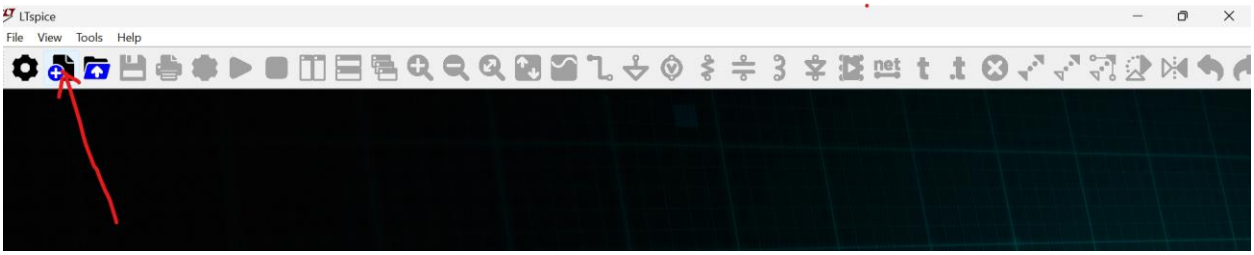
Design of an Inverter in LTSpice and DC Sweep

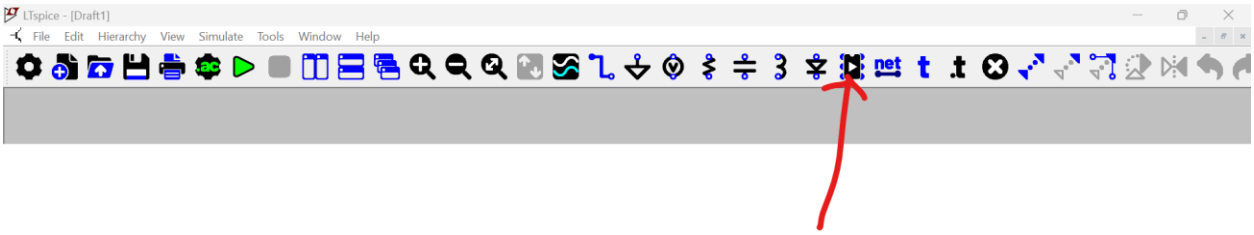
Note that, you may use your own knowledge of LTSpice. This is just a general guideline.

Step 1: Open LTSpice

Step 2: Start designing a CMOS inverter. To do that, click on “New Schematic”.

