Lab 3: Common Source Amplifier Design

Introduction

In this lab, you will design a resistively-loaded common source amplifier. The topology to be used is shown in Figure 1. Some *approximate (emphasis on approximate)* device parameters are shown in Table 1. These will be useful for first-pass hand calculations. The required design parameters and specifications are shown in Table 2.

Overall, you have three knobs you can tune: the value of the resistor and the width/length of the transistor. Pay close attention to the region of operation of your transistor. If the voltage drop across the resistor is too large, you may push the transistor into triode, reducing your gain.

Procedure

1. Design the circuit in Figure 1 such that it meets the requirements in Table 2
    - Run AC sweep to check gain and gain-bandwidth product
2. Layout your schematic (exchange your analoglib resistor for an opppcres resistor from the IBM PDK library)
3. Pass DRC, LVS, and PEX
4. Re-check circuit to make sure that it still meets the requirements in Table 2
    - Run AC sweep to check gain and gain-bandwidth product
    - Adjust schematic/layout until specification is met

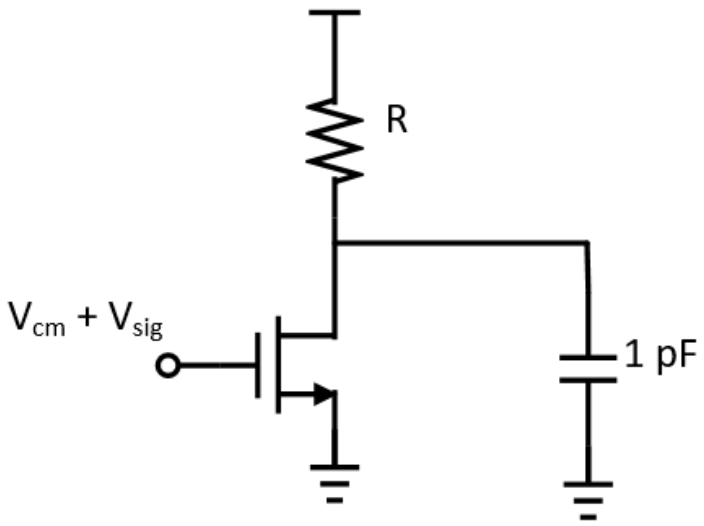

Figure 1 – Common Source Amplifier for Lab 3

Vth	**300 mV**
$\boldsymbol{\lambda}$	**0.3** $\boldsymbol{V^{-1}}$
$\boldsymbol{\mu_n C_{ox}}$	**645** $\boldsymbol{\mu A/V^2}$

Table 1 – Useful Device Parameters

VDD	**1.2 V**
Vcm	**0.4 V**
$\boldsymbol{C_L}$	**1pF**
$\boldsymbol{I_D}$	$\leq$ **100** $\boldsymbol{\mu A}$
$\boldsymbol{\lvert A_v \rvert}$	$\geq$ **20 dB**
GBW (gain-bandwidth product)	$\geq$ **100 MHz**

Table 2 – Design Parameters and Specifications

What to turn in?

- **Schematic of circuit (with values) that meets the specifications in Table 2**
- **A paragraph (approximately) explanation of your design thought process**
- **AC magnitude plot showing that the circuit meets both the gain and gain-bandwidth requirements (schematic only)**
- **Picture of layout**
- **Same AC magnitude plot as before but now post-PEX**