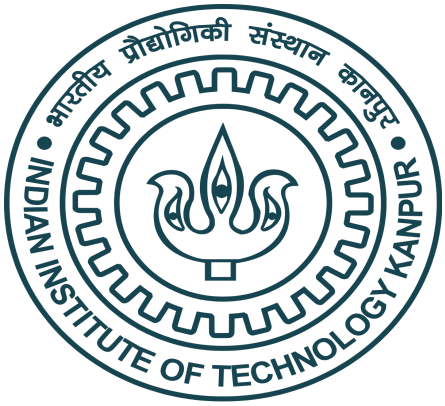

INDIAN INSTITUTE OF TECHNOLOGY, KANPUR

EE-619 VLSI SYSTEM DESIGN

SPICE PROJECT

GROUP NO: 7

ANANYA
ADITI
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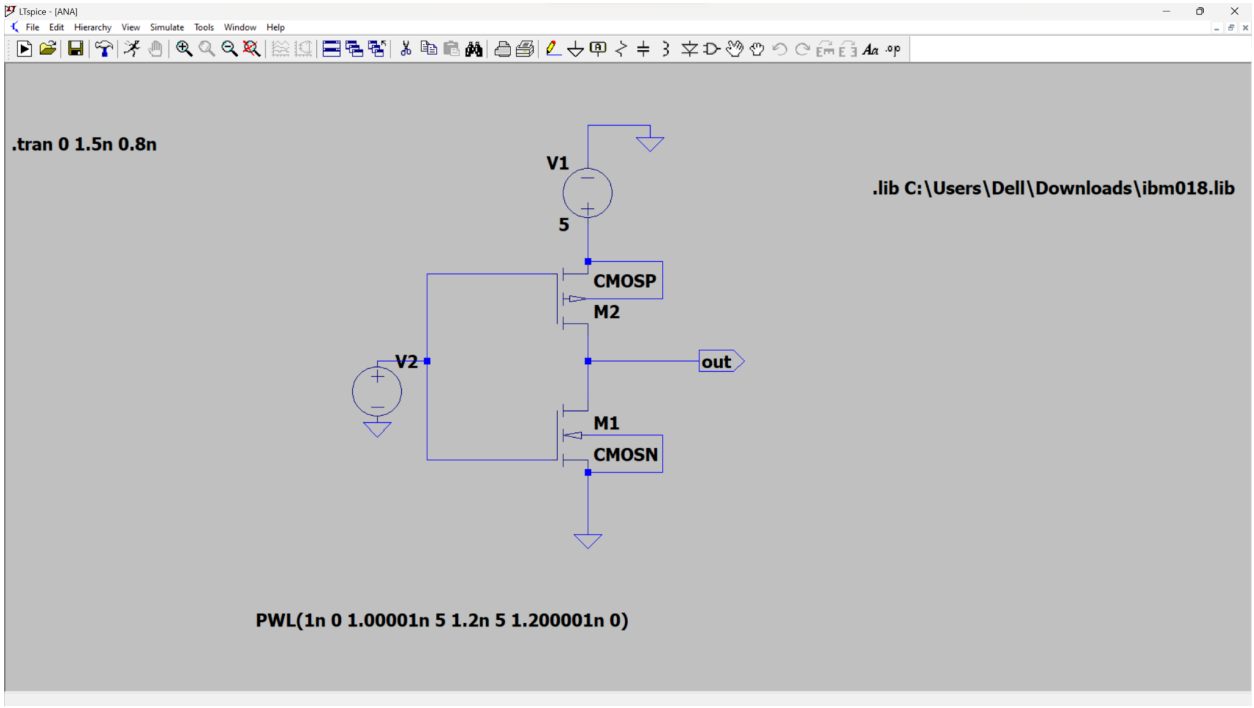
SAI VEDANT-210901

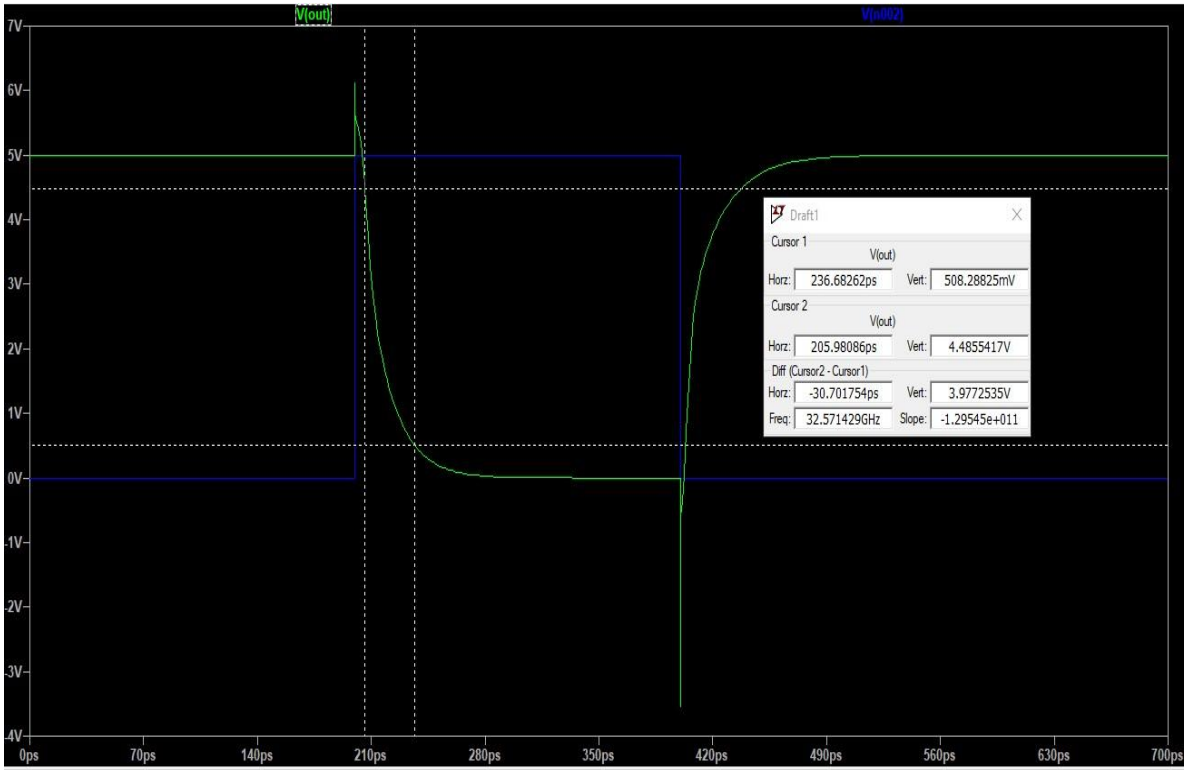
Course Instructor : Dr. Rik Dey

Technology used:-IBM018 (Library Files attached)