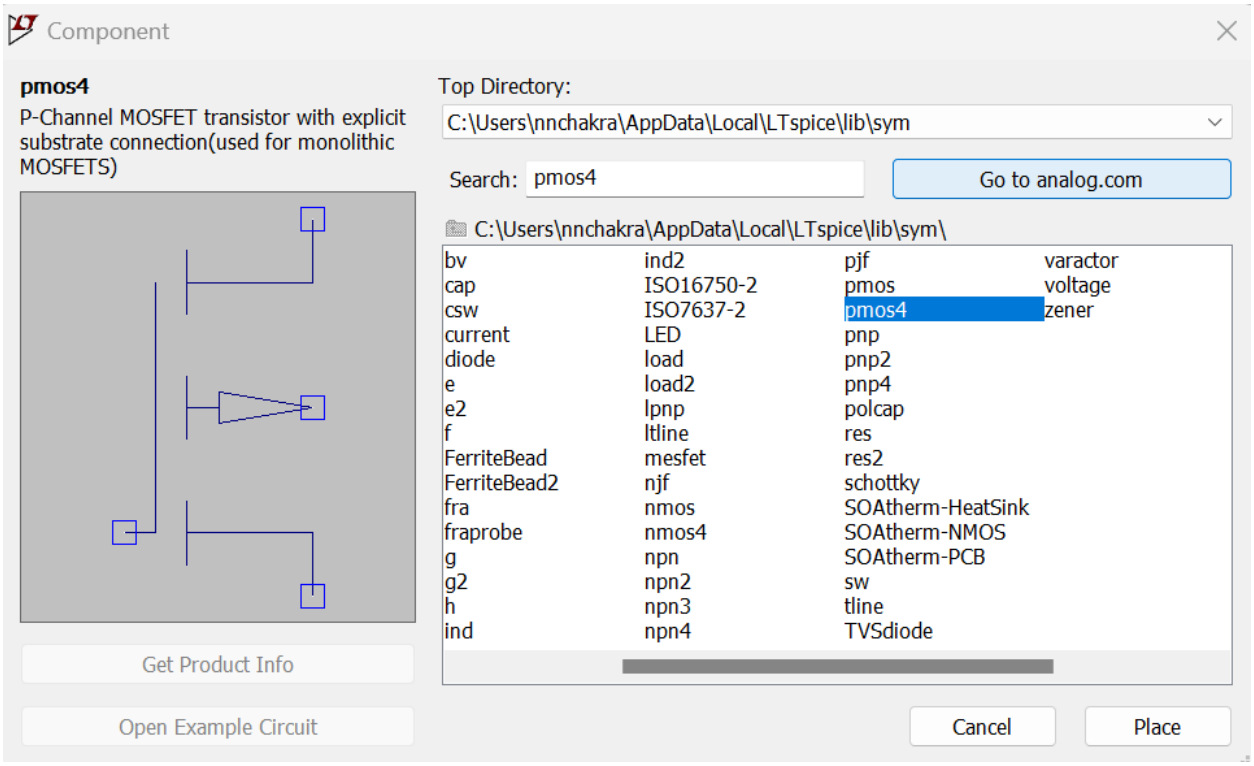


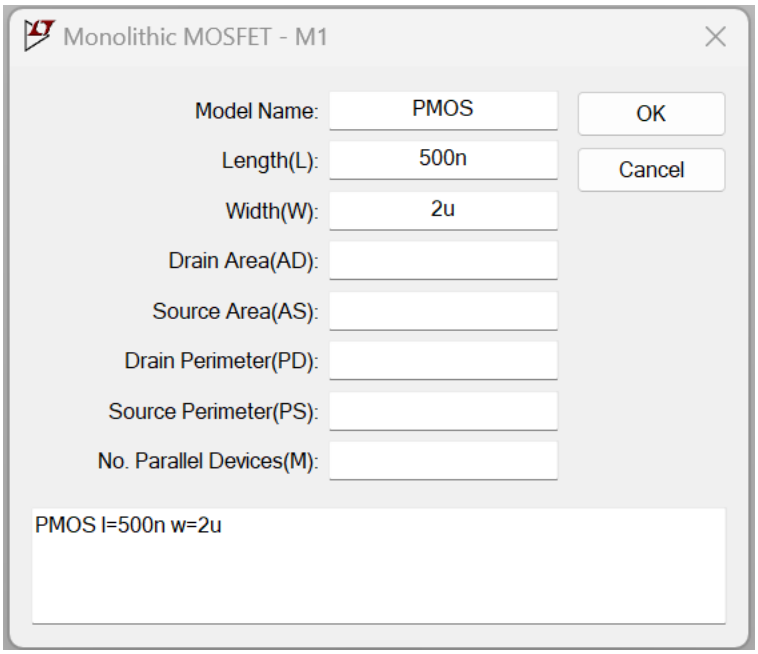
Step 3: To design an inverter, we will use a pmos and an nmos. For that purpose, we will use ‘pmos4’ and ‘nmos4’. To place the components, click on “Component”.



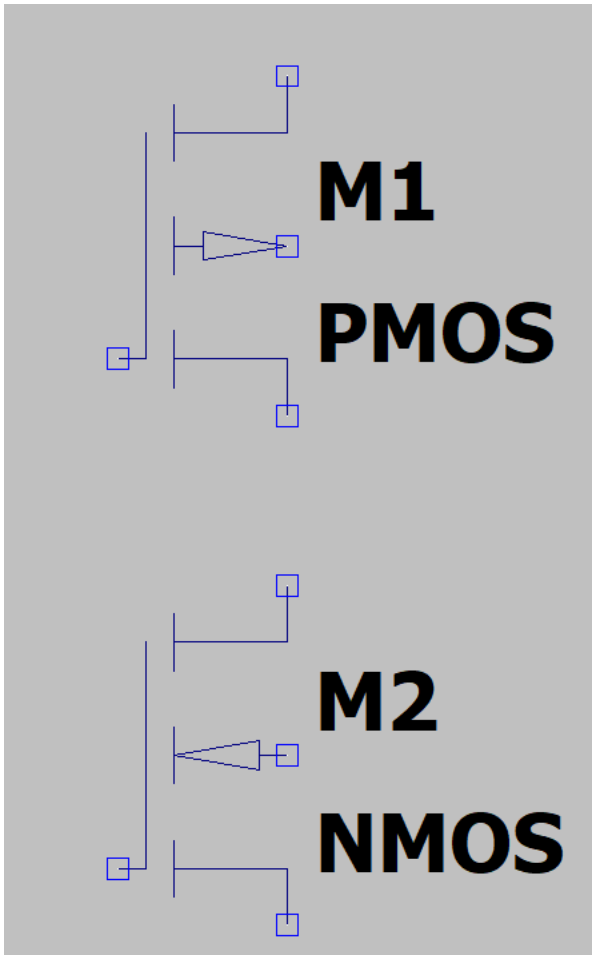
Then select ‘pmos4’ and click place. After placing the pmos, right click on it. It will let you edit the pmos properties. Set the length to 500n and width to 2u.

