

Inverter Chain - Narain

Given that our input capacitance was:

$$\text{Input capacitance} = 91\text{e-18C}$$

$$N = \ln(C_l/C_{in})$$

$$N = \ln(C_l/(\text{integral of current vs time}))$$

$$N = \ln(1.28\text{e-12}/91\text{e-18}) = 9.55 \Rightarrow N = 9$$

But since our input capacitance wasn't similar to other students input capacitance calculations (other students begin 300e-18C vs our 91e-18C) we went with:

$$N = \ln(1.28\text{e-12}/300\text{e-18}) = 8.36 \Rightarrow N = 8$$

$$U (\text{optimized}) = (1.28\text{e-12}/91\text{e-18})^{(1/N)}$$

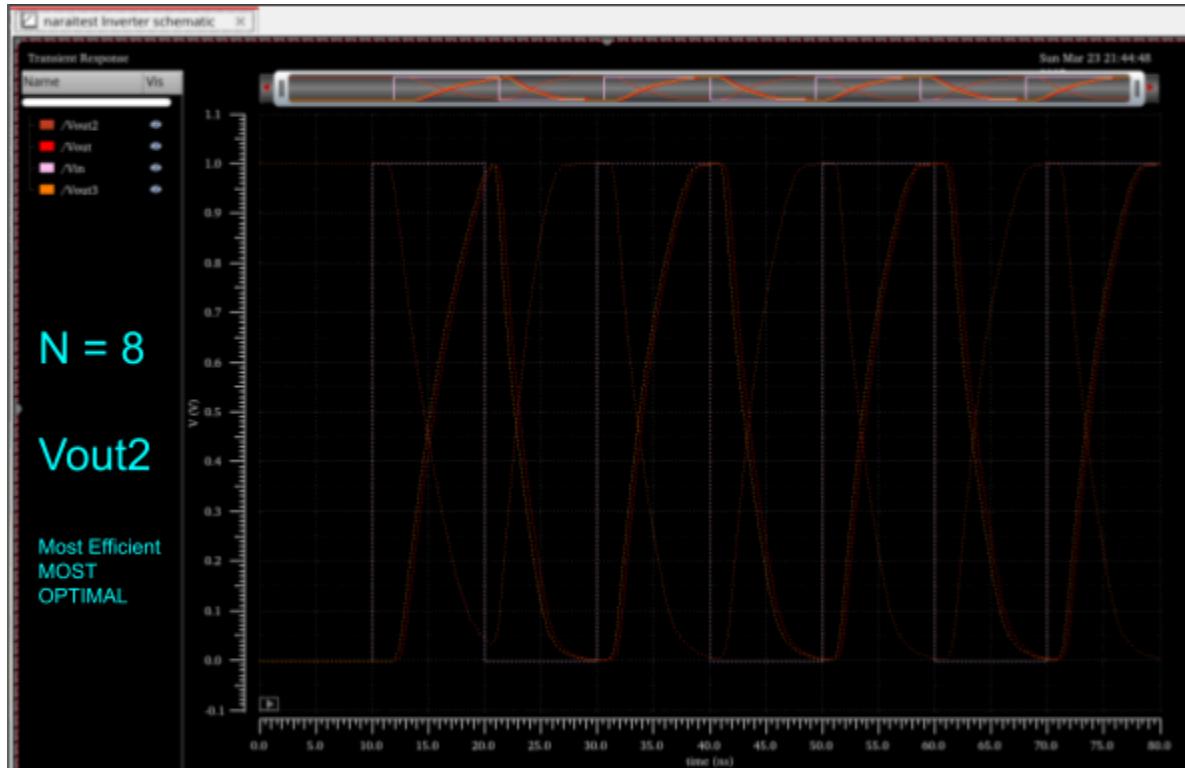
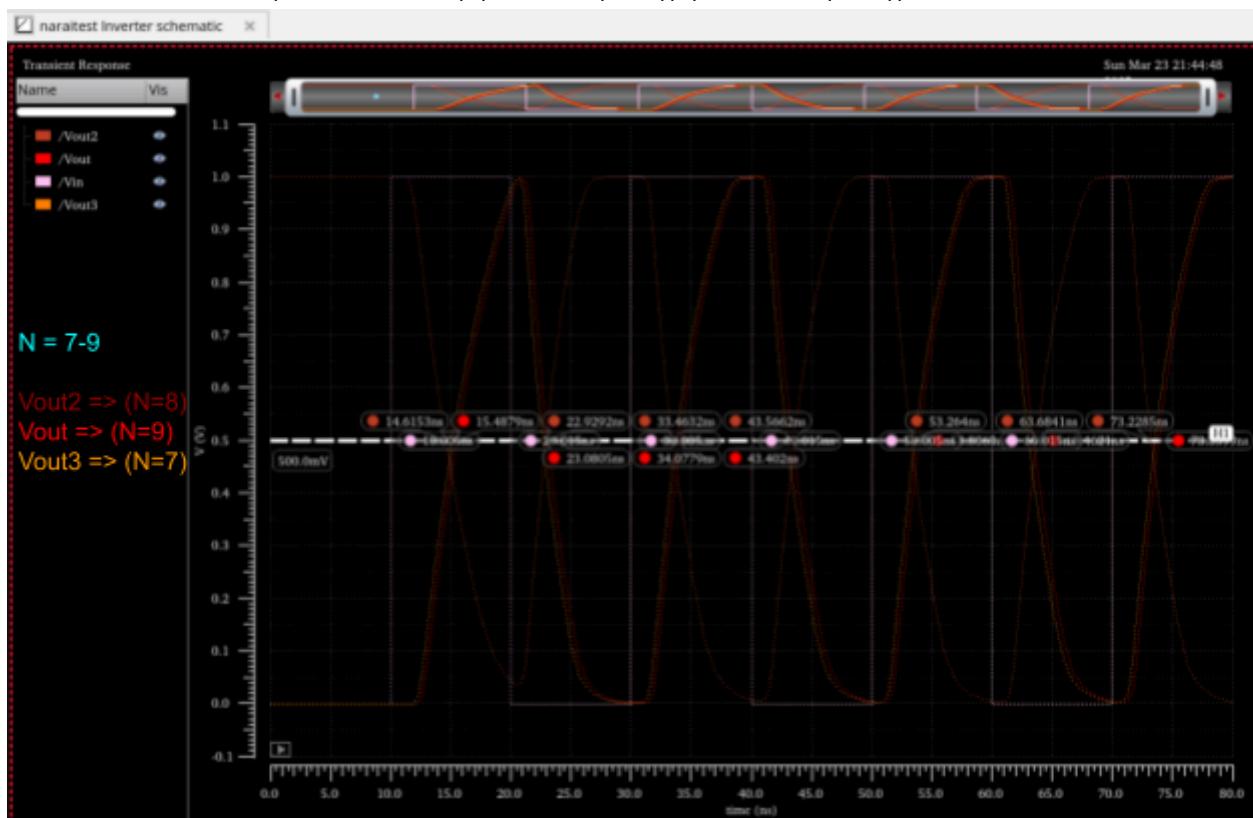
$$U (\text{optimized}) = (1.28\text{e-12}/91\text{e-18})^{(1/8)} = U = 3.3$$

Optimal

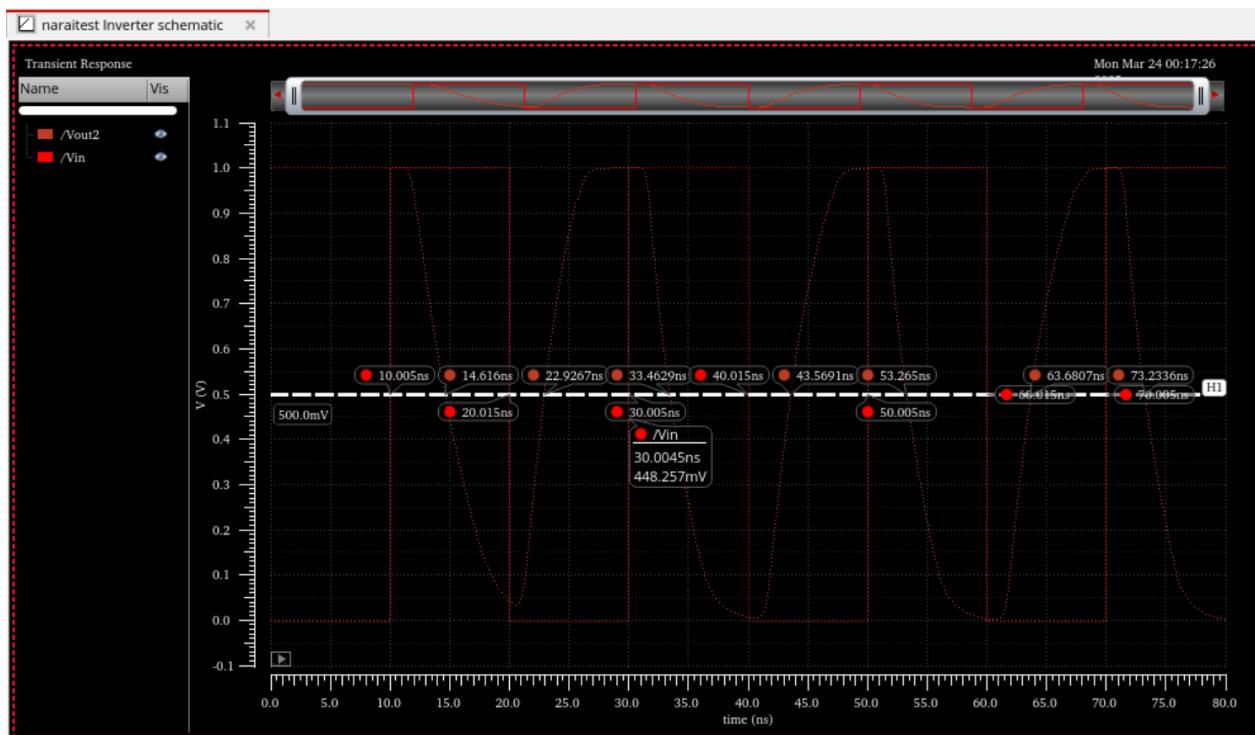
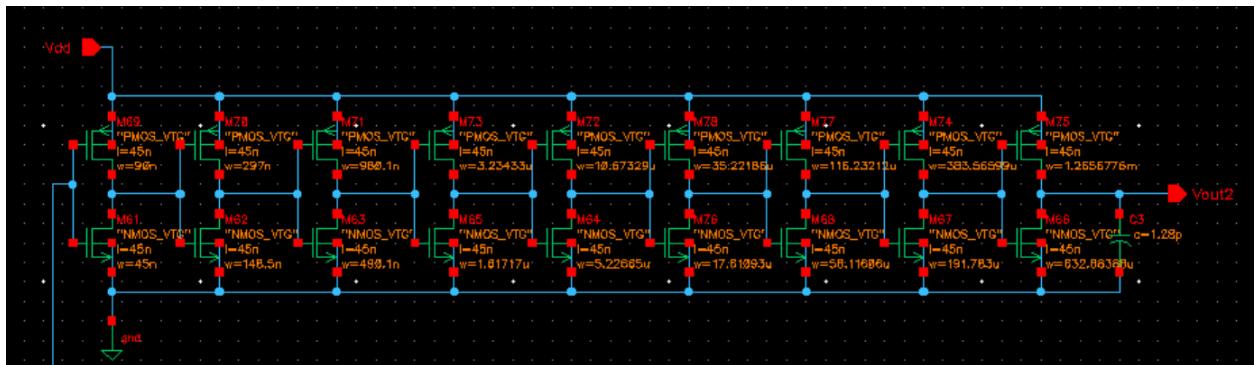
$$N = 8$$

