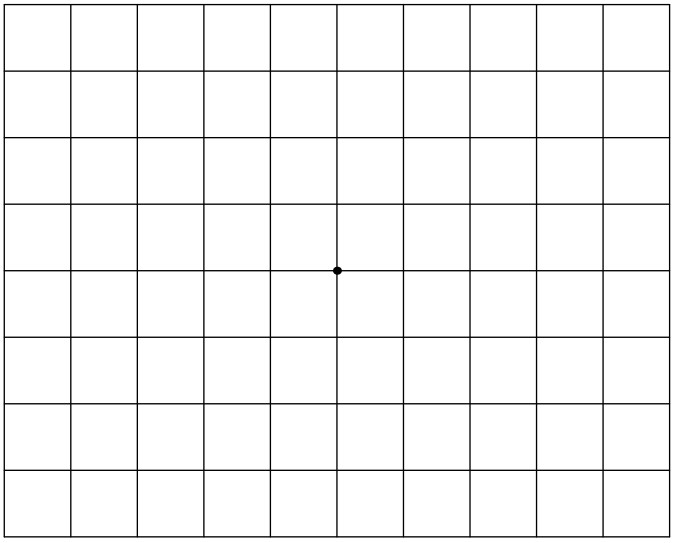
3.1.3 Measure I_{BIAS} and the DC voltage at v_{OUT}.

$I_{BIAS} = 0.109$ mA

$v_{OUT} = 2.72$ V

3.1.4 Using the oscilloscope, plot both the input v_{IN} and the output v_{OUT}. Sketch the waveforms you observe.

$v_{IN,p-p}$ is 40 mV. v_{OUT} is clipped at 0.9 V and 4.9 V.



3.1.5 Why is v_{OUT} not sinusoidal?

The supply rail is not high enough to support such a high gain from this cascode amplifier. The output waveform is clipped.

3.1.7 What is the peak-to-peak voltage of the output waveform (at v_L) with the load resistor? What is the gain of the amplifier with the resistive load?

$$v_{out,p-p} = 2 \text{ V}$$

$$\left|\frac{v_L}{v_{IN}}\right| = 35.7 \text{ dB}$$

3.2.1 Can you hear anything when the speaker is directly hooked up to the function generator?

No.

3.2.3 Can you hear anything when the speaker is hooked up to the output of the amplifier?

Yes.

3.2.4 Measure I_{BIAS1}, I_{BIAS2}, and the DC voltages at v_{OUT1} and v_{OUT2}?

$$I_{BIAS1} = 0.31 \text{ mA}$$

$$I_{BIAS2} = 21.28 \text{ mA}$$

$$v_{OUT1,DC} = 2.1 \text{ V}$$

$$v_{OUT2,DC} = -6 \text{ mV}$$

3.2.5 Measure V_{BE} of Q_2. Is the DC voltage at v_{OUT1} enough to bias Q_2 in the forward active region?

$$V_{BE} = 0.95 \text{ V}$$

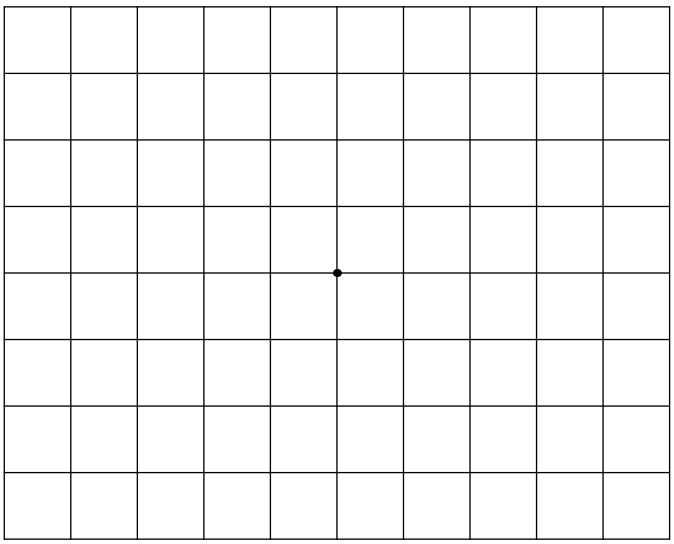
Yes

3.2.6 Using the oscilloscope, plot both the input v_{IN} and the output v_{OUT2}. Sketch these waveforms (a plot is on the following page).

$v_{IN,p-p}$ is 40 mV. $v_{OUT,p-p}$ is 765 mV.

3.2.7 Measure the gain and phase of v_{OUT2}/v_{IN}.

$$\left|\frac{v_{OUT2}}{v_{IN}}\right| = 25.5 \text{ dB}$$



3.2.8 Now increase the DC offset of the input waveform to 600 mV. What happens to the waveform at v_{OUT2}?

The waveform is distorted and clipped. The sound is very noisy. This is because the DC bias is not optimal in biasing the two stages. Some transistors are no longer biased in the forward active region.