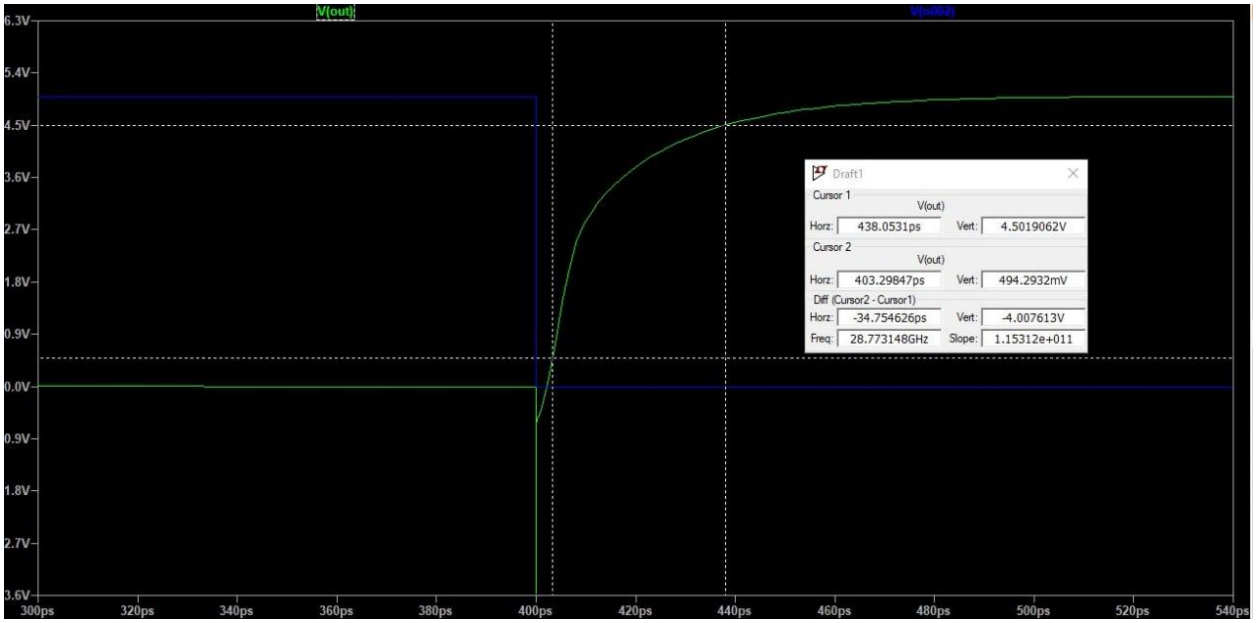
1) A) VTC of inverter



INVERTER SCHEMATIC



Fall Time of Minimum size inverter=30.70ps

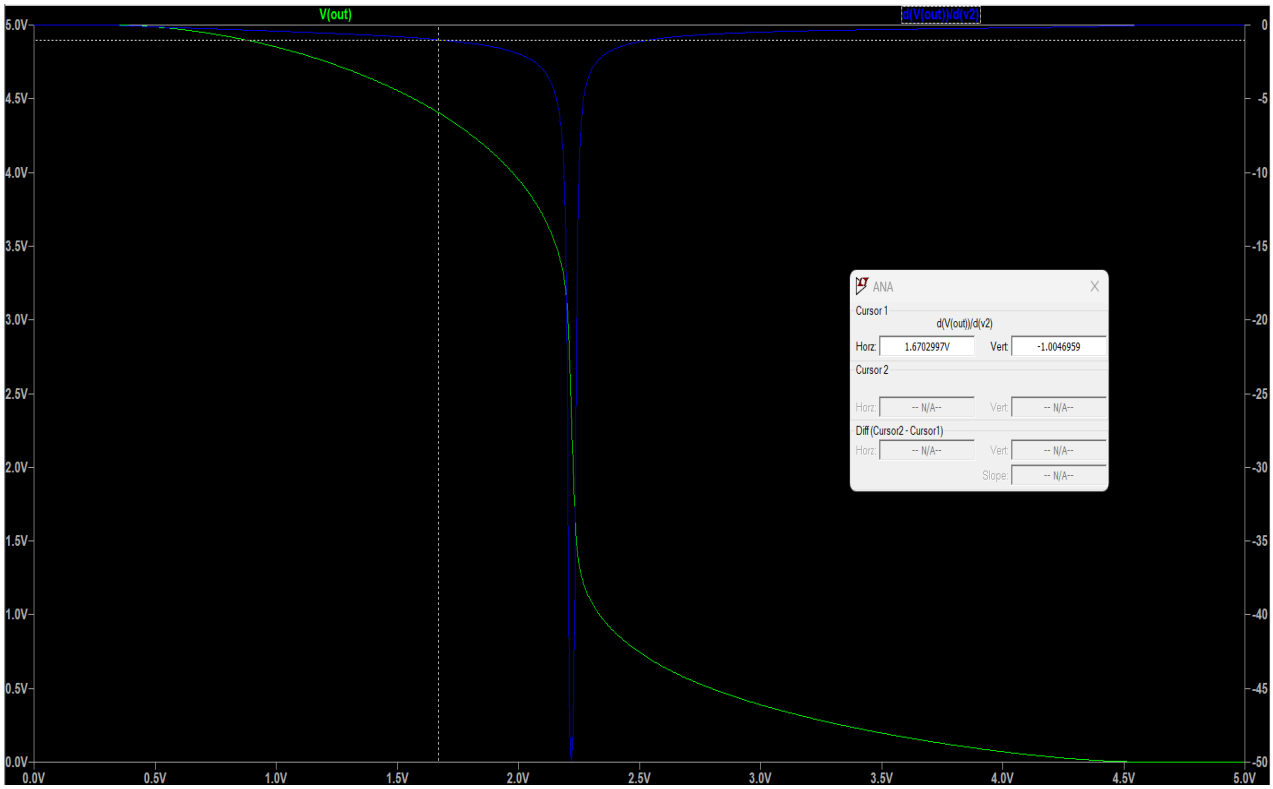


Rise Time of Minimum size inverter=34.75ps

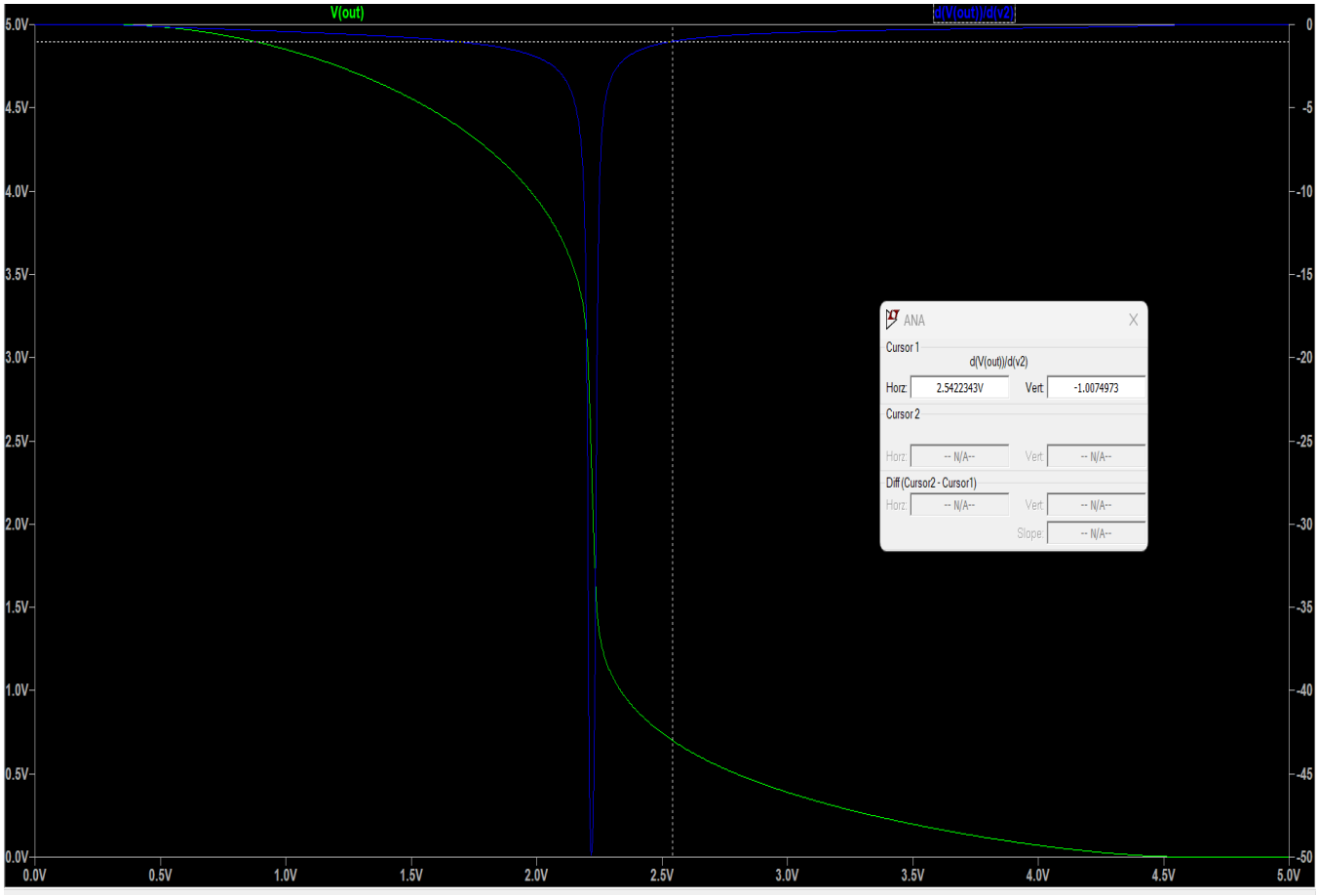
Required sizing

NMOS(Minimum size)- W=250nm. L=1000nm. $(W/L)_n$=0.25

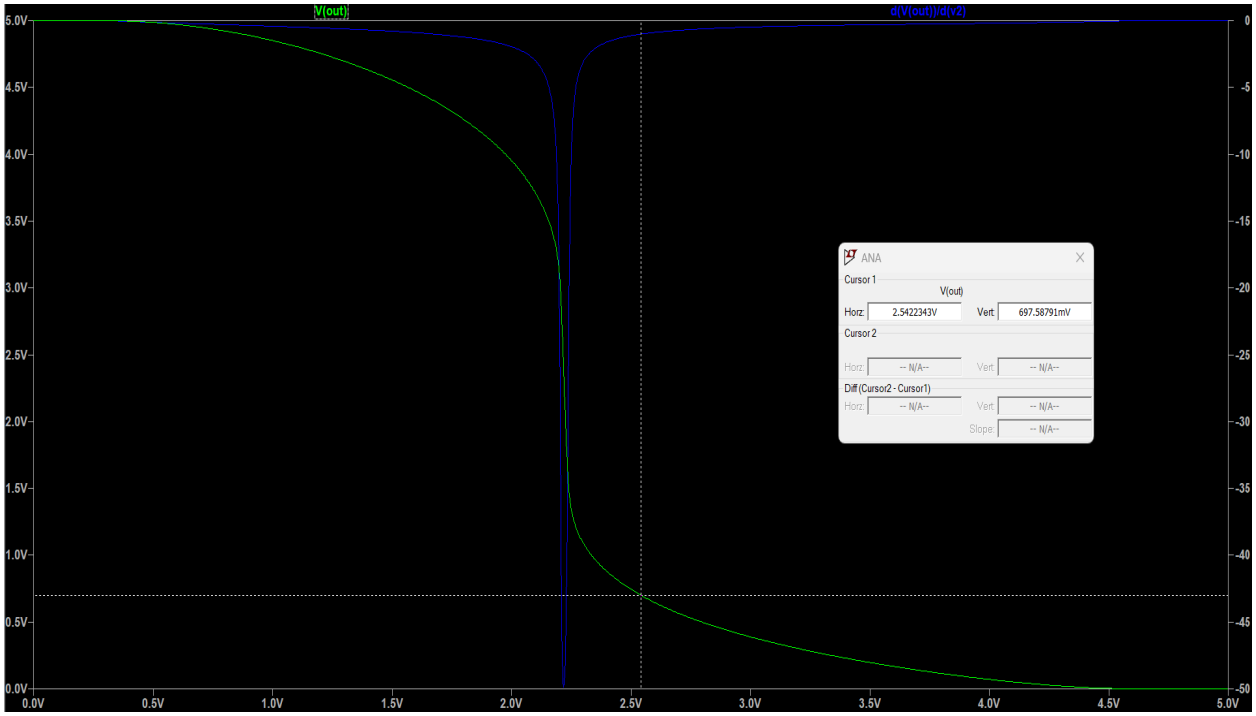
PMOS(Minimum size)- W=518.4nm. L=1000nm. $(W/L)_p$=4.44



