

Figure 1: A sample design for a resistively loaded common source amplifier.

1 Lab Introduction

In this lab you will characterize a common-source amplifier (loaded resistively and actively) and a current mirror using MOSFETs. The learning goals are listed below:

- Get some practice with MOSFET equations and amplifiers.
- Observe the difference between actively and passively loaded amplifiers

2 Resistively Loaded Common Source Amplifier

Simulate the common source amplifier picture in Figure 1 using the TN2106 N-channel MOSFET. Vary V_B and plot the large-signal transfer characteristic (V_O vs. V_B) for this amplifier. Use the transfer characteristic to pick a value of V_B that will maximize your gain and swing. Measure I_D , r_{in} , r_{out} , a_v , and V_{SW} for this design with your V_B value. Use your results to extract g_m and V_T for this device, and compare your V_T value to the datasheet.

Required Data: Transfer characteristic. Descriptions of how to measure I_D , r_{in} , r_{out} , a_v , and V_{SW} . Equations relating these parameters to g_m and V_T . Values for all of these parameters.

3 Current Mirror

Simulate the current mirror pictured in Figure 2 using two TP2104 MOSFETs. Verify that the current in the source and load branches match as you vary the bias current and the load resistance.

Required Data: Plot of I_{LOAD} vs. I_{SRC} . Plot of I_{LOAD} vs. R_{LOAD}

4 Current Mirror Loaded Common Source Amplifier

Simulate the common source amplifier picture in Figure 3 by combining your circuits from the first two sections. Biasing this amplifier is going to be a little bit tricky. Vary the current in your current source until V_O is at 7.5V. Then measure I_D , r_{in} , r_{out} , a_v , and V_{SW} for this design. As before, extract g_m and V_T and compare them to your datasheet. Also, vary V_B and plot the large-signal transfer function (V_O vs. V_B) for this amplifier. Comment on differences in your results as compared to the resistively loaded common source amplifier.

Required Data: Transfer characteristic. Descriptions of how to measure I_D , r_{in} , r_{out} , a_v , and V_{SW} . Equations relating these parameters to g_m and V_T . Values for all of these parameters. Commentary on differences between active load and resistive load.

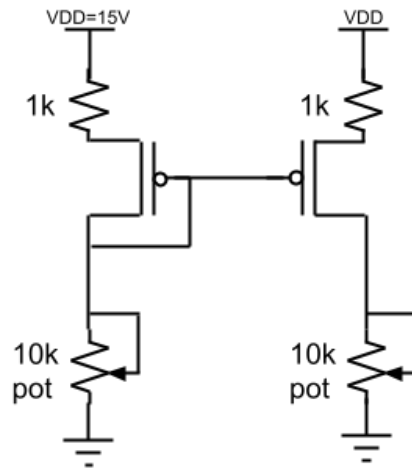


Figure 2: A sample design for a PMOS current mirror.

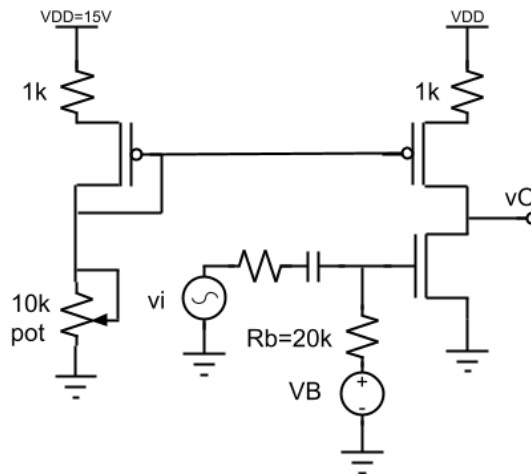


Figure 3: A sample design for an actively loaded common source amplifier.