

EECE7248 Lab #4:

Differential Amplifier

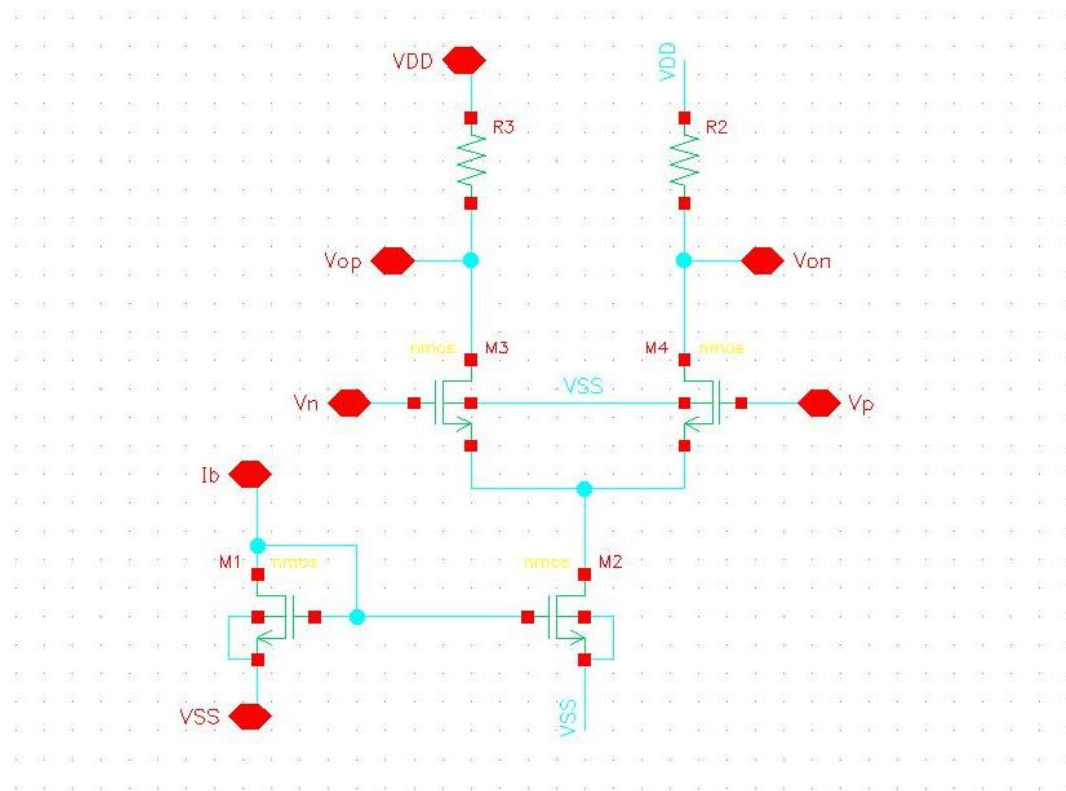
Gyunam Jeon, Yixuan He, Yong-Bin Kim

Design problem #1. Differential Amplifier.

For this problem, we will design a fully differential amplifier with a current mirror. Its schematic is shown below. Notice that the polarities of two input signals are swapped so that the overall gain is positive. And the node " I_b " of M1 is connected to DC current source in test bench to supply bias current.

Given parameters:

- Power supply: $V_{dd} = 1.8V$.
- Current supply: $I_{bias} = 500\mu A$.
- Channel length for all transistors: $L = 0.36\mu m$.
- Input DC bias: $V_{in,dc} = 1V$.
- Input transient signal amplitude: $V_{in,amp} = 50mV$.
- Operating frequency: $f = 100kHz$.
- Load at each output node: $C_L = 200fF$.



Design requirements:

- AC Gain: $A_v > 20dB$.
- No clipping or serious distortion in transient output signal.

Questions:

- 1) Submit the image of your schematic (the amplifier, not the test bench) with labeled node voltage and DC operating point.
- 2) Plot the AC gain and phase (1Hz – 100GHz) of the amplifier and mark the -3dB gain point and the gain at 100KHz.
- 3) Plot transient input & output signal and check the voltage gain comparing with the result from AC simulation.
- 4) What is the bandwidth of your amplifier?
- 5) What is the compliance voltage of your current mirror?
- 6) List 2-3 advantages of differential amplifier comparing to common-source amplifier.

*****Due on 11/20 (Wed) *****