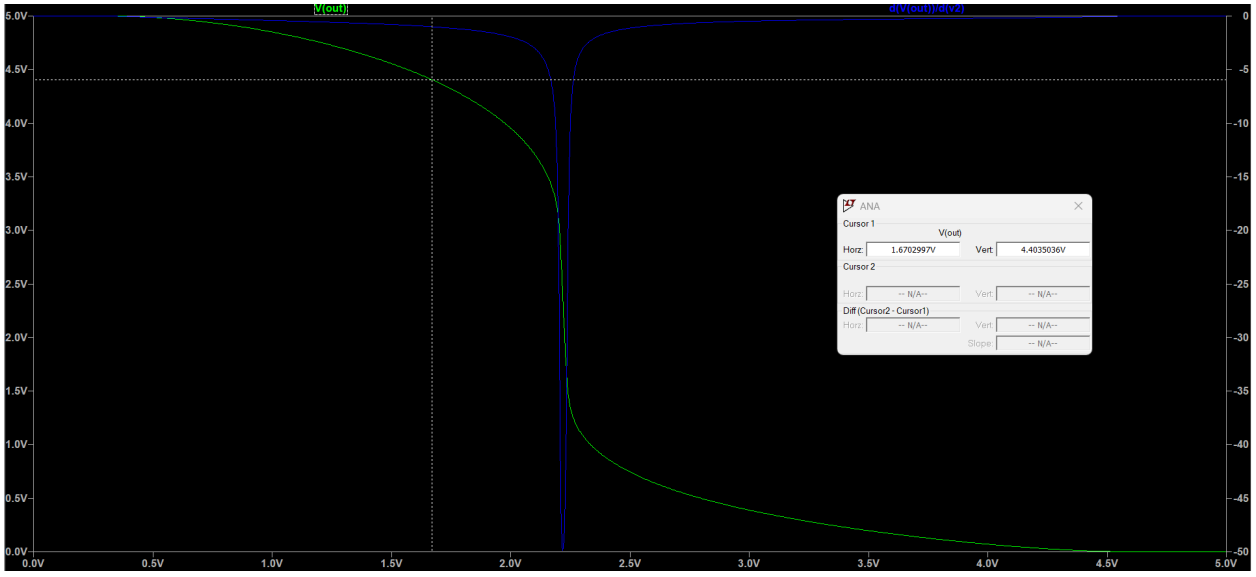
VTC with VIL=1.67V


V(out)
d(V(out))/d(v2)
5.0V
4.5V
4.0V
3.5V
3.0V
2.5V
2.0V
1.5V
1.0V
0.5V
0.0V
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
0.0V
0.5V
1.0V
1.5V
2.0V
2.5V
3.0V
3.5V
4.0V
4.5V
5.0V
ANA
X
Cursor 1
d(V(out))/d(v2)
Horz: 2.5422343V
Vert: -1.0074973
Cursor 2
Horz: -- N/A--
Vert: -- N/A--
Diff (Cursor2 - Cursor1)
Horz: -- N/A--
Vert: -- N/A--
Slope: -- N/A--