In the same way, place nmos using ‘nmos4’. Set the length to 500n and width to 1u.



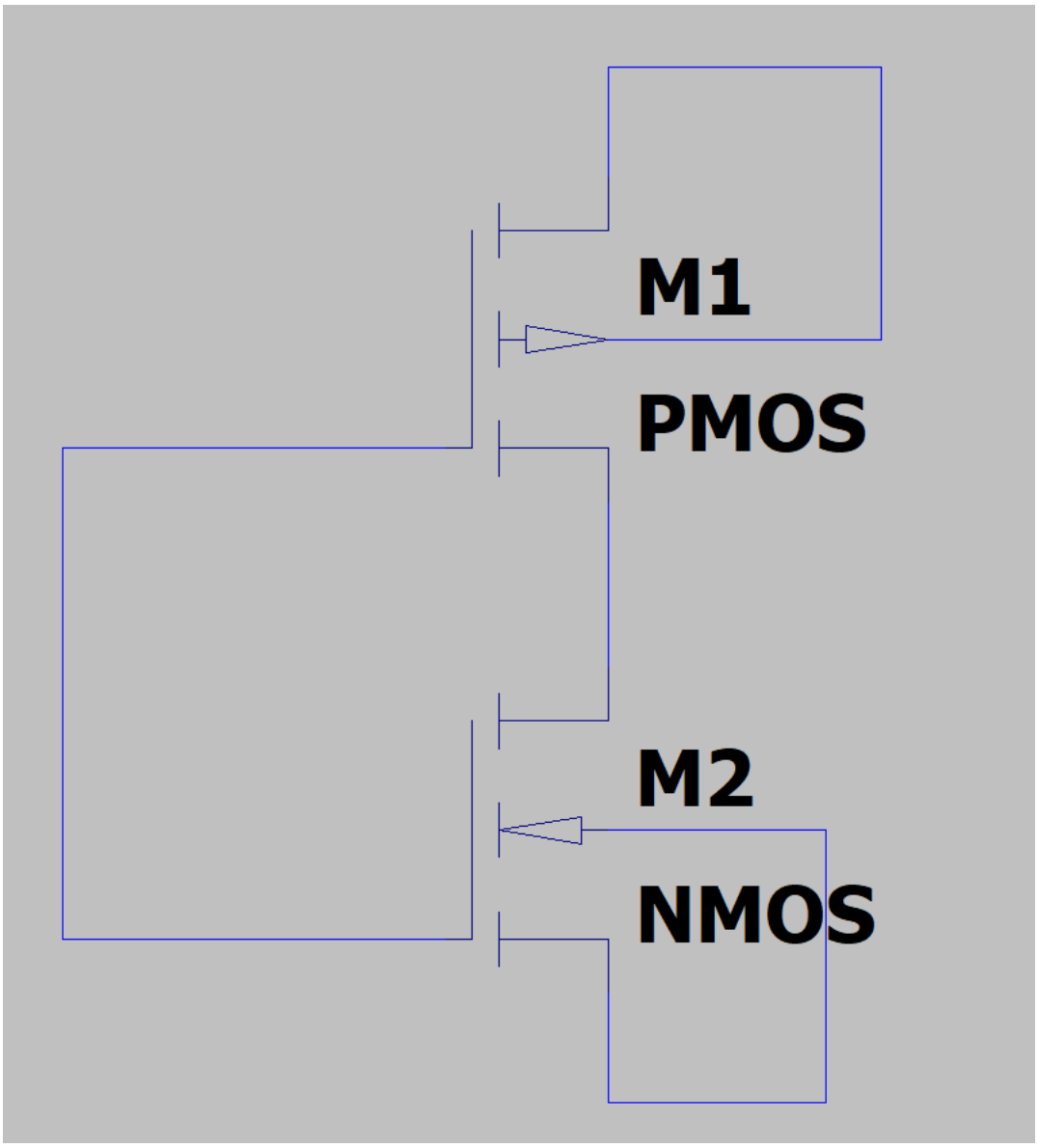


After placing the mosfets, it will look like following:

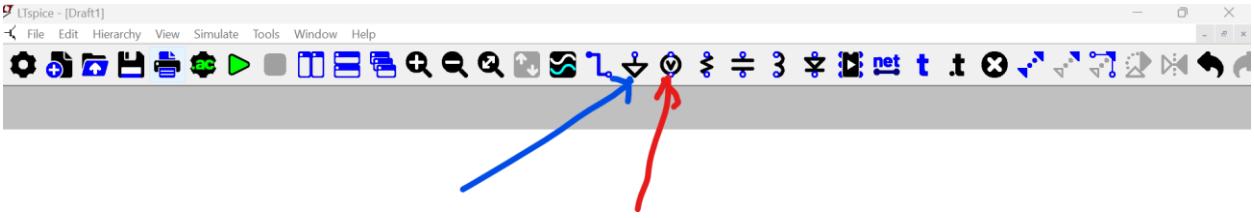


Step 4: Wire it up. Click on ‘Wire” and connect the inverter.

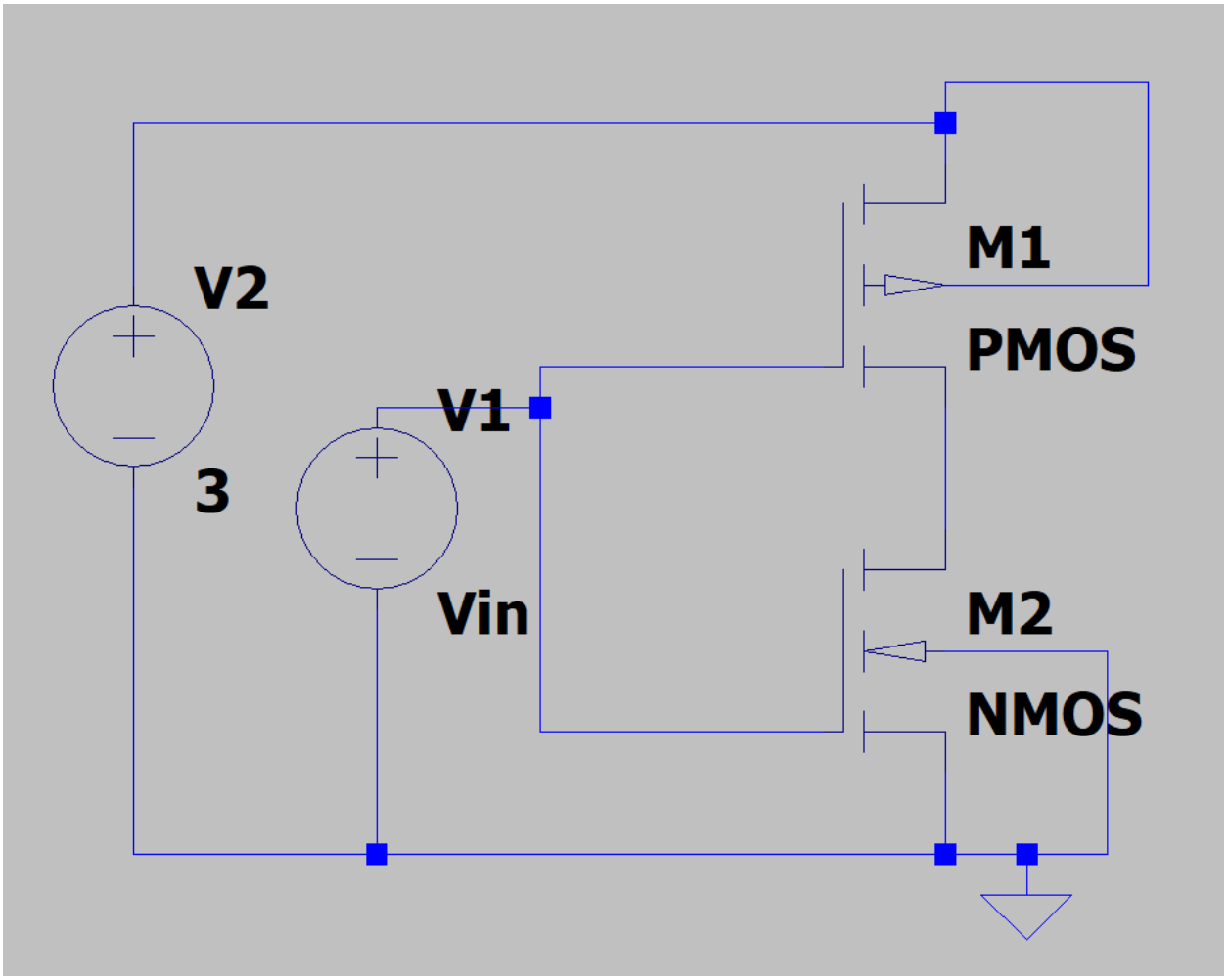
After connecting, it will look like following. Connect the body of PMOS to power supply and body of NMOS to ground.



