Analog Lab 2022

EE2401

akumar@ee.iith.ac.in

Experiment 1: Inverter characteristics

1. Determine large-signal I_{out} vs V_{in} of a CMOS inverter using the circuit below:

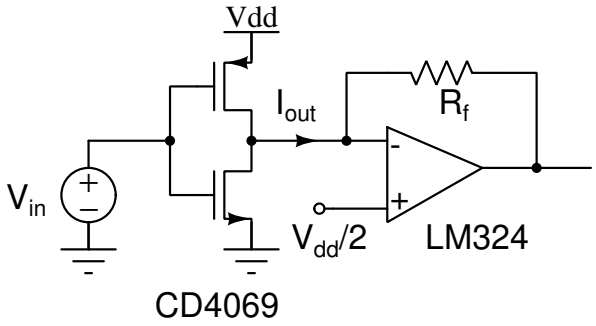
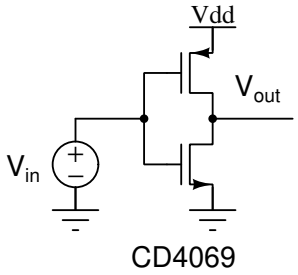


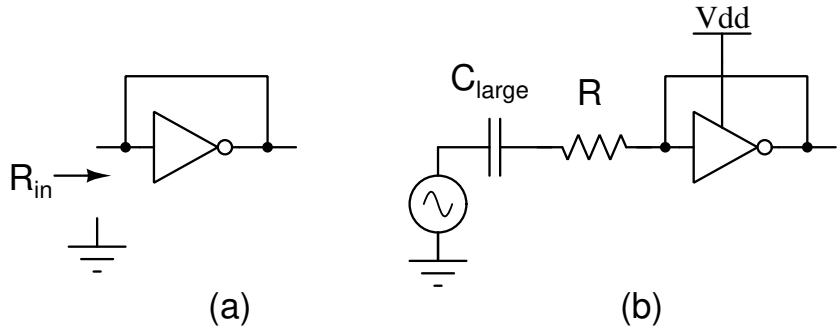
Figure 1: Setup to find I_{out} without using an ammeter.

- Sweep V_{in} from 0V to V_{DD} (6V).
- What is the self-bias voltage (V_B) of the inverter? [$V_B = V_{in}$ when $I_{out} = 0$]
- Find the transconductance at V_B.
- Choose appropriate supply voltages for the opamp.

2. Determine large-signal V_{out} vs V_{in} of a CMOS inverter using the circuit below:



Find small-signal resistance of the self-biased inverter using the circuit shown below for V_{DD} = 5V, 6V and 9V:



3. Using the data from above two experiments, estimate small-signal g_m and r_o of the transconductor. Also find out V_T and β of the NMOS and PMOS of inverter.

Submit the following:

- Testbench snapshot, output plots
- Hand calculation
- Any unusual observation along-with comments

IC product page:

- Use models of the components available at their product page
- CD4069 https://www.ti.com/product/CD4069UB
- LM324 https://www.ti.com/product/LM324
- PSPICE models can be used in LTspice using this procedure: https://www.analog.com/en/technical-articles/ltspice-simple-steps-to-import-third-party-models.html