VIH= 2.54V



VOL=0.69V

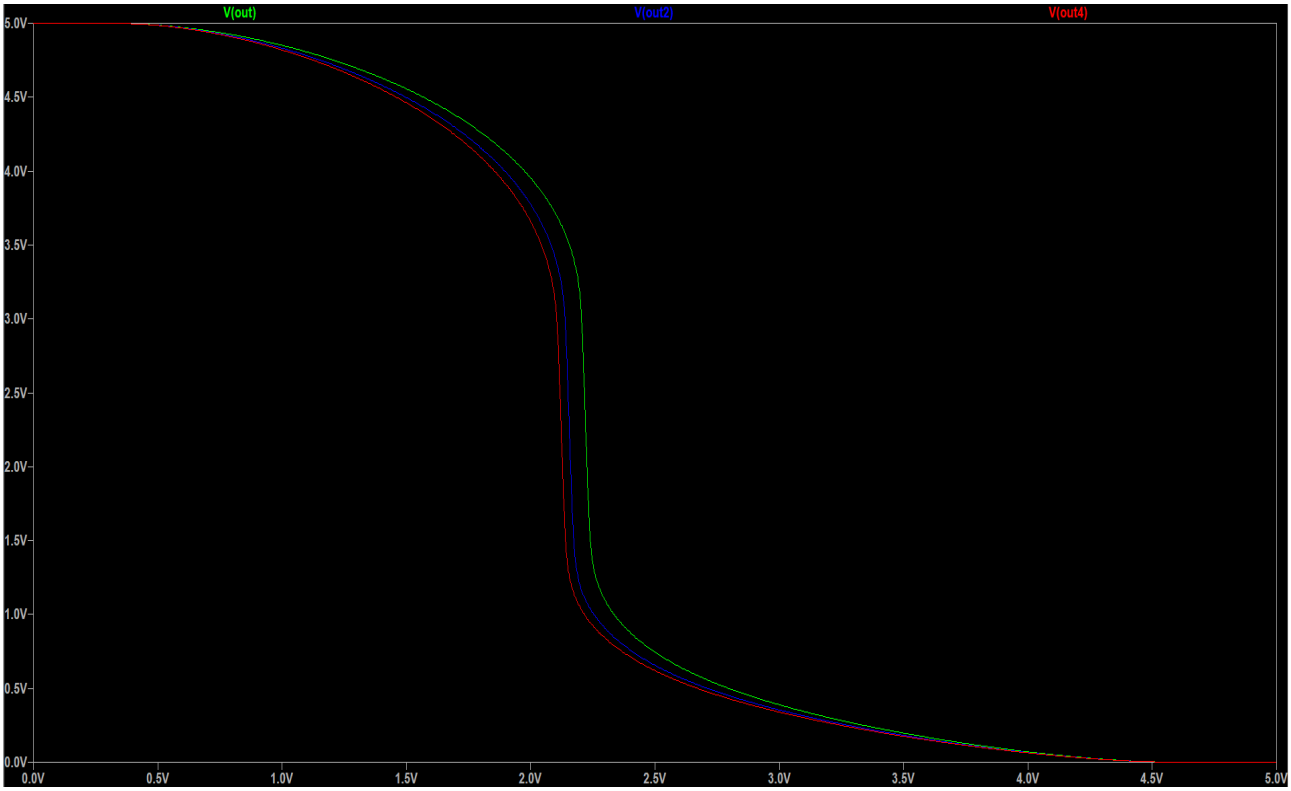


VOH=4.40V

NML=VIL-VOL=0.98

NMH=VOH-VIH=1.86

Noise immunity= Min(NML, NMH)=0.98V



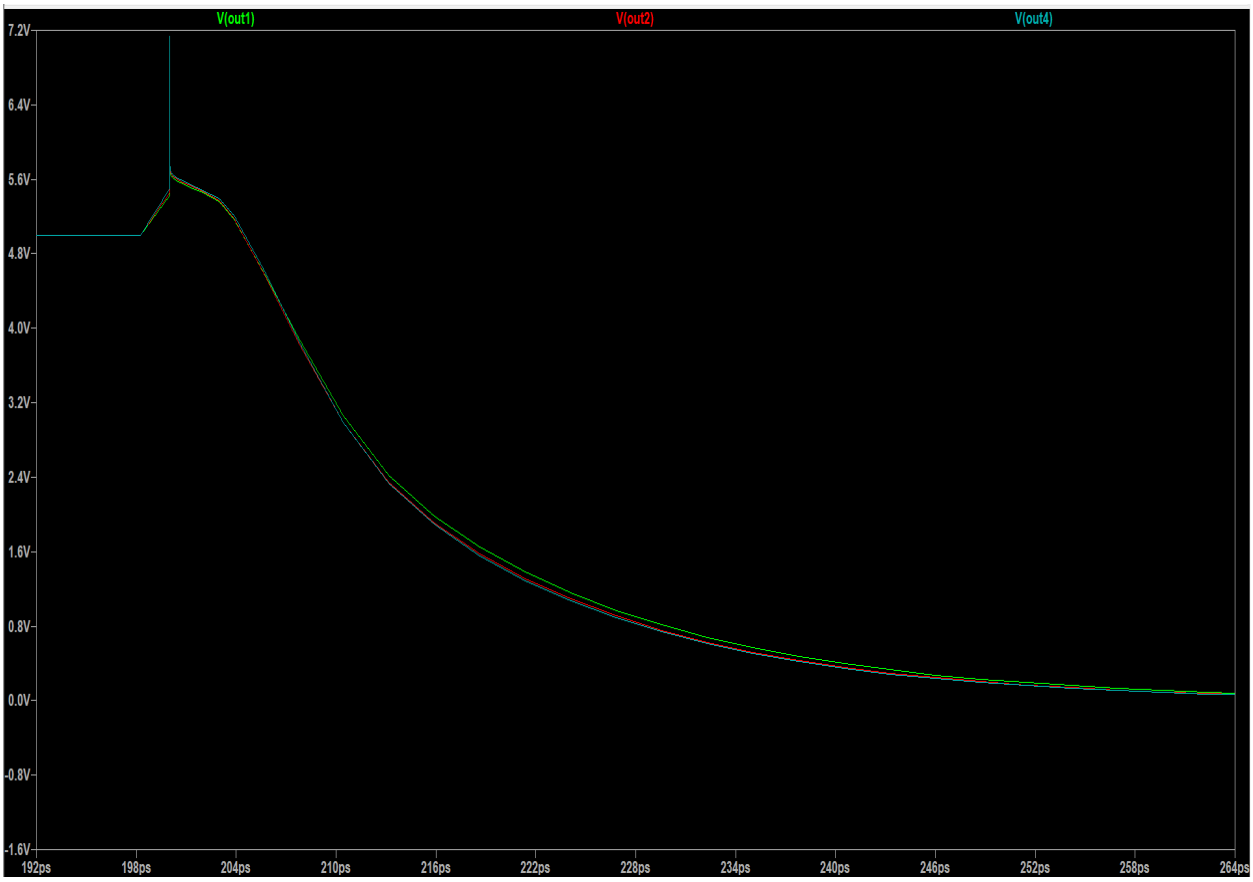
Variation of VTC with sizing.