$$U = 3.3$$

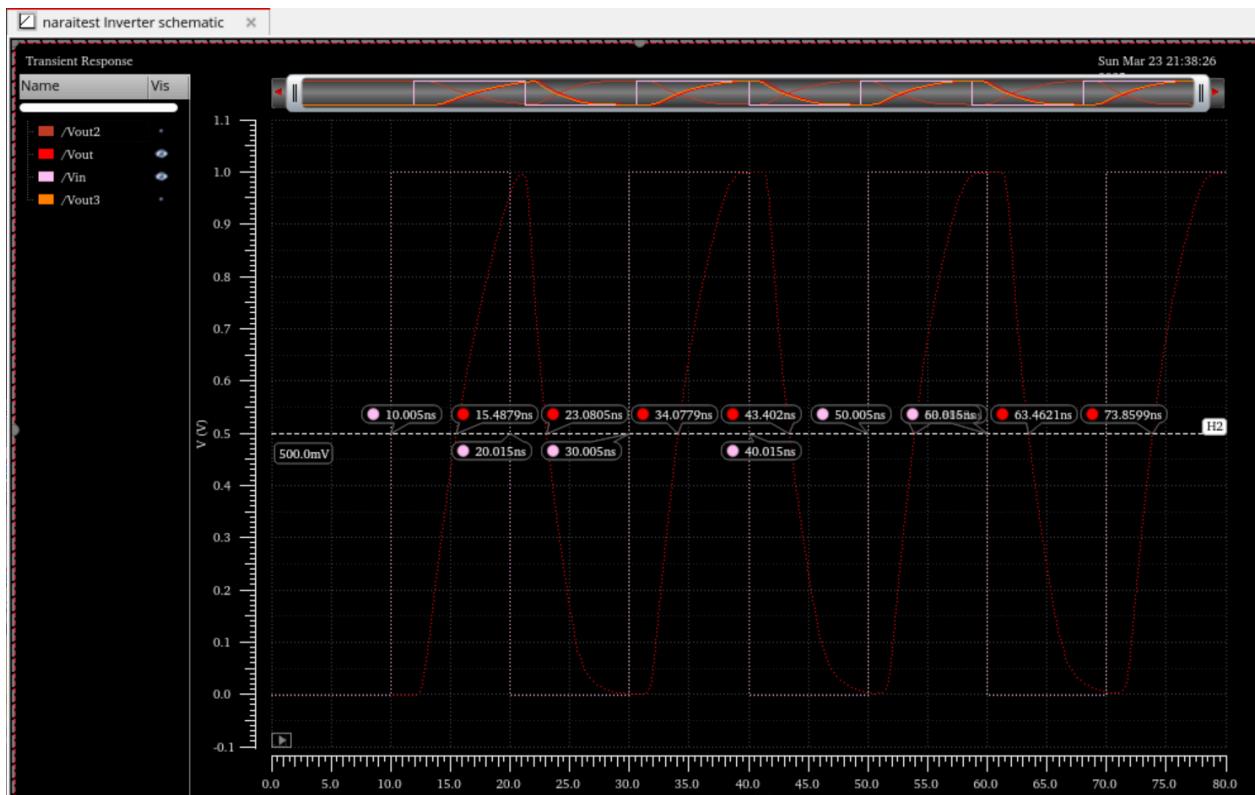
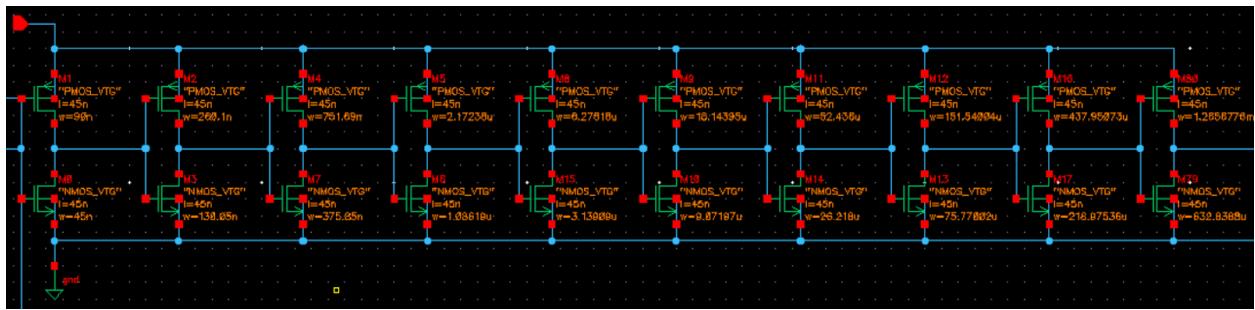
Inverter Chain Plots (Vout2 => N=8) (Vout => (N=9)) (Vout3 => (N=7))



