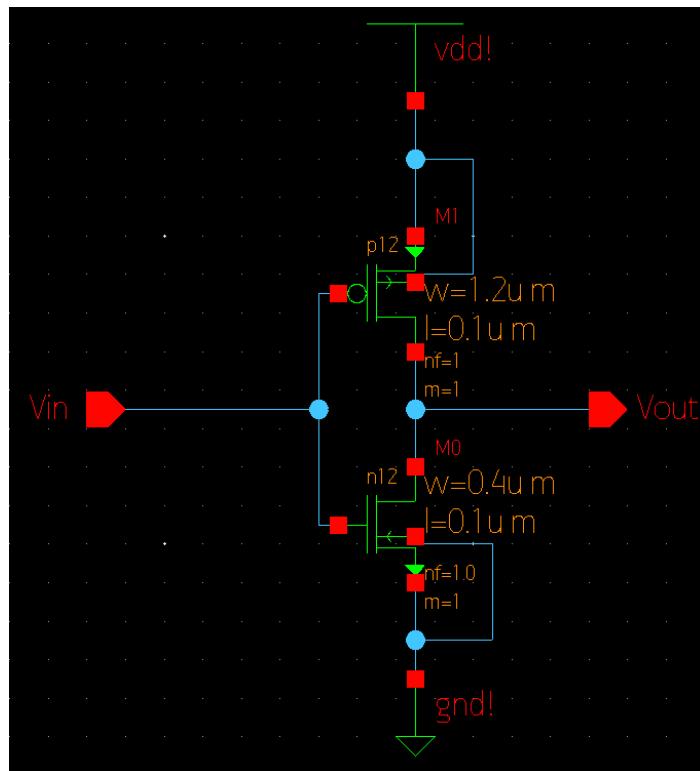


Laboratory #2: CMOS Inverter**I. OBJECTIVES**

- To learn how to create and edit symbols and testbenches in Synopsys Custom Compiler
- To capture a CMOS inverter schematic and symbol
- To simulate the Voltage transfer characteristic (VTC) of the inverter as well as a transient simulation.

II. LAB PROCEDURE**1. Schematic and Symbol**

Follow Section V of the Synopsys Tutorial pages 20-24 to create the schematic and symbol¹ of the CMOS inverter.



¹ Symbols are useful for hierarchical description of large circuits, analogous to subroutines within a larger program. It enables 're-use' of a basic building-block within a larger circuit. In the corresponding netlist description, symbols become subcircuits.

