Lab 8 Report: MOSFET Amplifier

Cory Lanker

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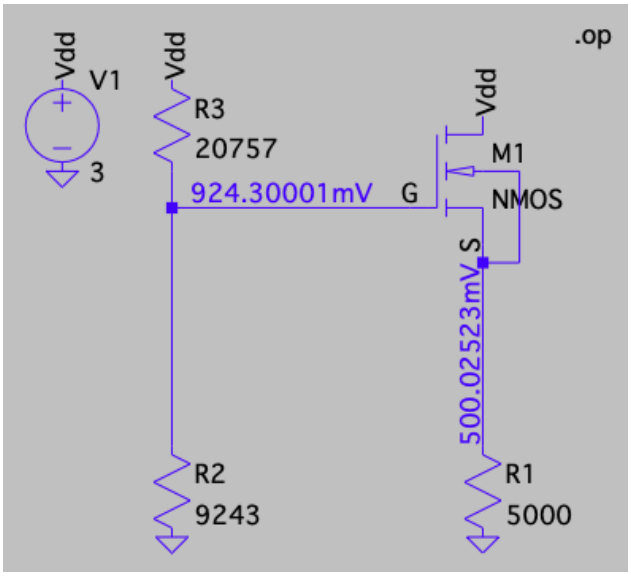
Introduction

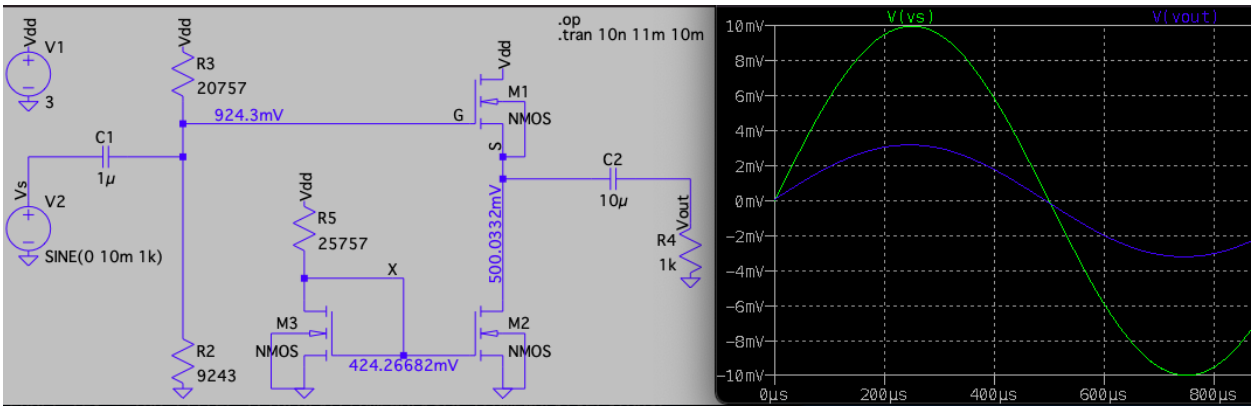
This lab is an interesting introduction to MOSFET amplifiers. We compose an emitter follower amplifier with a MOSFET pair current source as a load. I did not have enough time to prototype the circuit and measure the DC and AC characteristics.

Design Procedure

Here are the calculated values for the biasing and with $R_E = 5000\Omega$:



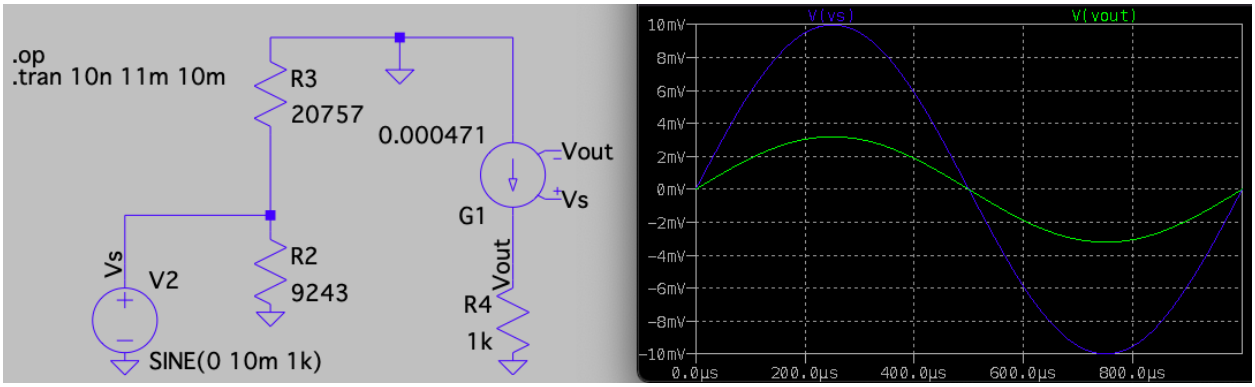
Here are the calculated values for the biasing and current source topologies:



Note that these LTspice nmos4 madels all have $W = 10$ and $L = 0.18$, and simulations showed that $\beta_n = 1.111\, mA/V^2$, because $\mu_n C_{ox} = 20\, \mu A/V^2$ (found with $W = L$).

Small Signal Model

Here is the AC circuit model that has the same output response as the full DC model:



Voltage gain

The voltage gain is

$$\frac{v_{out}}{v_i n} = \frac{g_m R_L}{1 + g_m R_L} = \frac{(0.000471)(1000)}{1 + (0.000471)(1000)} = \frac{0.471}{1.471} = 0.320$$

The LTspice simulation has the v_{out} amplitude as 0.3197.