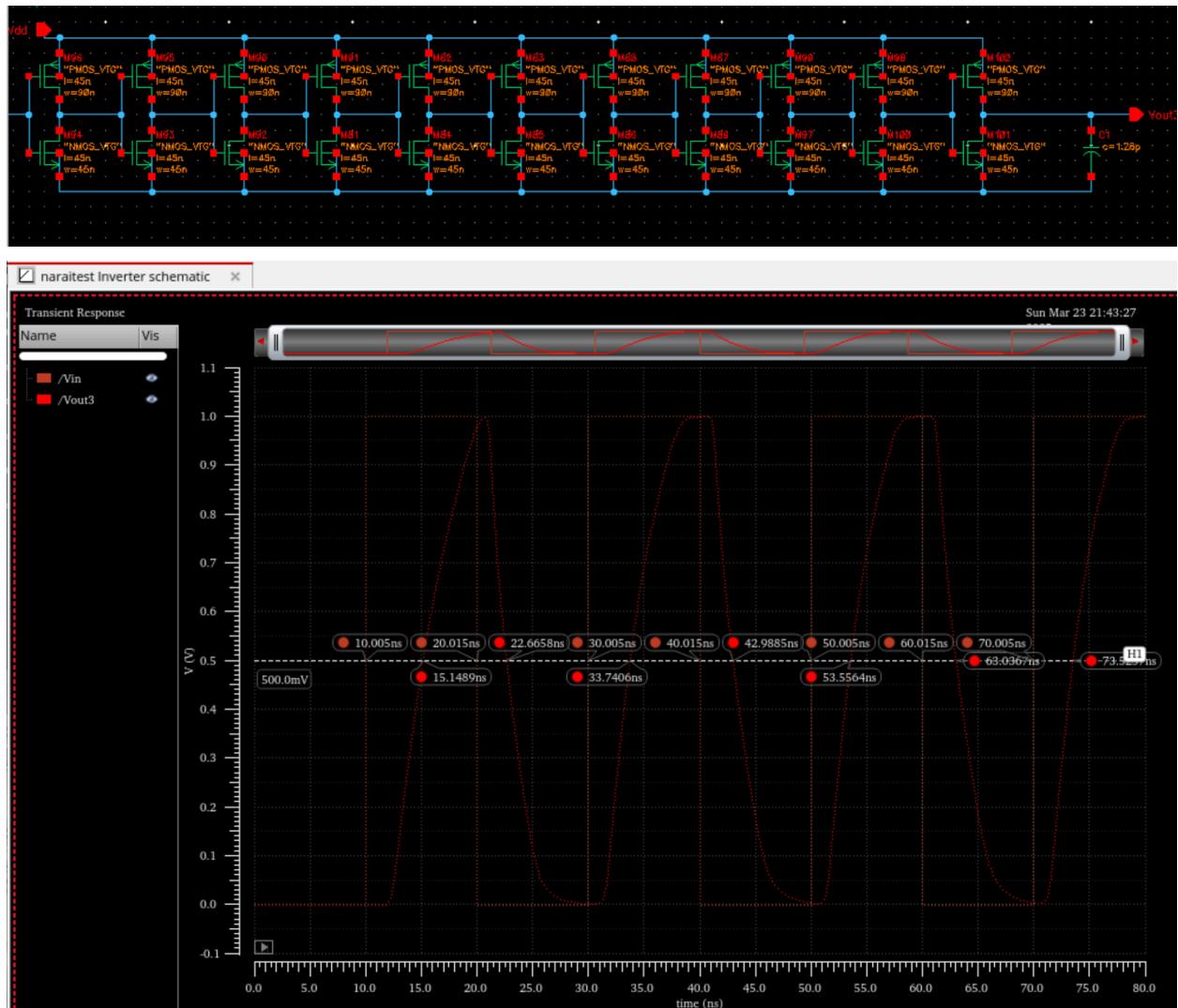
N=8



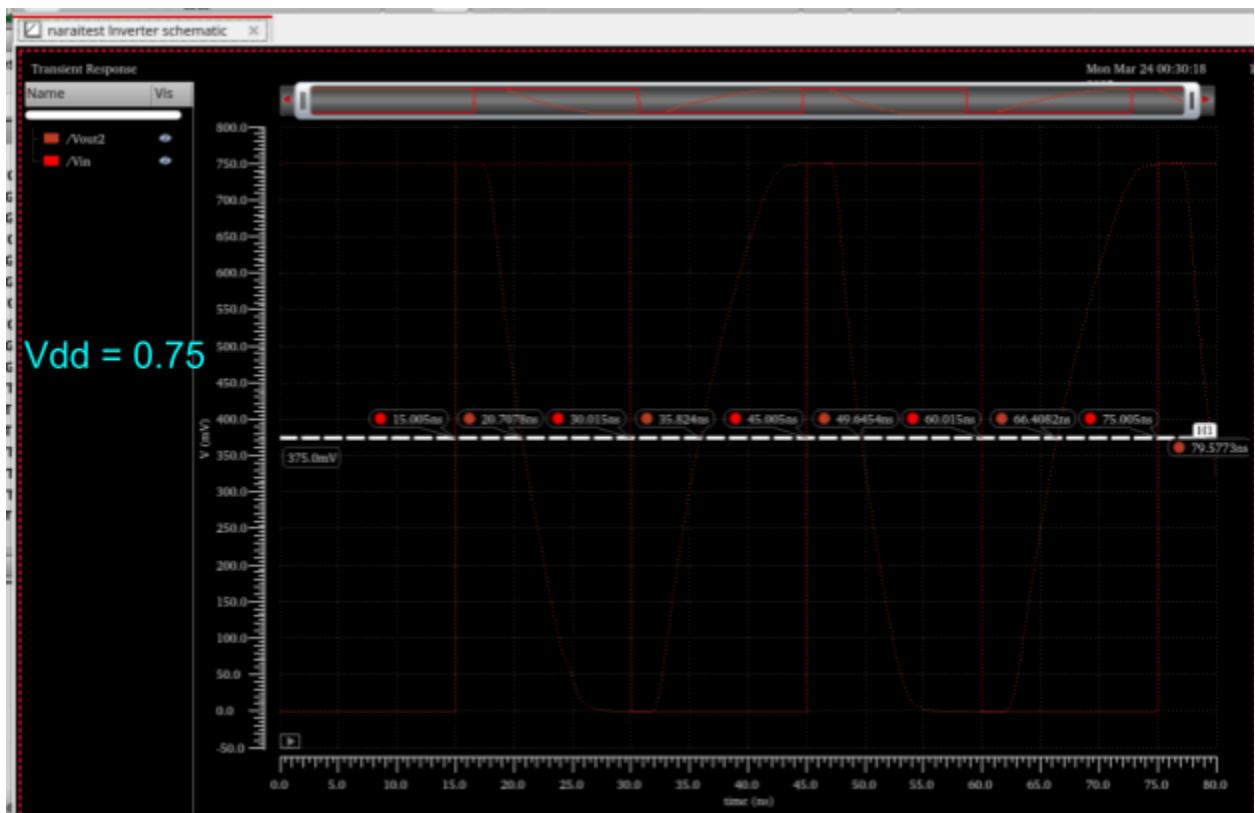
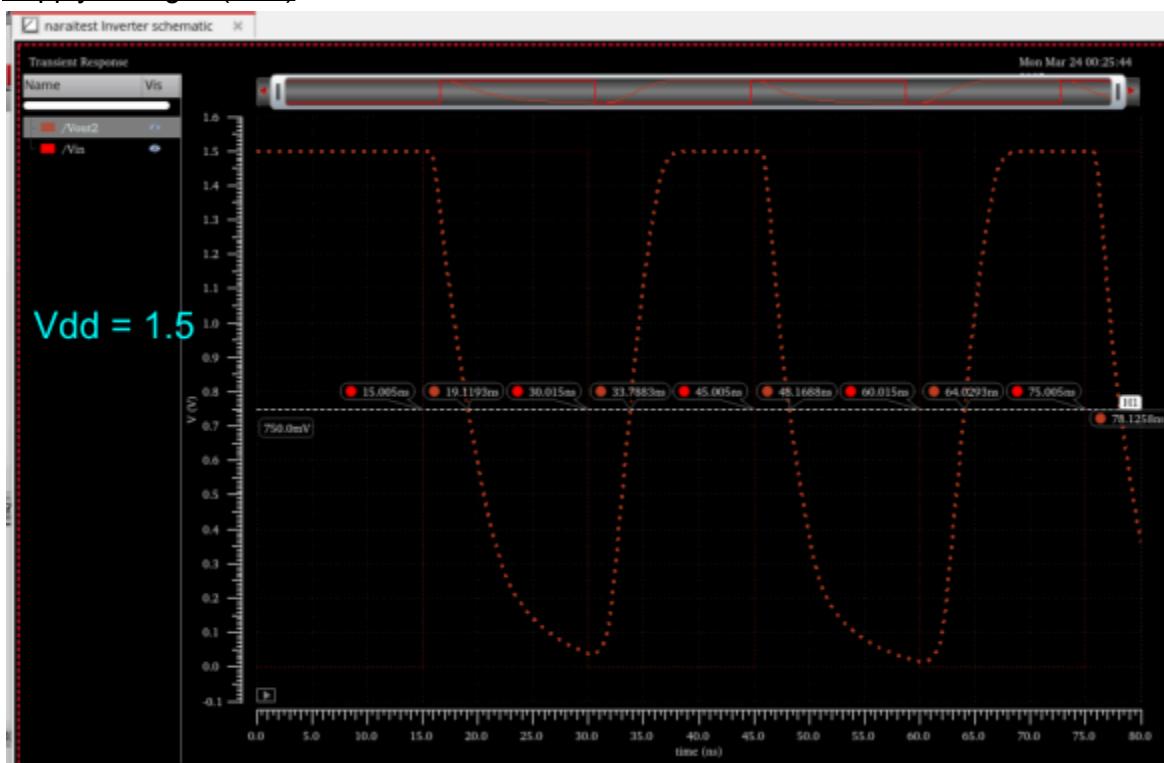
N=9