Step 5: Add power supply and ground. Add DC sources as power supply. Both power supply and ground can be found on the toolbar.

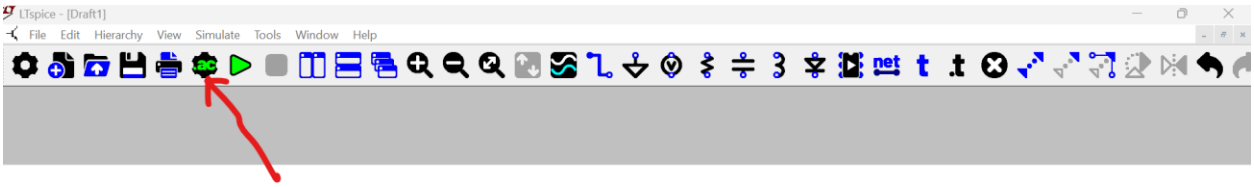


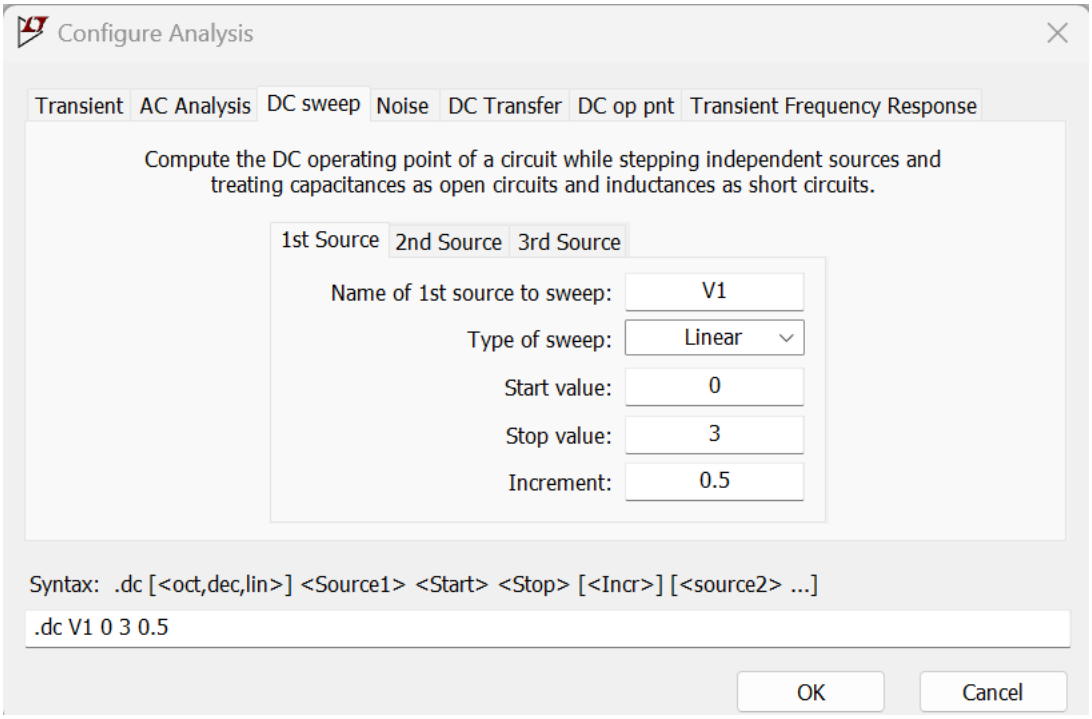
After connecting everything, your circuit will look something like the following:

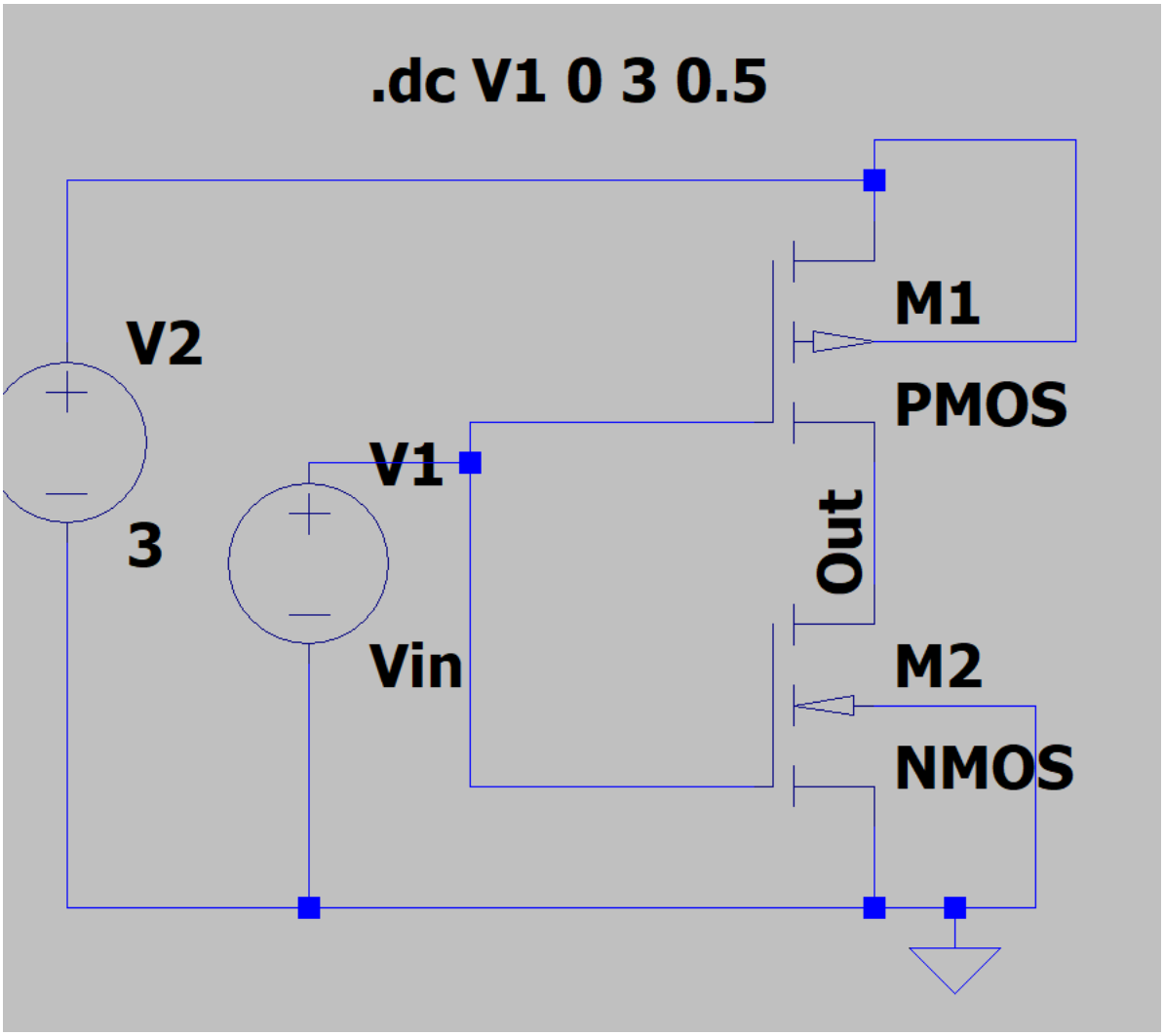


Set the DC voltage to 3V and the input voltage of the inverter to 0.

Step 6: Do a DC sweep with the input voltage of inveter. Vary V1 from 0 to 3V. Click on “Configure Analysis”, select “DC sweep”. Select the voltage to sweep (V1 in my schematic). Fill out the boxes. Click on “Run” (Next to “Configure Analysis”), and plot the output voltage and inverter current.




Configure Analysis
Transient
AC Analysis
DC sweep
Noise
DC Transfer
DC op pnt
Transient Frequency Response
Compute the DC operating point of a circuit while stepping independent sources and treating capacitances as open circuits and inductances as short circuits.
1st Source
2nd Source
3rd Source
Name of 1st source to sweep:
V1
Type of sweep:
Linear
Start value:
0
Stop value:
3
Increment:
0.5
Syntax: .dc [<oct,dec,lin>] <Source1> <Start> <Stop> [<Incr>] [<source2> ...]
.dc V1 0 3 0.5
OK
Cancel



Now, sweep the other voltage source as well and see the results.