# EE105 MiniProject: AM Radio

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## 1 Introduction

## 2 Circuit Diagram

## 3 Topology

We used a total of 6 stages in our amplifier. Five common sources and one source follower. Our first decision was to choose topologies to use for amplification. We first considered using a cascode stage because of its characteristically high gain and good frequency response (high bandwidth). However, due to the high gain of the cascode it was very difficult to bias it correctly such that it would not rail. The possible cascode configuration is shown in Figure 2, We need to choose R1 and R2 carefully such that the current being forced by both PMOS and NMOS current mirrors are the same. Otherwise, the small difference in current will reflect as a voltage drop in one of the $r_o$s and the high gain of the cascode will amplify and rail this difference.

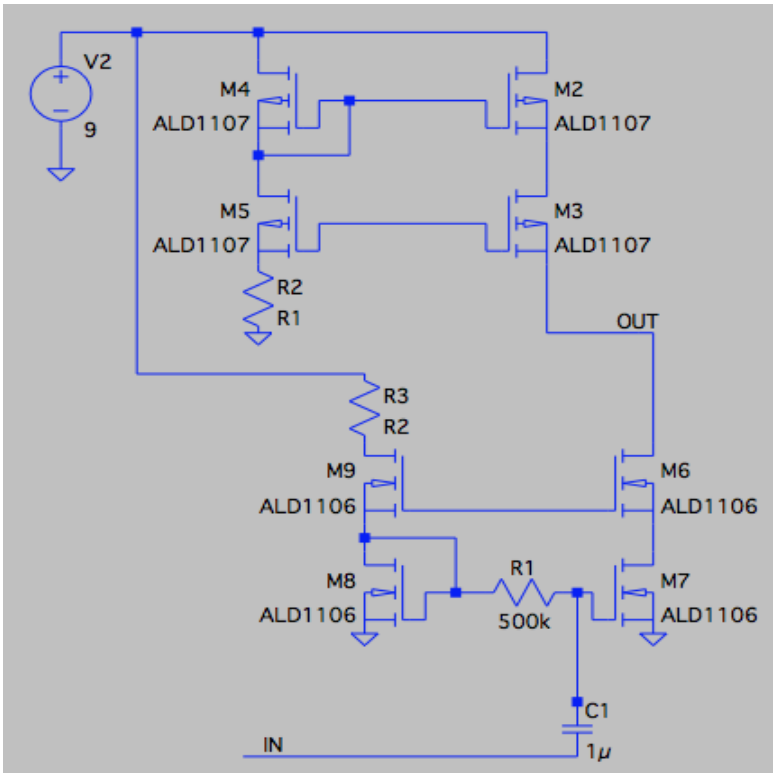


Figure 1: Cascode topology

After some more consideration, we decided to use multiple stages of common source topologies because they

would be much easier to bias than cascode stage. We also decided to use MOSFETS rather than BJTs because while they had lower gain than BJTs (the $g_m$ of MOSFETS is in the order of $10^{-3}$ compared to the BJT's 0.038), the large gate impedance of MOS proved more attractive since we dont have to worry much about impedance loading between stages. As for the specific MOS, we used the BS170 N-channel MOSFETs because they had high saturation current capacity and, thus, a higher $g_m$ and gain.

Going back to the biasing of the common sources. Our first decision was to choose a desired current depending on the gain and the $V_{outBIAS}$ that we want. We will go through this calculations in a later section, but it is easy to see that both drain current and $V_{outBIAS}$ are easy to bias. Drain current is set by using a current mirror, as shown in Figure 3.

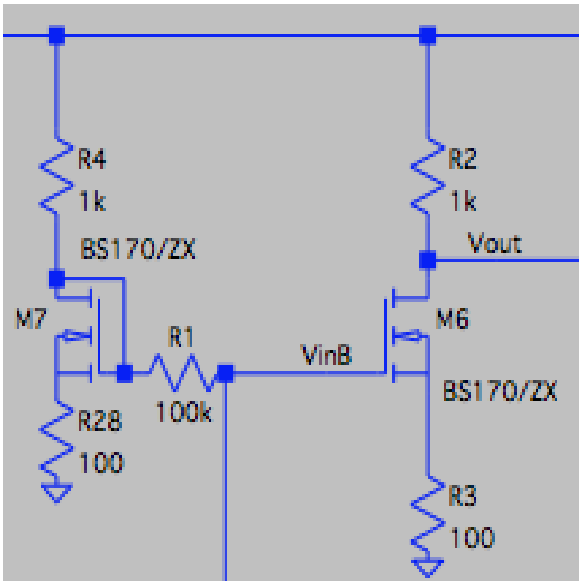


Figure 2: Current Mirror Biasing a common source

## 4 Hand Calculations and Measurements

### Magnitude/Phase Bode Plot

### Output Impedance

### Bias Voltages/Currents

### Power Consumption