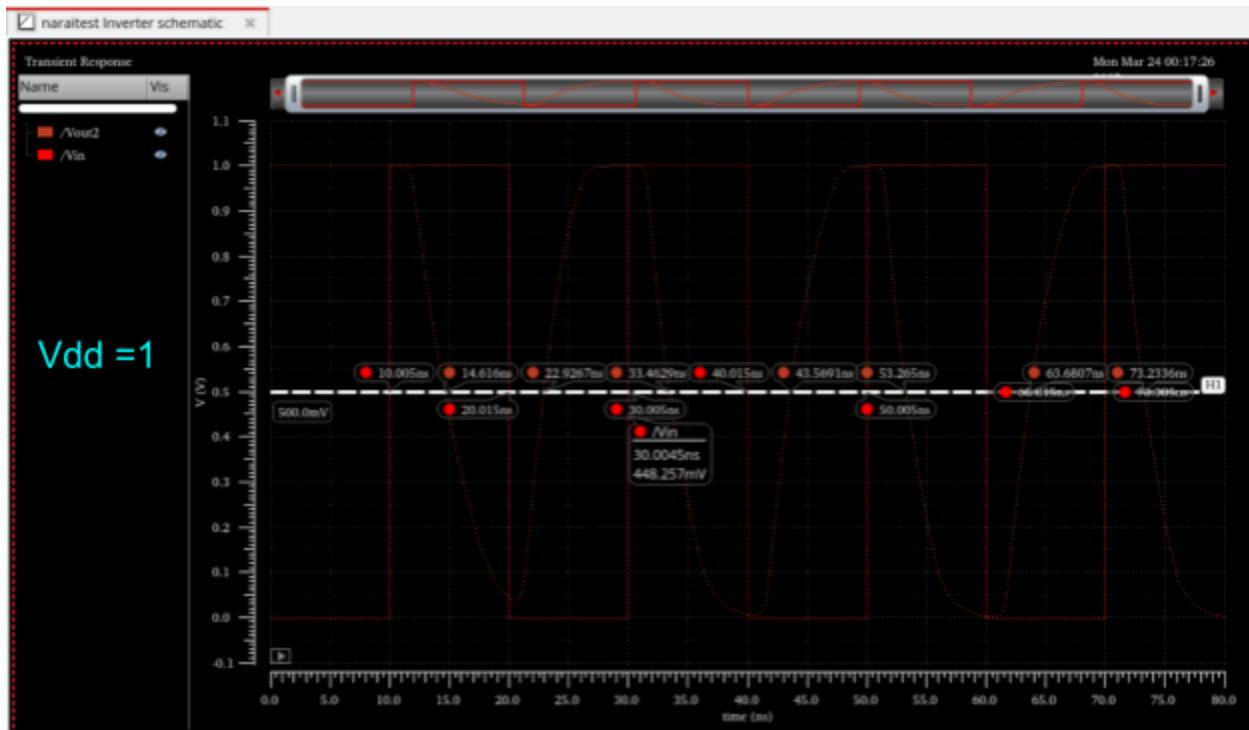


N=7

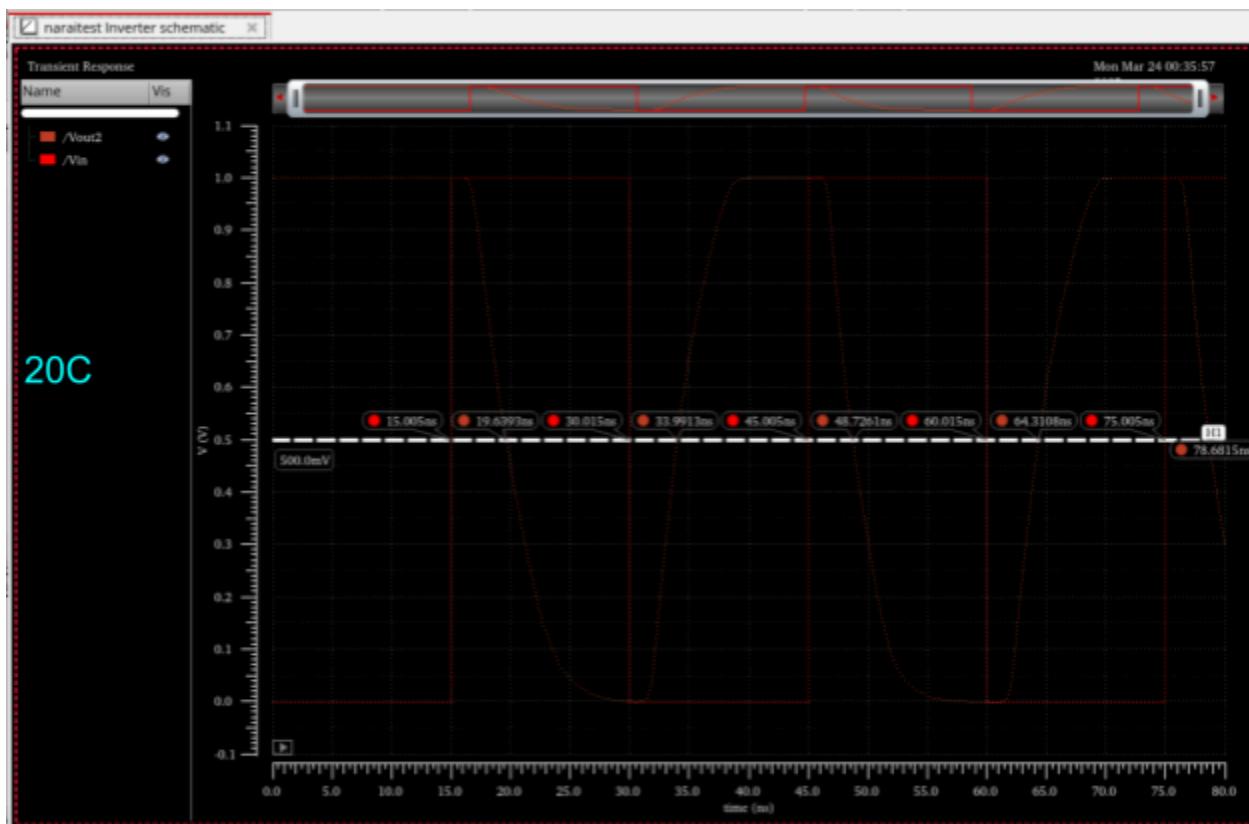


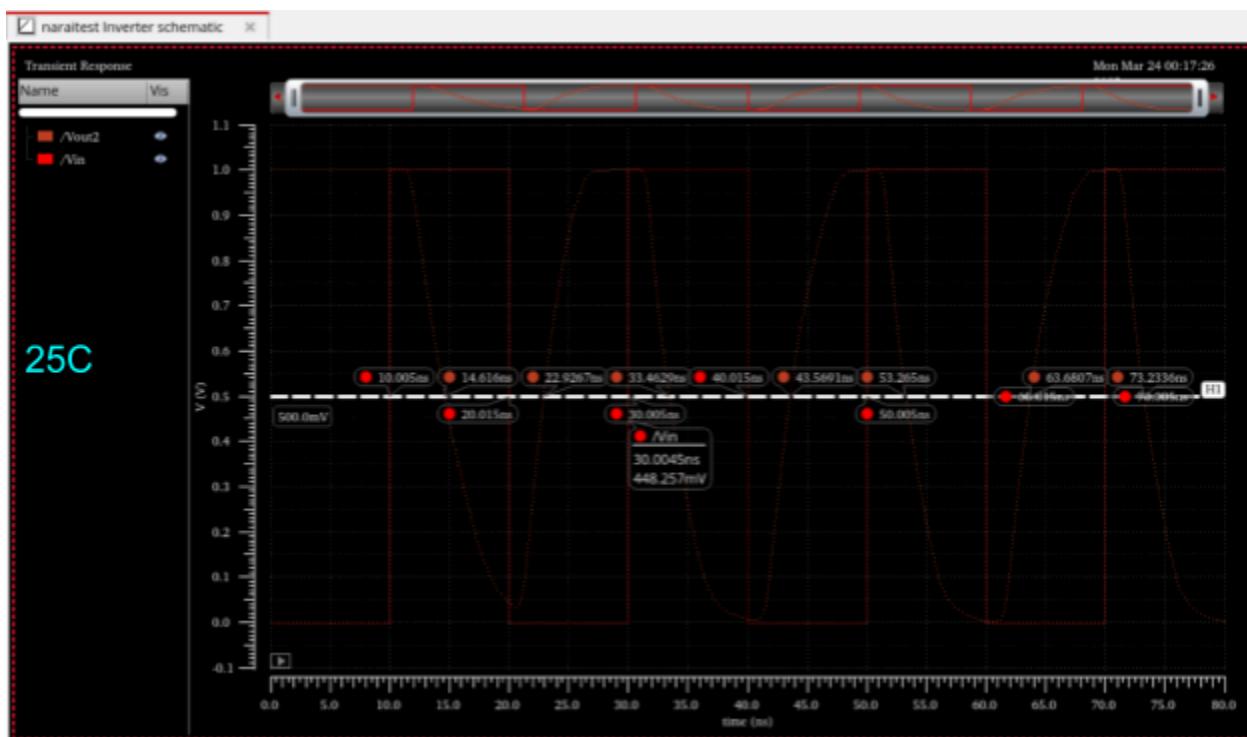
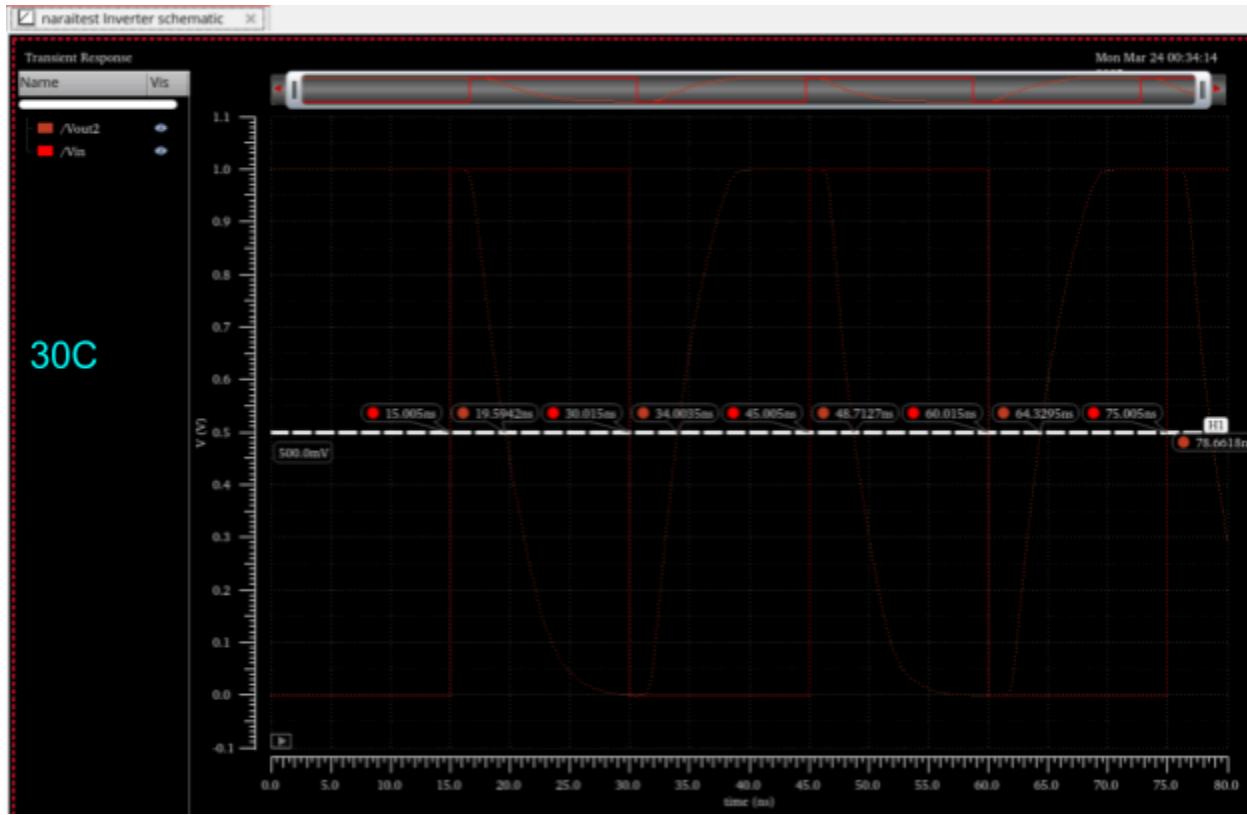
Supply Voltages (N=8)