Green S=1

Blue S=2

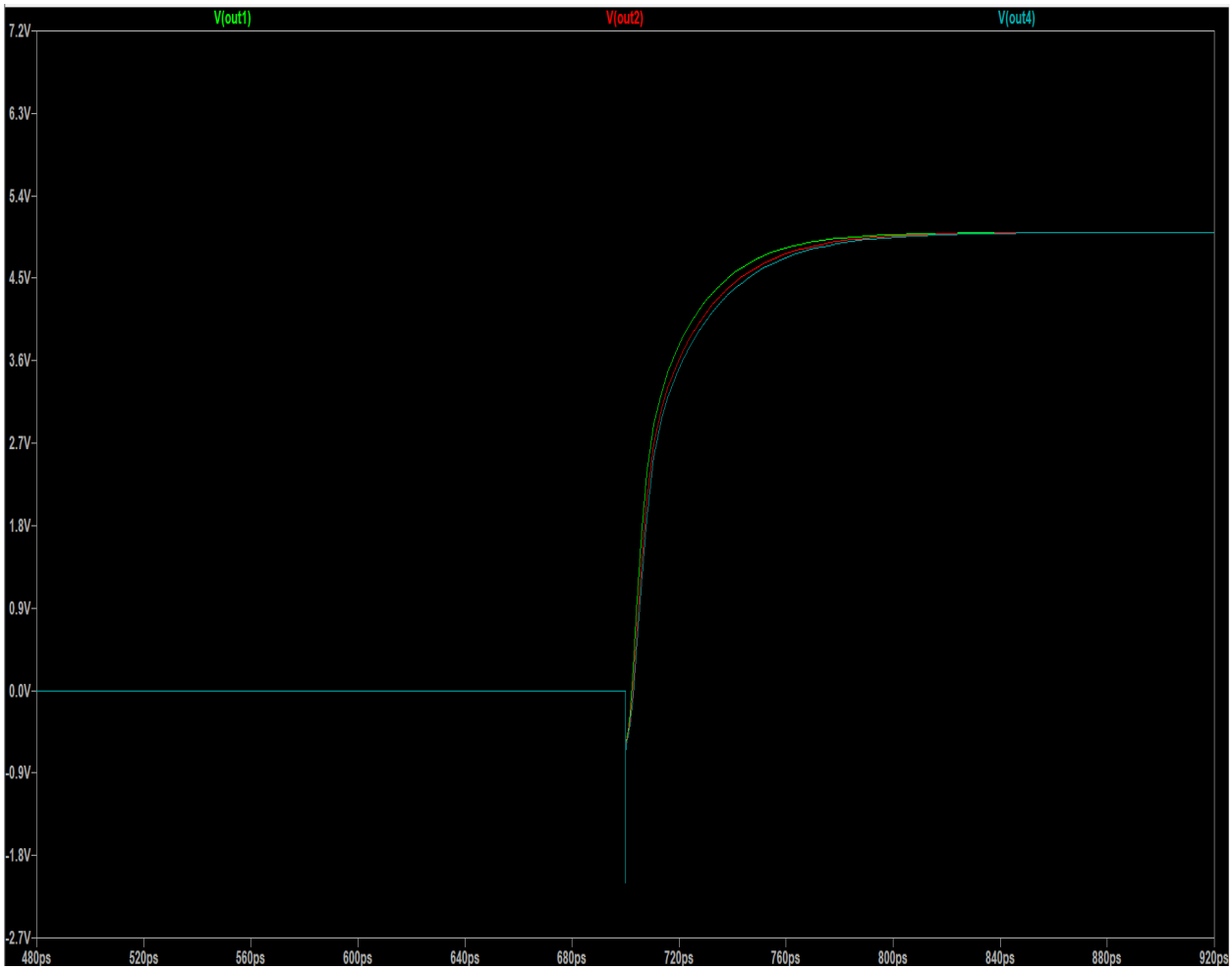
Red S=4

B) Transient Analysis



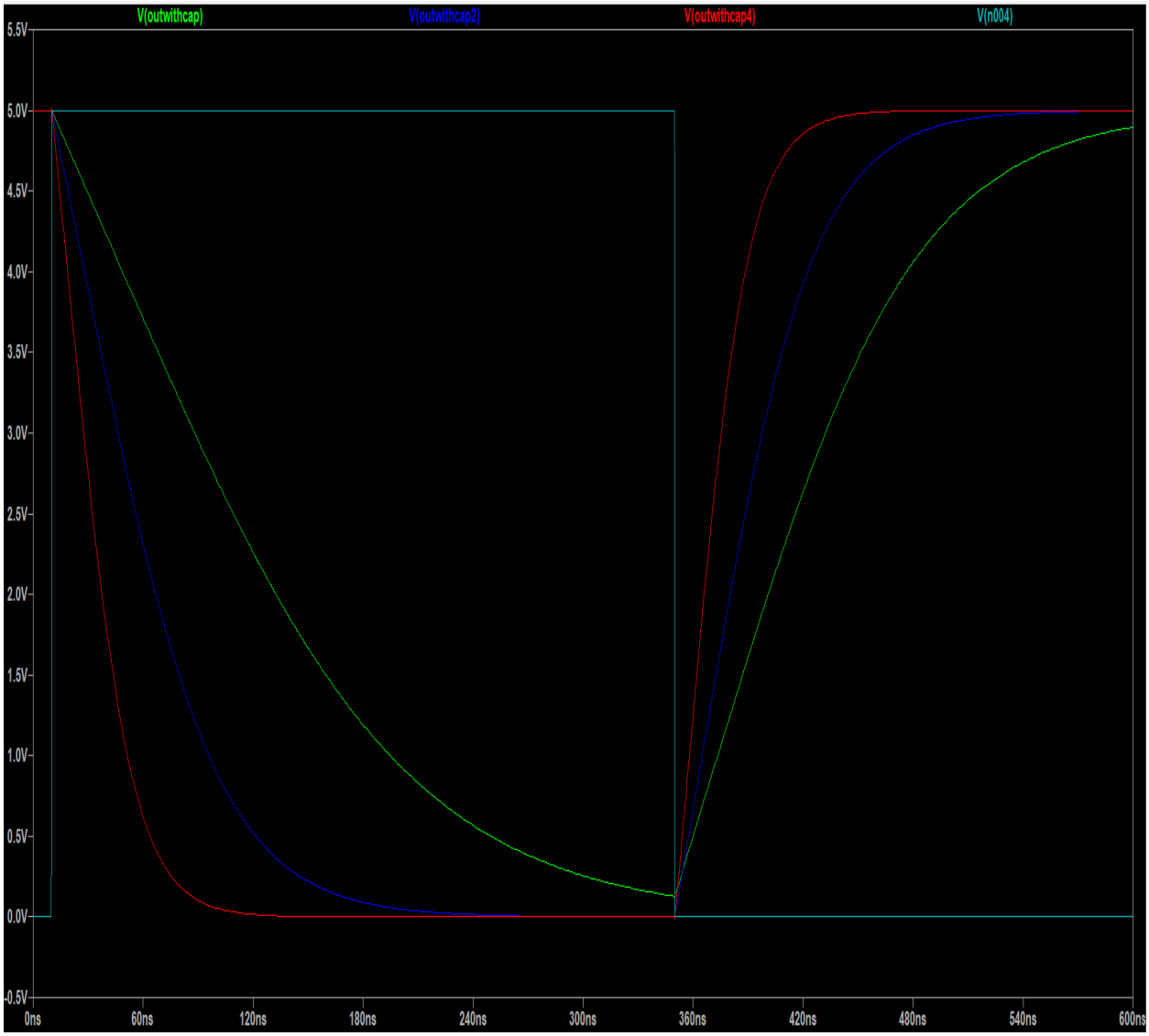
Fall time without Capacitor

Size	Fall Time(without cap)
S=1	32ps
S=2	22ps
S=4	20ps



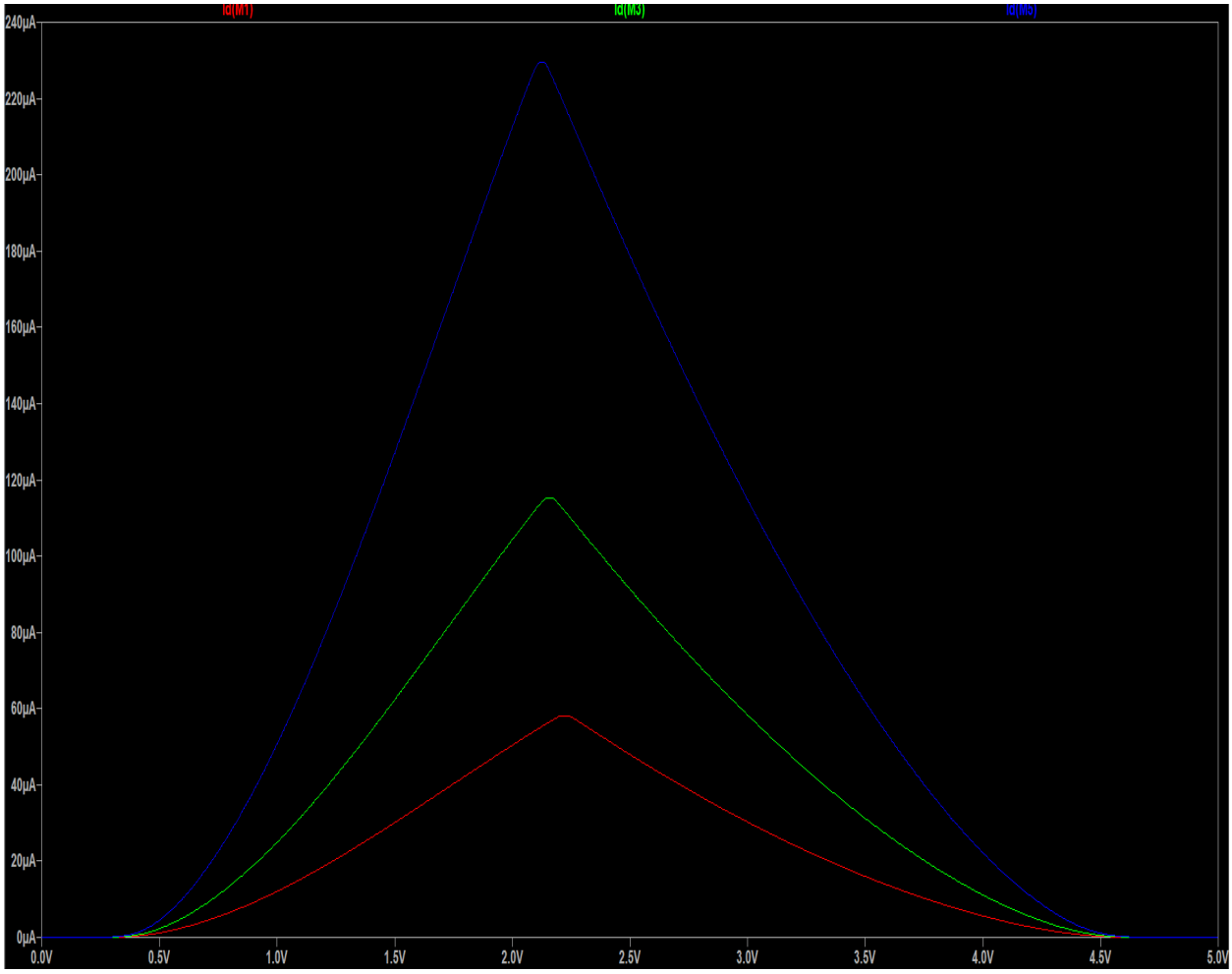
Rise time without Capacitor

Size	Rise Time(without cap)
S=1	47ps
S=2	39ps
S=4	38ps



Fall and Rise time with Capacitor

Size	Fall Time(with cap)	Rise Time(with cap)
S=1	219.41ns	156.399ns
S=2	100.21ns	89.967ns
S=4	50.108ns	46.69ns

