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| Lab 1: Common-Source Amplifiers |

Student Name: Click or tap here to enter text.

Student Number: Click or tap here to enter text.

Preparation

Fill in the following table:

Table 1: Hand analysis table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| VDD (V) | Type | Gain | Swing (VPP) | VOV (V) | ID (A) | gm (A/V) | Vo (V) | RD (Ω) | Av (V/V) |
| 5.0 | NMOS | - | Max | Click or tap here to enter text. | 1m | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. |
| 5.0 | PMOS | - | Max | Click or tap here to enter text. | 0.5m | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. |
| 1.2 | NMOS | Max | 0.2 | Click or tap here to enter text. | 0.5m | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. | Click or tap here to enter text. |

Hand in only this first page within 30 minutes of the start of the lab period.

Common-source Amplifier

In LTSpice, simulate the first two common-source amplifiers (NMOS \& PMOS) designed in the preparation.

1. Show your schematic.



1. Take a screen capture of the DC operating point simulation for the amplifiers. As mentioned before, some deviation from the hand analysis should not be a surprise. **MAKE SURE TO RELABLE NETS** so that your results can be interpretable by a TA.



1. Perform a DC sweep to plot VO, ID, and dVO/dVi = AV versus Vi in the same plot window. Vi should be swept from 0V to VDD. **ALSO:** label and comment on the plots to clearly show the small-signal gain AV, Vi, and output swing for the ID specified in Table 1.



**Lab - Part II: Common-Souce Amplifier Implementation**

1. Measuring Vo versus Vi: In experimental practice, the input-output transfer curve of a circuit can be extracted by imposing a low frequency triangular signal to the input and and measuring the input (Vi) and output (VO) simultaneously using 2 of the input channels of the oscilloscope. Then the XY plot mode of the oscilloscope is enabled to plot VO versus Vi. To mimic this condition, perform a transient simulation. Set the input voltage source to generate a triangular wave with 0V to VDD swing at 100Hz. Set the simulation time to cover two periods of the triangular wave.
2. Plot Vi and VO vs. time.



1. Extract the XY transfer curve. Change the x-axis variable to Vi by right-clicking on it and editing *"Quantity Plotted"*.



1. Compare results with previous step.

Click or tap here to enter text.

1. Sinusoid Testing: Perform a transient simulation to show VO versus time. Use a sinusoidal voltage source at 1kHz with 10mVPP amplitude as the input source. Make sure that the input and thus the output are biased at the voltages found in the previous steps. Verify the small-signal gain found in the previous steps.



* 1. Use a sinusoidal voltage source at 1kHz with 10 mVPP amplitude as the input source to your biased amplifier. Plot Vi and transistor's gate voltage in the same window. Plot VO to validate amplifier's gain.