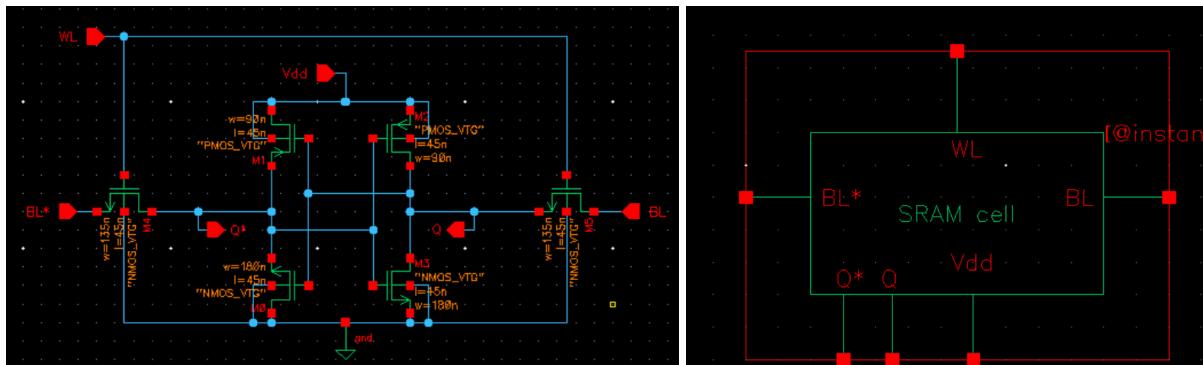


Temperatures (N=8)

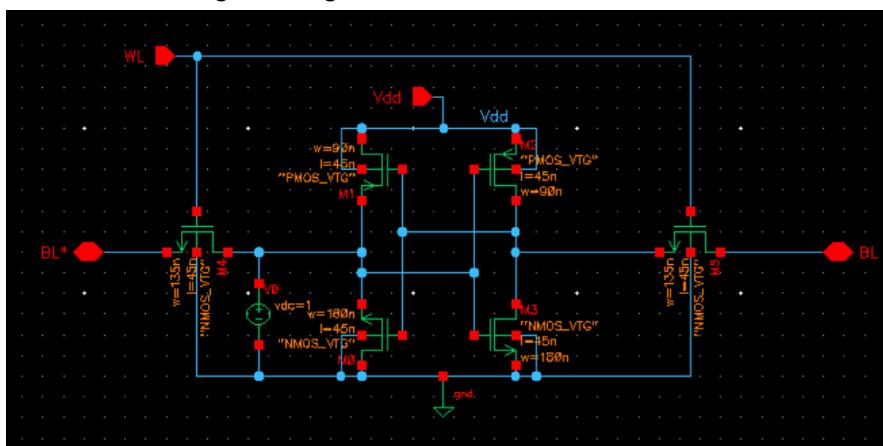




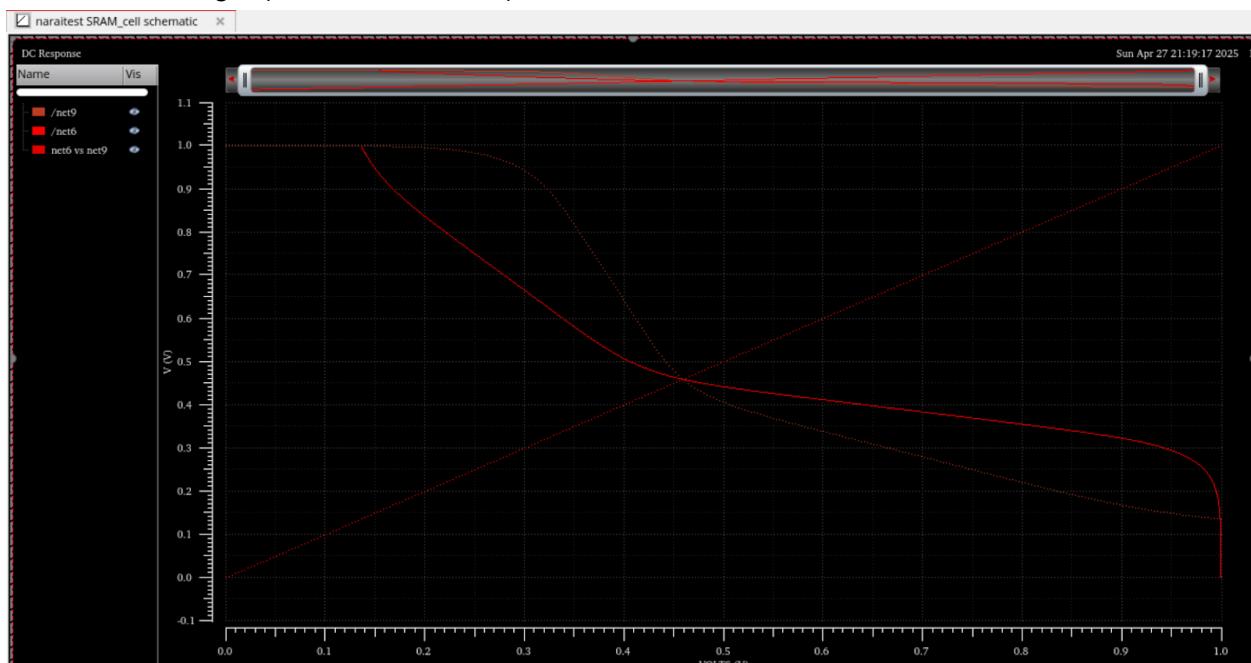
SRAM Cell - Narain



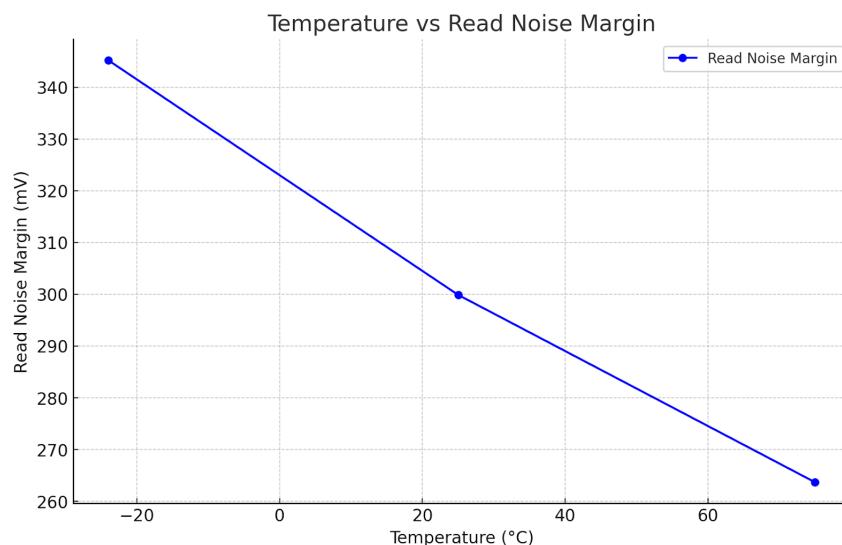
Read Noise margin configuration:



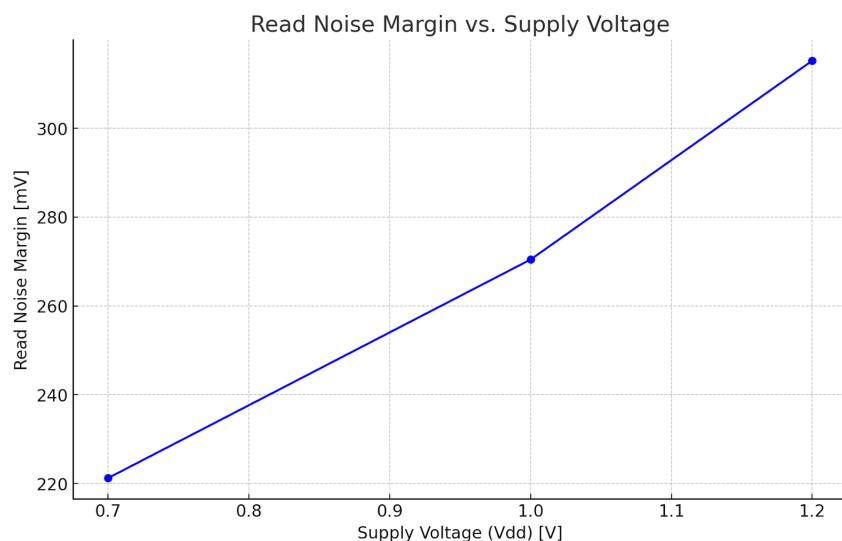
Read Noise Margin (Vdd = 1 & T = 25C)



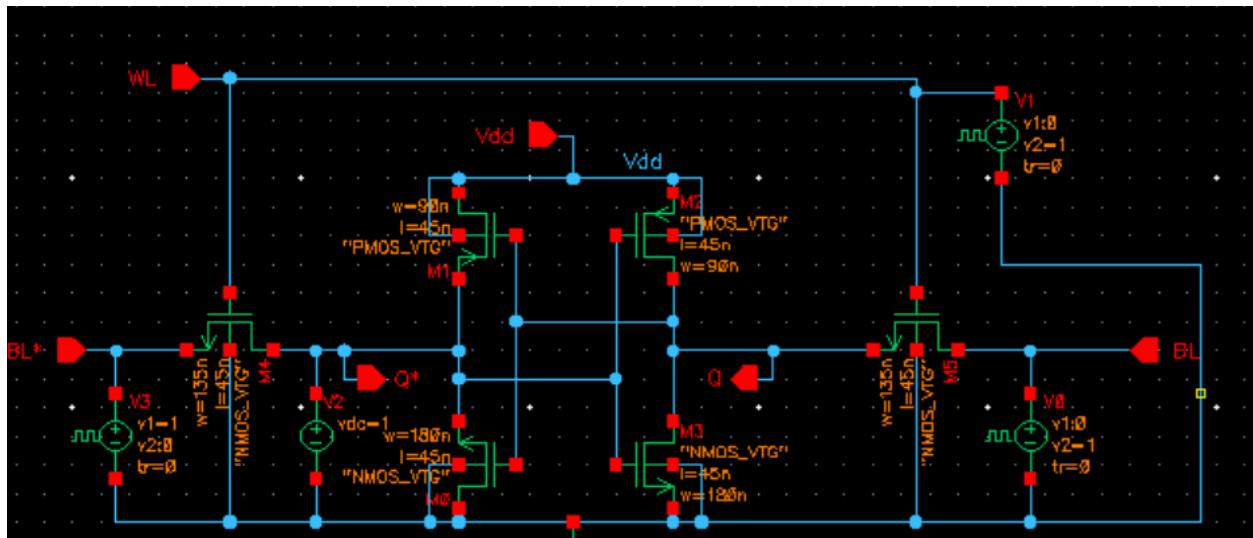
Temperature (C)	Read Noise Margin (mV)
-24C	345.21
25C	299.89
75C	263.68