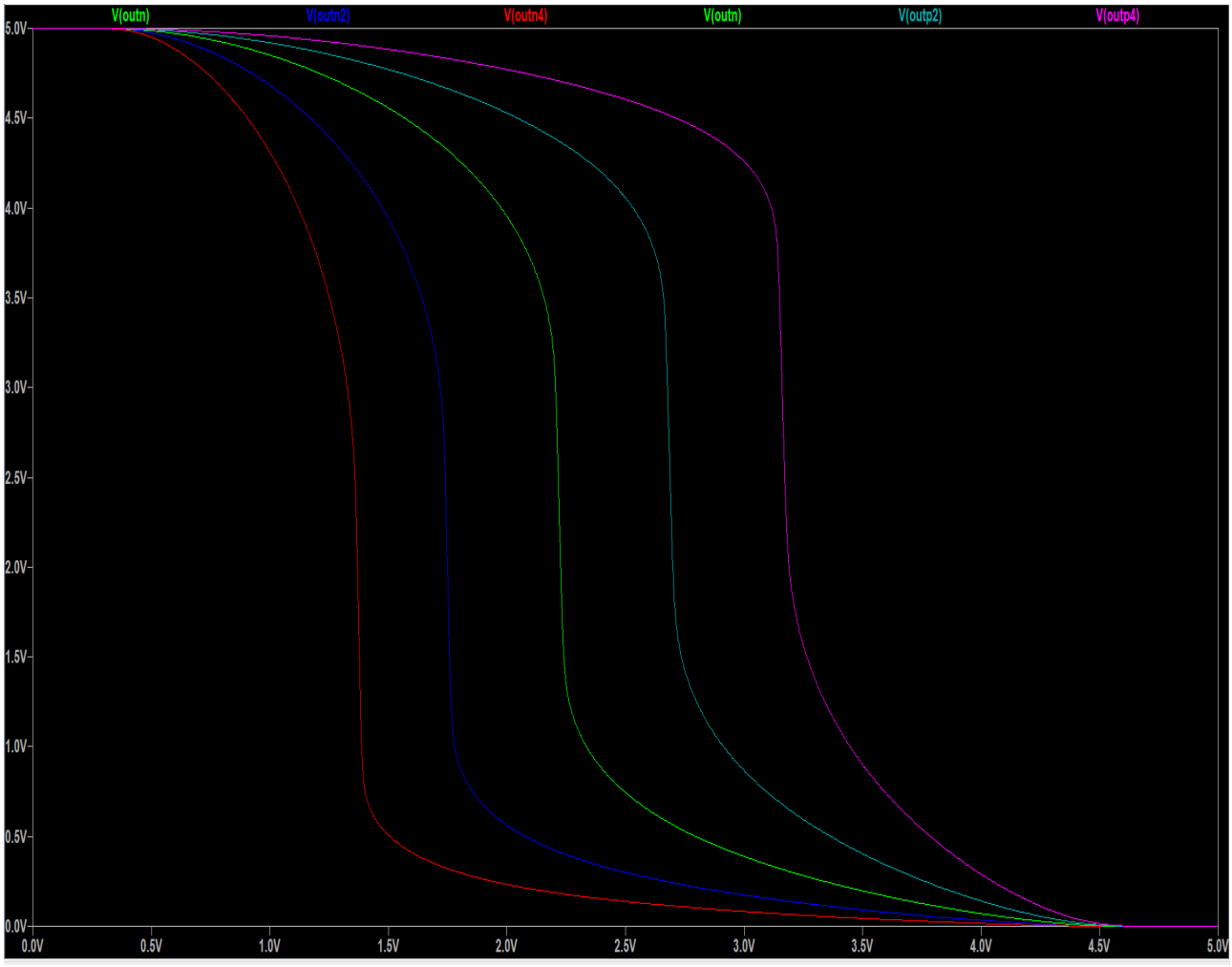


Current drawn

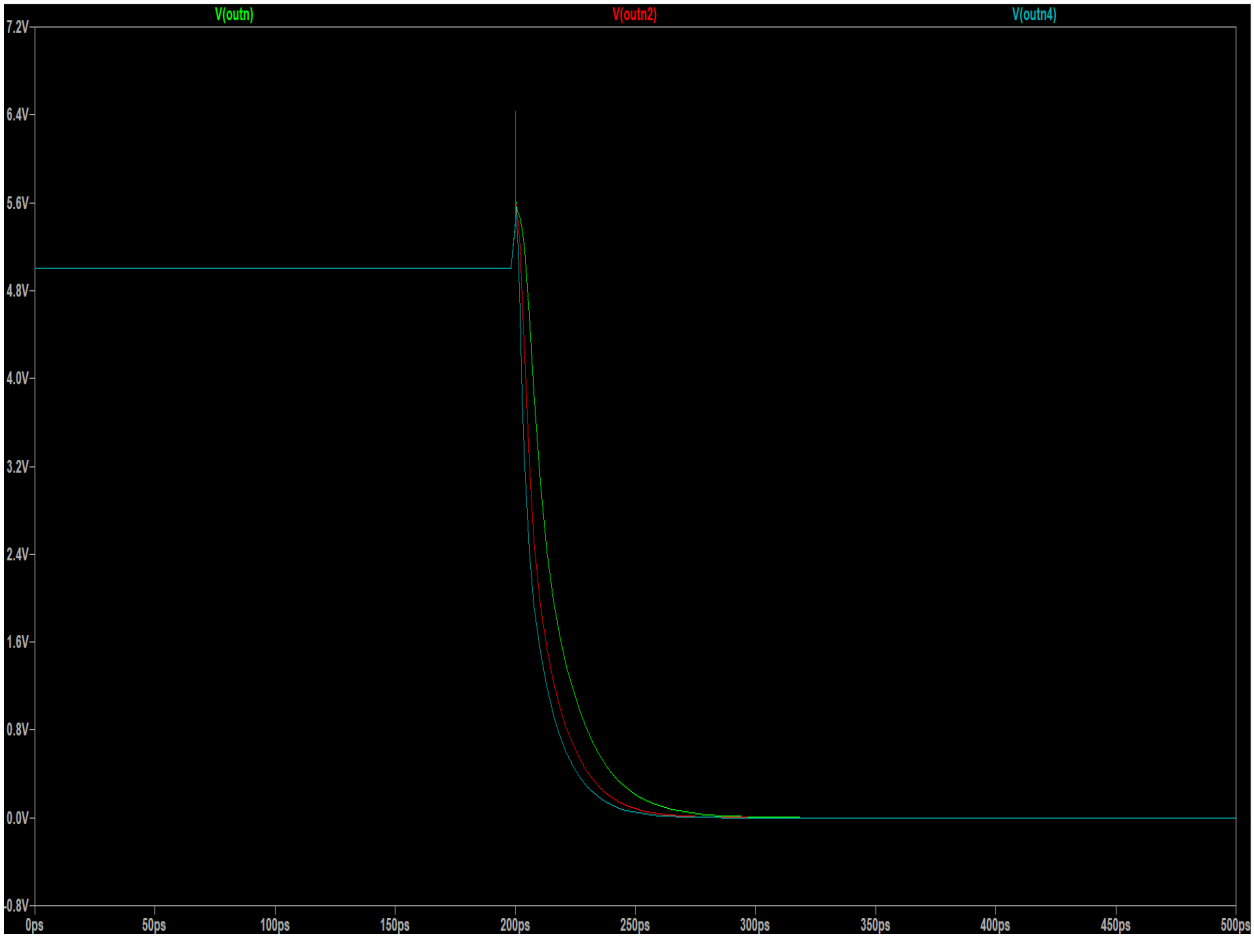
Power Calculations

Size	Avg Current	Static Power
1	21.92pA	109.6 pW
2	31.382pA	156.6pW
4	51.933pA	259.665pW

