ShanghaiTech University
School of Information Science and Technology

EE112 Lab Experiments

Experiment 3: Single Stage Common-Emitter (CE) &Common-Source (CS) Amplifier

Contents

1. Introduction

In this lab, you will implement common-emitter (CE) and common-source (CS) amplifier with real devices according to your design in the pre-lab. You need to verify the performance and make adjustments to satisfy all the specifications.

2. Materials

All the components you need in this lab are listed in Table 1. Be sure to bring the devices you already characterized. You can ask TA for 10k pots if you need even finer adjustment in your tuning.

Table 1: Lab3 Components

Component	Quantity
2N4401(NPN)	1(the one you already characterized)
BS170(NMOS)	1(the one you already characterized)
1nF	1
10uF	2
10k Pot	2
Resistors	Various Values

3. Attenuation Network

The attenuation network you already analyzed in your prelab is shown in Figure 1.The function generator is modeled as what is shown in the dash-lined box. **Make sure the output impedance of your function generator is set to 50 Ω.** Implement the rest

of the network, set the amplitude of your function generator to 2V (**Keep in mind that real peak-peak value of V_{source} in Figure 1 is actually twice of that, which is 4V. Refer to the tutorial of function generator for detailed description**) and function to sine, measure pk-pk value of V_{in} with V_{in} node open. Record the attenuation ratio.

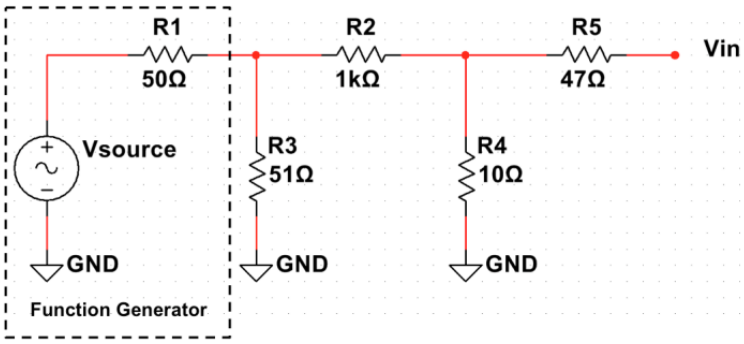

Figure 1: Attenuation Network

4. Single Stage Common-Emitter (CE) Amplifier

Implement single stage CE amplifier as shown in Figure 2. Pick resistors according to your pre-lab. Before you mount the potential meters onto the breadboard, set the resistance between the two pins that you will connect into the circuit to the values you designed. **Before turning on the DC Supply, set current limit to 100mA for protection of your device in case of any short circuit.**

Use a sinusoidal wave with 1V peak-to-peak magnitude as the source (V_{source}). Check if middle band gain, high cutoff frequency are satisfied. Gradually increase source magnitude until output is swing limited and check if output swing is satisfied. (Refer to the descriptions in the pre-lab for the measurement of output swing.) Tune potential meter if necessary to meet all the design specs. Record the voltage gain from 10Hz to 100kHz with 10 points per decade. Make sure you did not miss the points of f_L and f_H. Plot Bode plot with data and mark A_{mid}, f_L and f_H on the curve. Record the output waveform showing output swing. Use potential meter to measure voltage cross R_{b1} and R_c, calculate currents in those two branches and then calculate power consumption. After you finish, measure the value of potential meter you tuned.

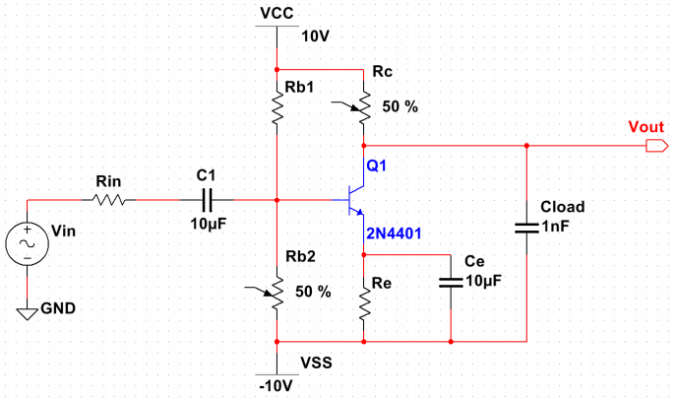

Figure 2: Single Stage Common-Emitter Amplifier

5. Single Stage Common-Source (CS) Amplifier

Implement single stage CE amplifier as shown in Figure 2. Pick resistors according to your pre-lab. Before you mount the potential meters onto the breadboard, set the resistance between the two pins that you will connect into the circuit to the values you designed. **Before turning on the DC Supply, set current limit to 100mA for protection of your device in case of any short circuit.**

Use a sinusoidal wave with 1V peak-to-peak magnitude as the source (V_{source}). Check if middle band gain, high cutoff frequency are satisfied. Gradually increase source magnitude until output is swing limited and check if output swing is satisfied. (Refer to the descriptions in the pre-lab for the measurement of output swing.) Tune potential meter if necessary to meet all the design specs.

Record the voltage gain from 10 Hz to 100 kHz with 10 points per decade. Make sure you did not miss the points of f_L and f_H .Plot Bode plot with data and mark A_{mid}, f_L and f_H on the curve. Record the output waveform showing output swing. Use potential meter to measure voltage cross R_{b1} and R_c, calculate currents in those two branches and then calculate power consumption. After you finish, measure the value of potential meter you tuned.

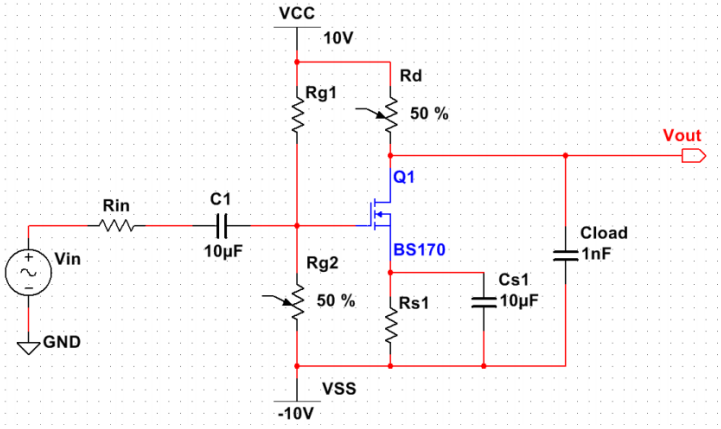

Figure 3: Single Stage Common-Source Amplifier

Reference

[1] UNIVERSITY OF CALIFORNIA AT BERKELEY, College of Engineering Department of Electrical Engineering and Computer Sciences, EE105 Lab Experiments