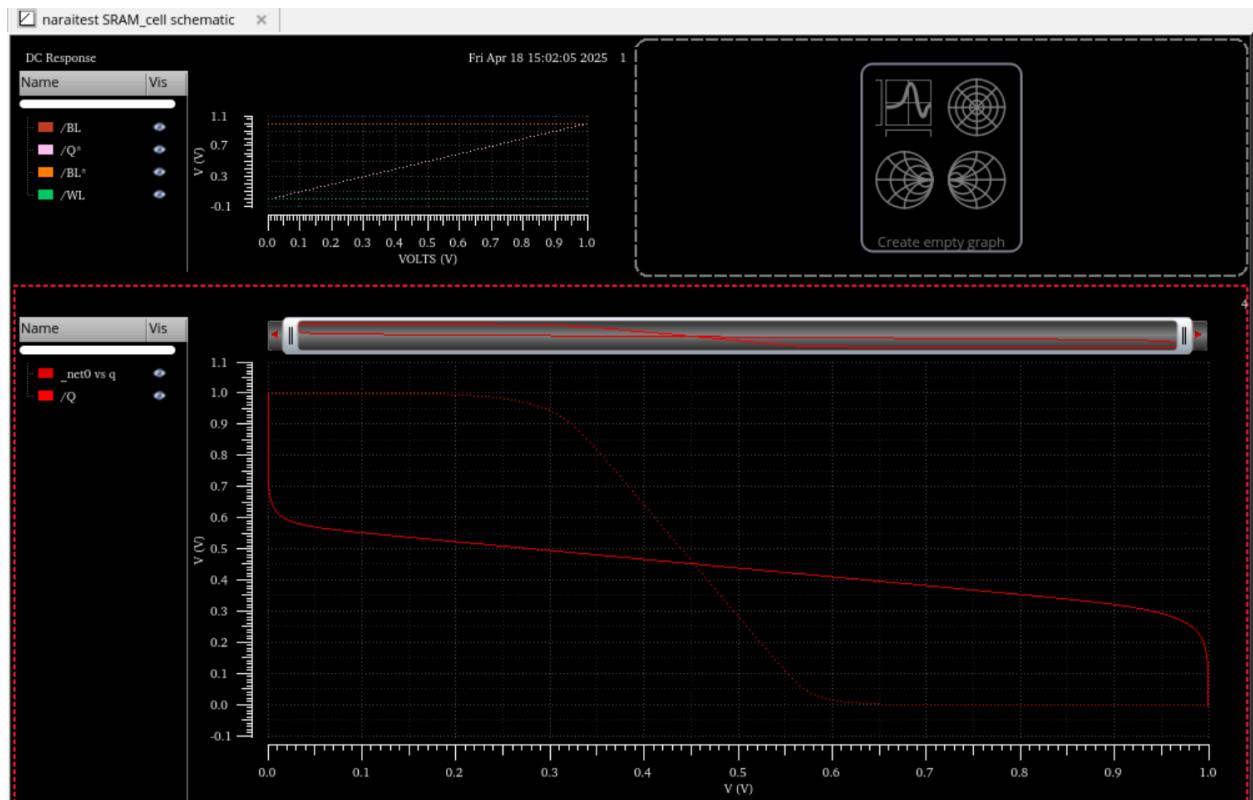
Supply Voltage (Vdd)	Read Noise Margin (mV)
0.7	221.24
1	270.44
1.2	315.21



Read Noise margin configuration:



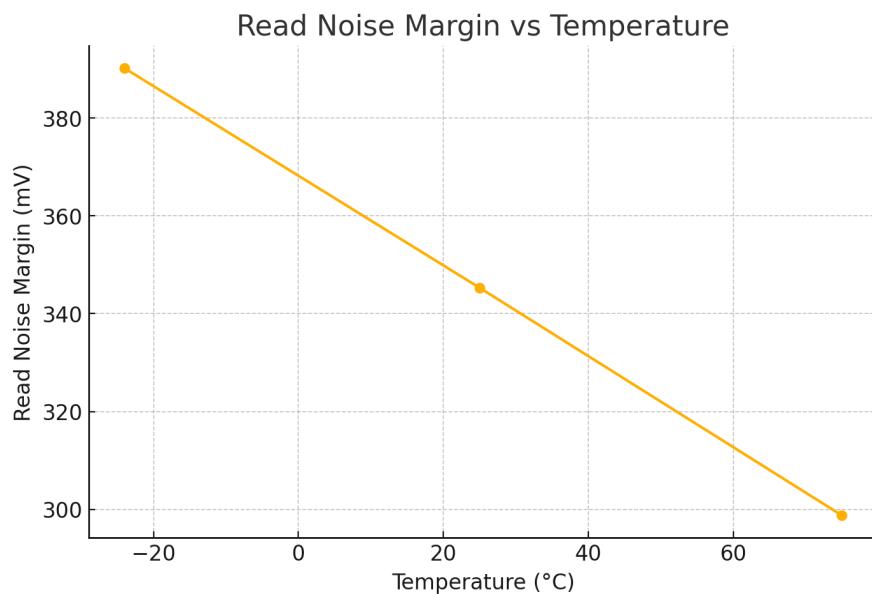
Write Noise Margin ($Vdd = 1$ & $T = 25C$)



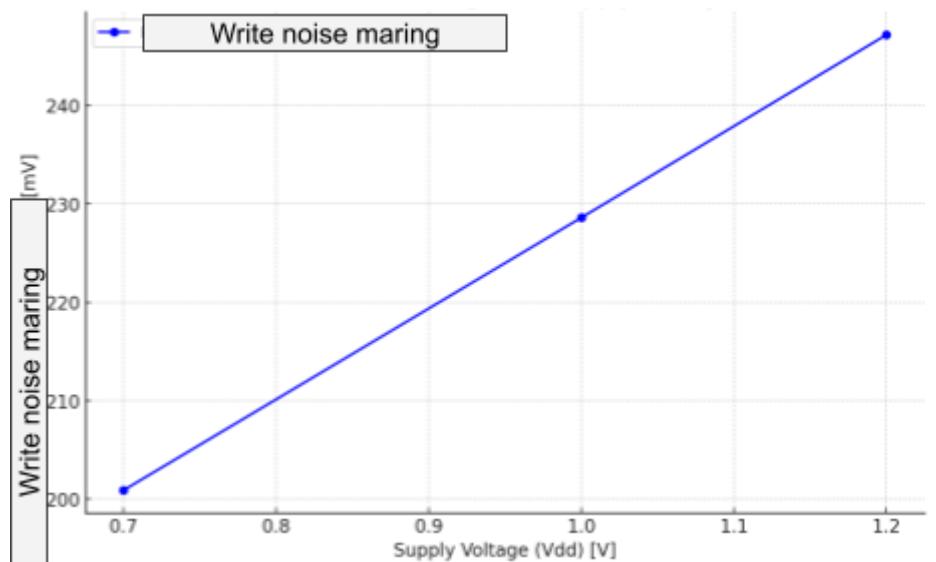
Temperature (C)

Write Noise Margin (mV)

-24C	390.17
25C	345.29
75C	298.76



Supply Voltage (Vdd)	Write Noise Margin (mV)
0.7	200.9
1	228.61
1.2	247.2



Expressions

Plot	Name	Expression
<input checked="" type="checkbox"/>	V_il	cross(deriv(getData("/Q" ?result "dc")) -1 1 "falling" nil nil nil)
<input checked="" type="checkbox"/>	V_ih	cross(deriv(getData("/Q" ?result "dc")) -1 1 "rising" nil nil nil)
<input checked="" type="checkbox"/>	V_oh	value(getData("/Q" ?result "dc") V_il)
<input checked="" type="checkbox"/>	V_ol	value(getData("/Q" ?result "dc") V_ih)
<input checked="" type="checkbox"/>	NM_h	V_il-V_ol
<input checked="" type="checkbox"/>	NM_I	V_ih-V_oh
<input checked="" type="checkbox"/>	NM	sqrt(NM_h**2 + NM_I**2)

Virtuoso (R) Visualization & Analysis XL calculator

File Tools View Options Constants Help

In Context Results DB: /home1/AD/nvazq3/simulation/SRAM_cell/hspiceD/schematic/psf

app plot erplot

vt vf vdc vs os op ot mp vn sp vswr hp
it if idc is opt var vn2 zp yp gd

Off Family Wave Clip Append Rectangular

Key P... deriv(deriv(deriv(sqrt(NM_h**2 + NM_I**2)))

Stack

```
getData("/Q" ?result "dc")
cross(deriv(getData("/Q" ?result "dc" )) -1 1 "falling" nil nil )
cross(deriv(getData("/Q" ?result "dc" )) -1 1 "falling" nil nil nil )
deriv(getData("/Q" ?result "dc" ))
```