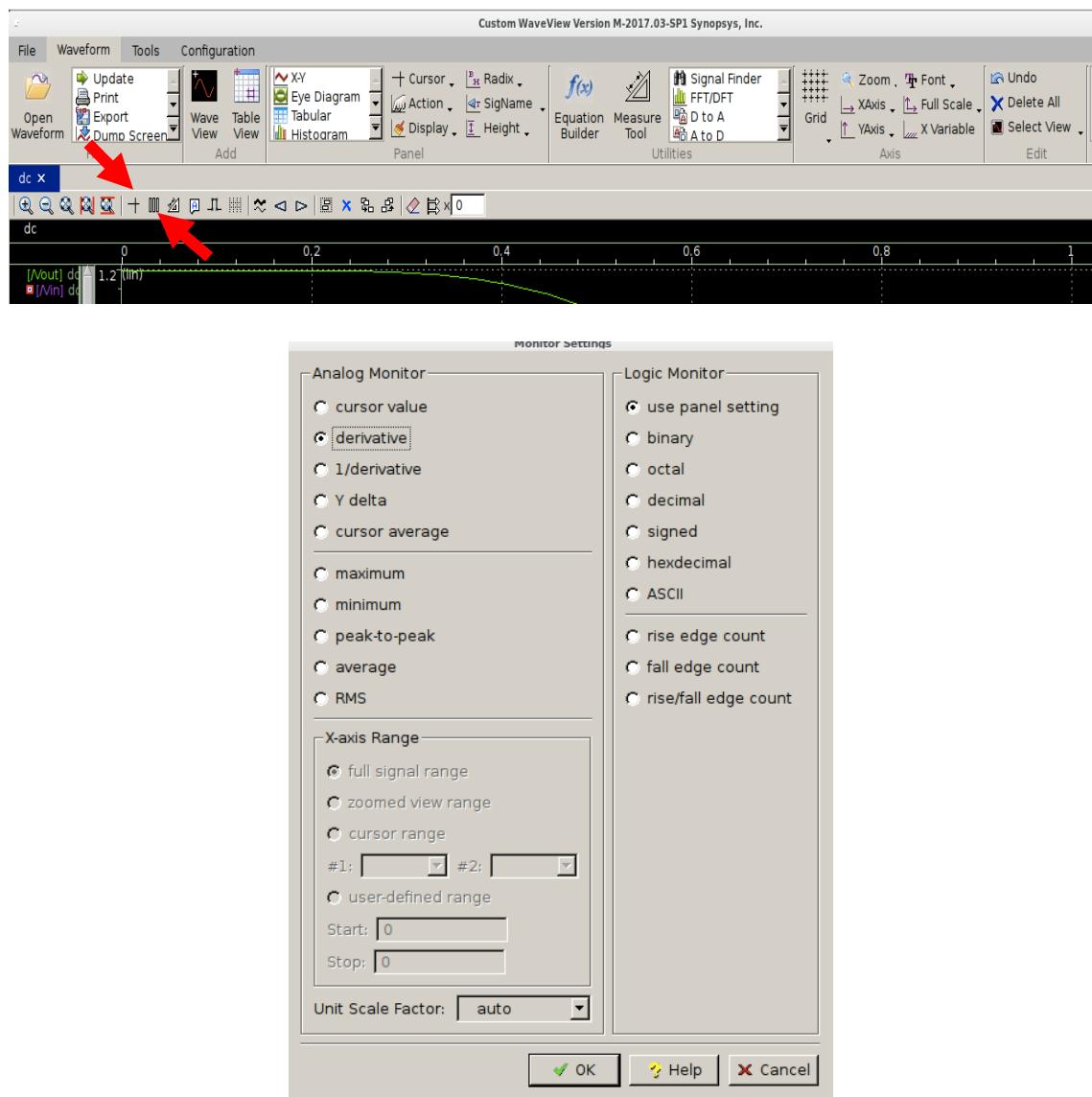
2. Simulations

Continue Section V of the Synopsys Tutorial pages 24-32 to perform VTC simulations as well as transient simulations.

3. Inverter Threshold Voltage

From the VTC simulations results find the following:

- Inverter threshold voltage V_M graphically, where $V_M = V(\text{IN}) = V(\text{OUT})$.
- V_{IH} and V_{IL} of the inverter by finding the value of the input voltage, at which the slope of $V_{out}=-1$. To do that, in Custom WaveView, follow the steps below:
 - 1) Add a cursor to your waveforms, by selecting the icon below.
 - 2) Select the Waveform Monitor tool, and select derivative.¹
 - 3) Find the V_{in} value for when V_{out} slope is -1



¹ Symbols are useful for hierarchical description of large circuits, analogous to subroutines within a larger program. It enables 're-use' of a basic building-block within a larger circuit. In the corresponding netlist description, symbols become subcircuits.

III. REPORT

Write a short laboratory report that details all the work done. Describe the objective and procedures of this lab with your own words. The lab report should contain the following:

- a) All schematics used in your lab.
- b) Screenshots of all Simulation setups in SAE
- c) All Simulation Results, including waveforms and any required values/measurements.
- d) Answer any questions in the lab assignment
- e) Conclusions

¹ Symbols are useful for hierarchical description of large circuits, analogous to subroutines within a larger program. It enables 're-use' of a basic building-block within a larger circuit. In the corresponding netlist description, symbols become subcircuits.