Function Panel

cross

Signal: deriv(deriv(deriv(sqrt(NM_h**2 + NM_I**2))))

Threshold Value: -1

Edge Number: 1

Edge Type: falling

Number of occurrences: single

Plot/print vs.: time

Tolerance: nil

OK Apply Defaults Help Close

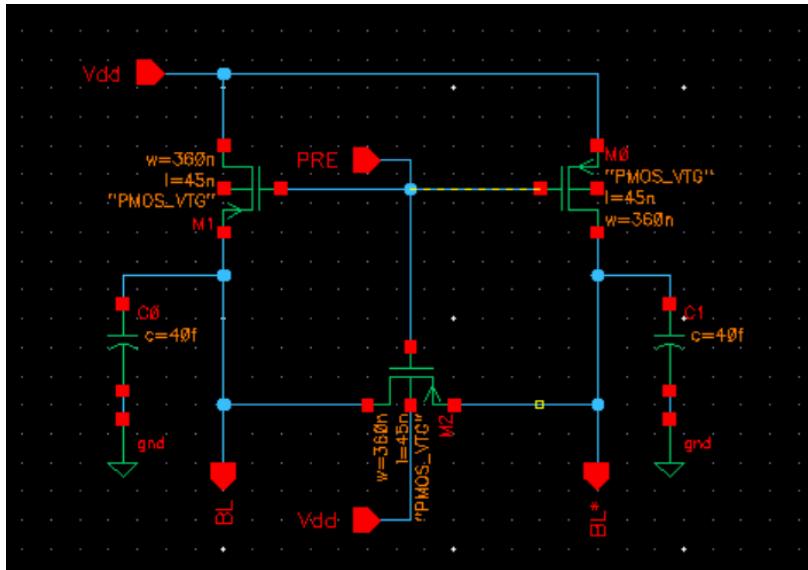
Expression Editor

Plot Name Expressions

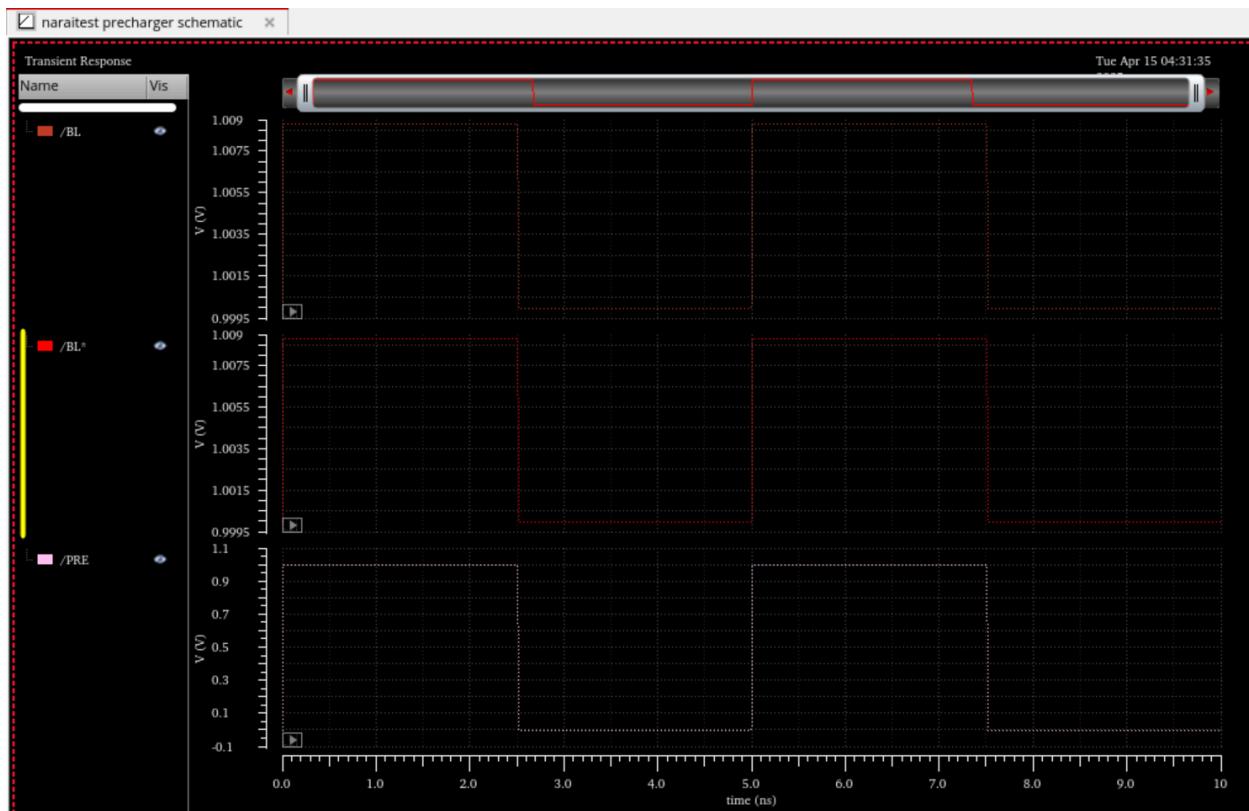
Plot	Name	Expression
<input checked="" type="checkbox"/>	V_il	cross(deriv(getData("/Q" ?result "dc")) -1 1 "falling" nil nil nil)
<input checked="" type="checkbox"/>	V_ih	cross(deriv(getData("/Q" ?result "dc")) -1 1 "rising" nil nil nil)
<input checked="" type="checkbox"/>	V_oh	value(getData("/Q" ?result "dc") V_il...)
<input checked="" type="checkbox"/>	V_ol	value(getData("/Q" ?result "dc") V_ih...)
<input checked="" type="checkbox"/>	NM_h	V_il-V_ol
<input checked="" type="checkbox"/>	NM_I	V_ih-V_oh
<input checked="" type="checkbox"/>	NM	sqrt(NM_h**2 + NM_I**2)

SRAM Array - Narain

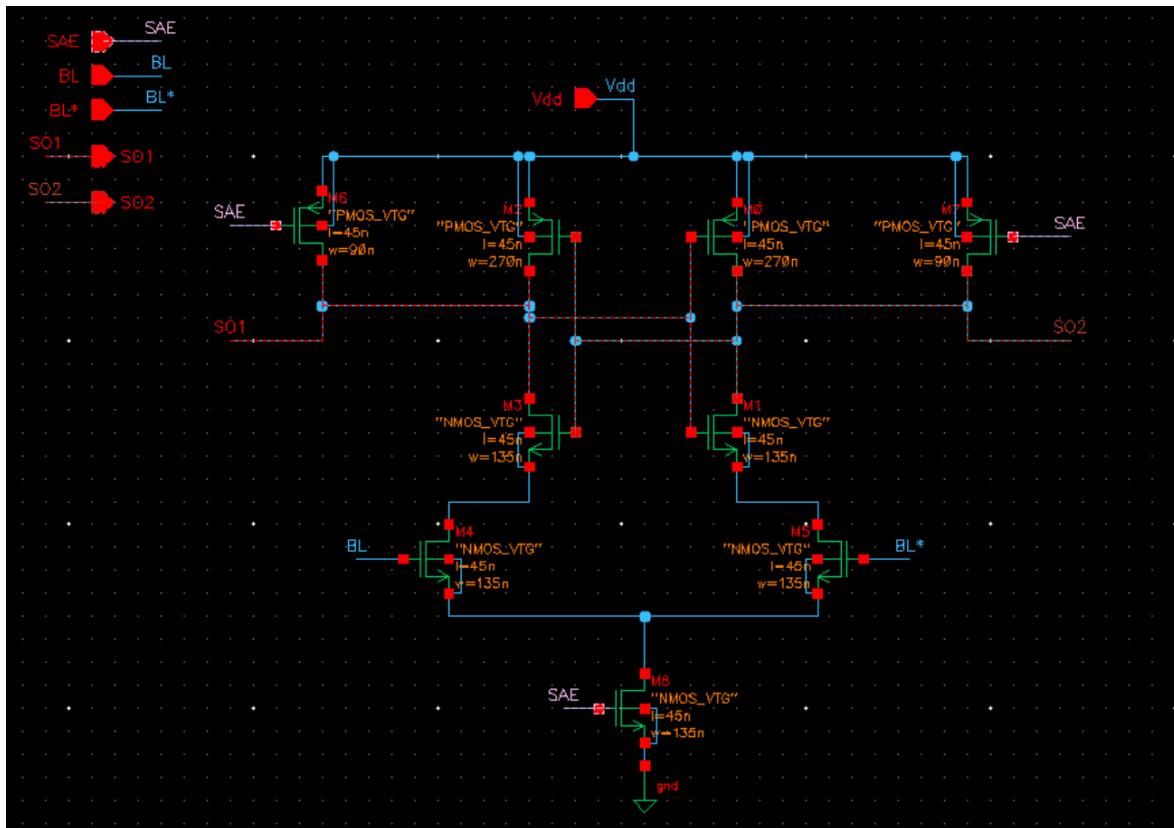
Precharger:



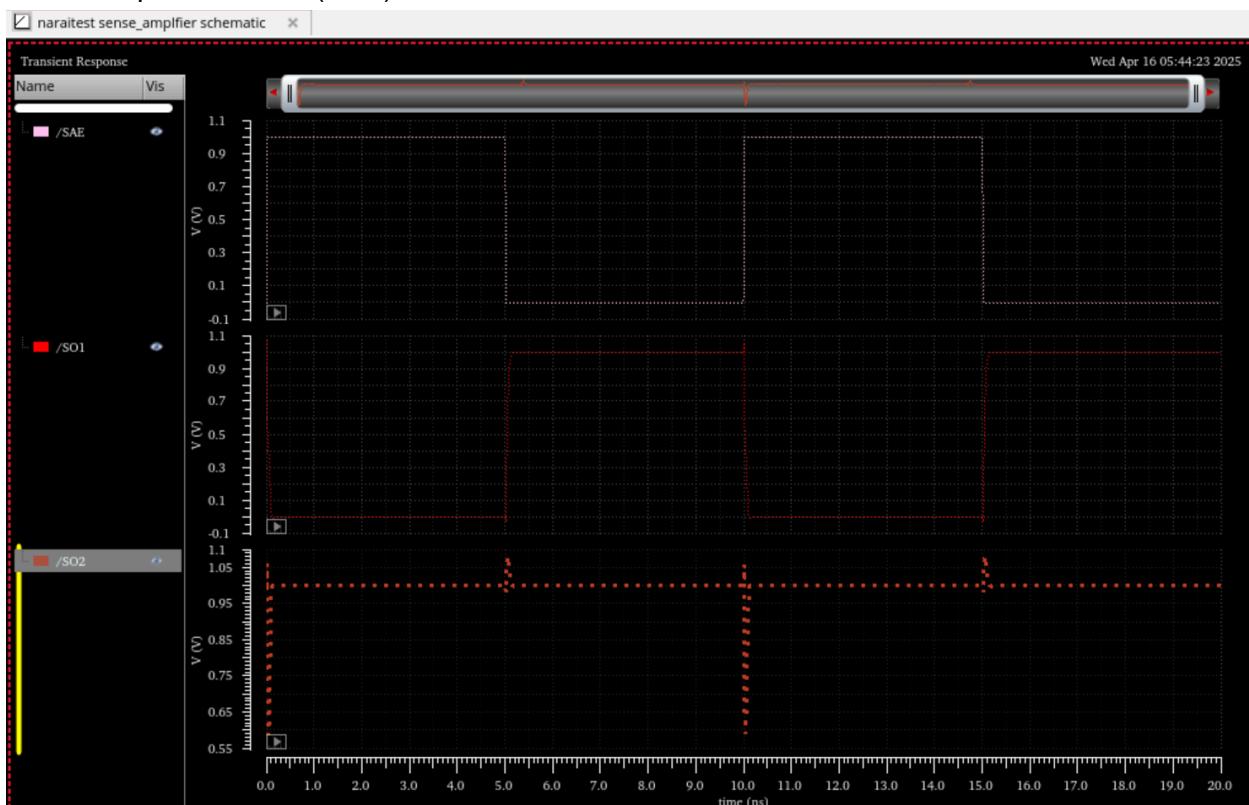
Precharge Logic:



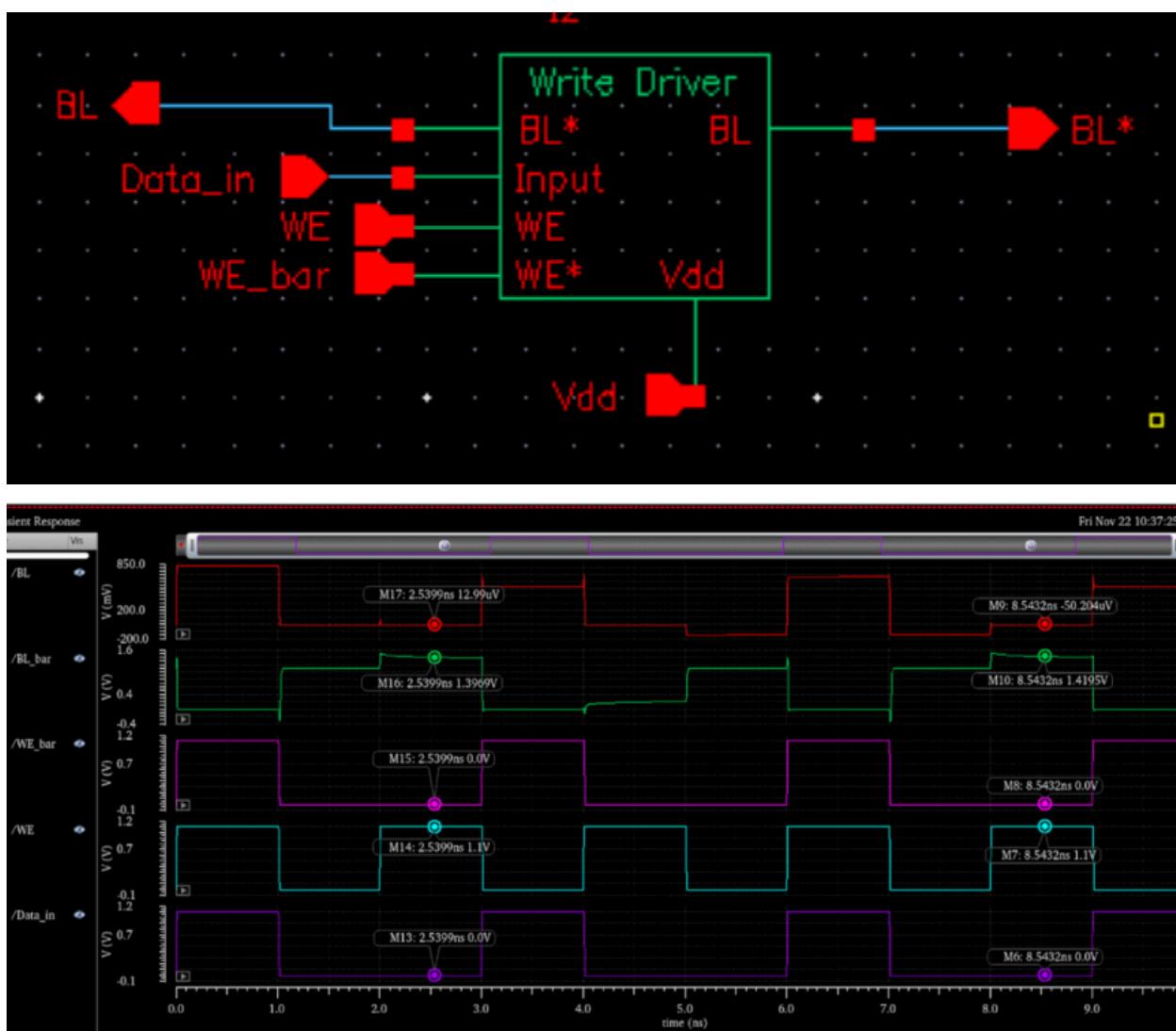
Sense Amplifier:



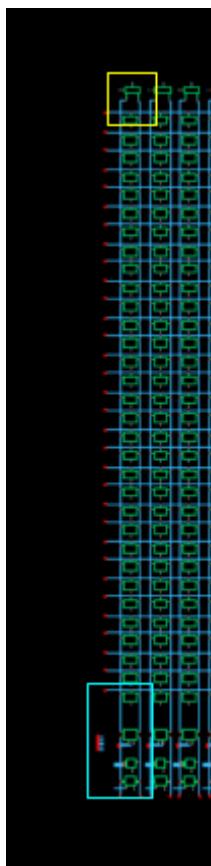
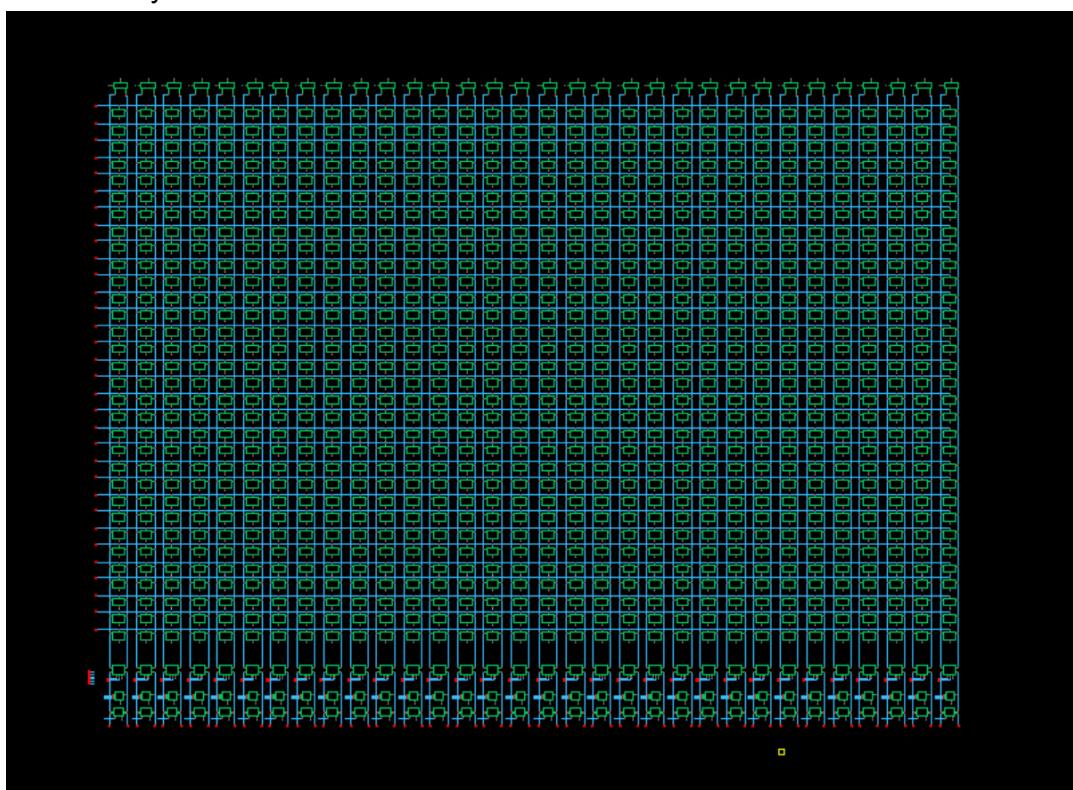
Sense Amplifier Enable (SAE):



Write Driver



SRAM Array



SRAM Column