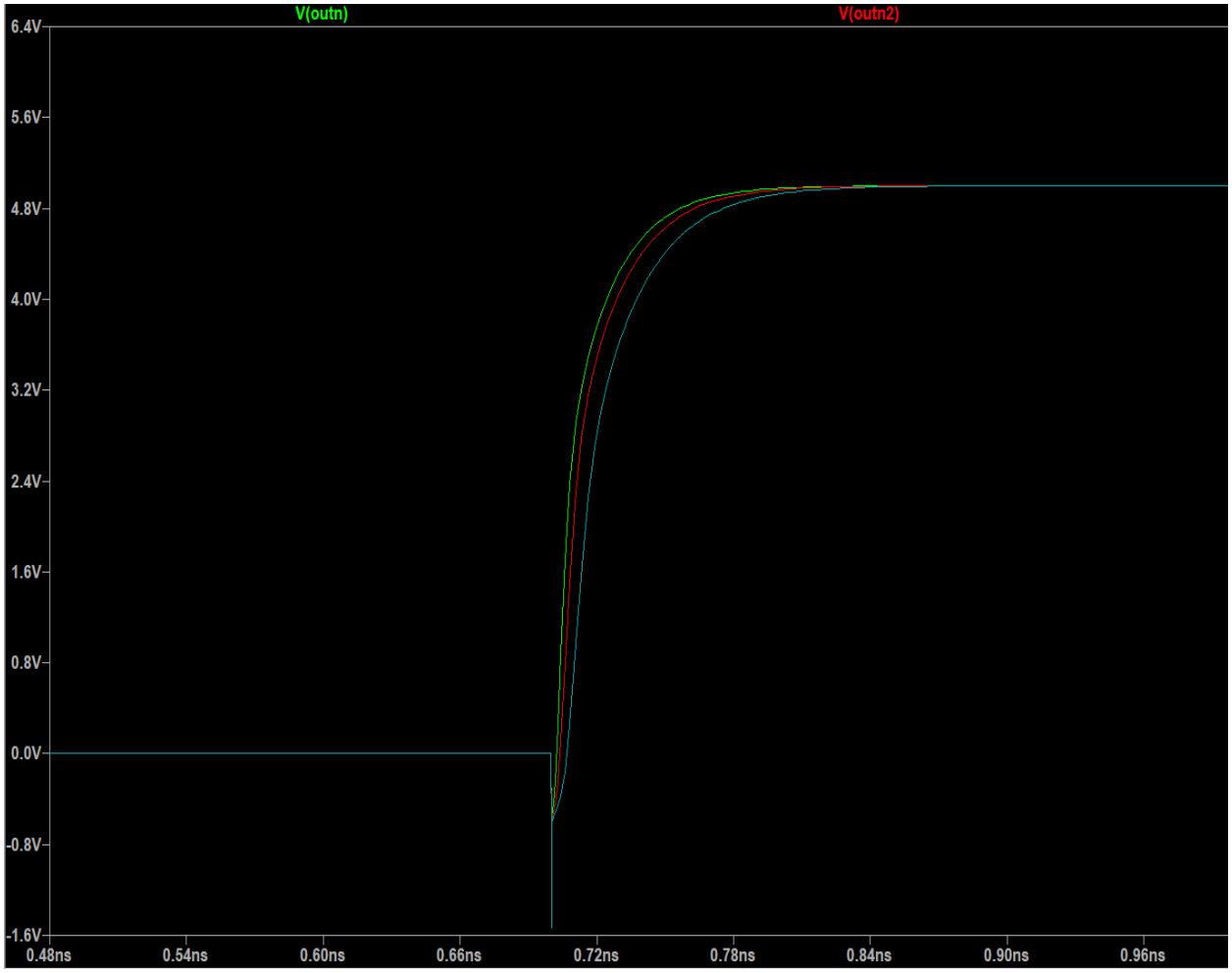
C)VTC of Skewed CMOS Inverter



D)Transient Analysis

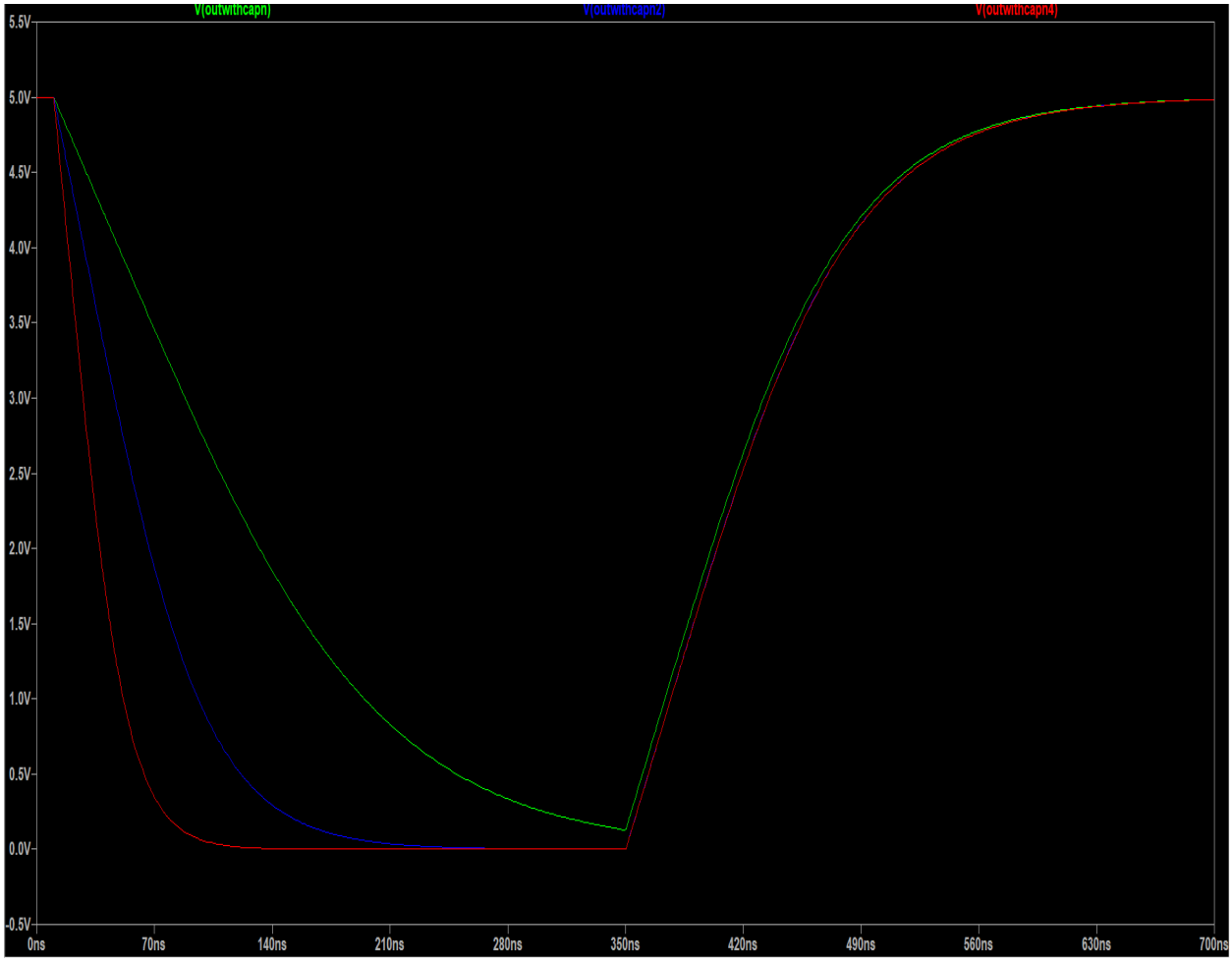


Fall time of Varying N without Capacitor



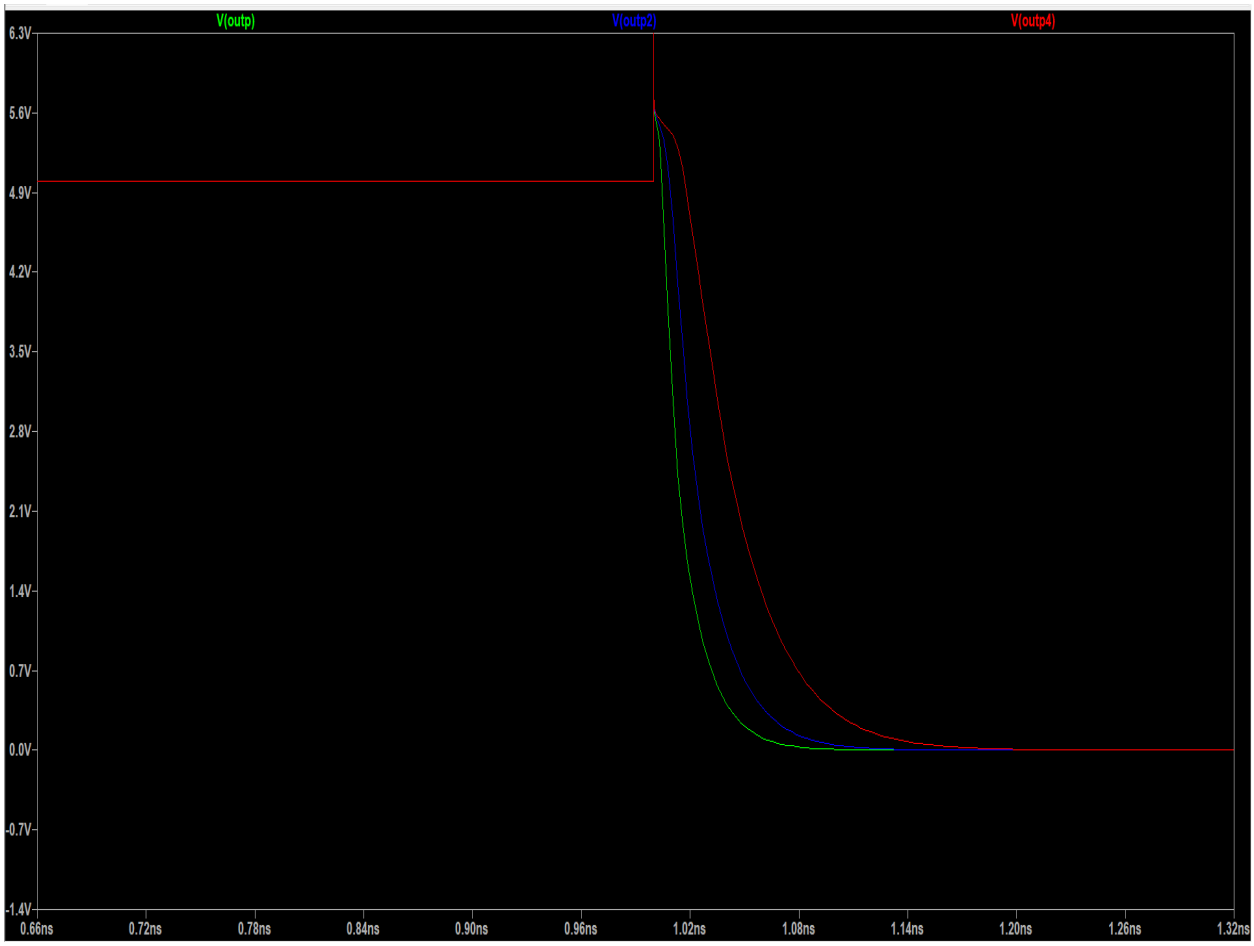
Rise Time of Varying N without Capacitor

Size	Fall Time- n without cap	Rise Time- n without cap
1	31.07ps	35.09ps
2	33.69ps	40.39ps
4	21.03ps	45.192ps

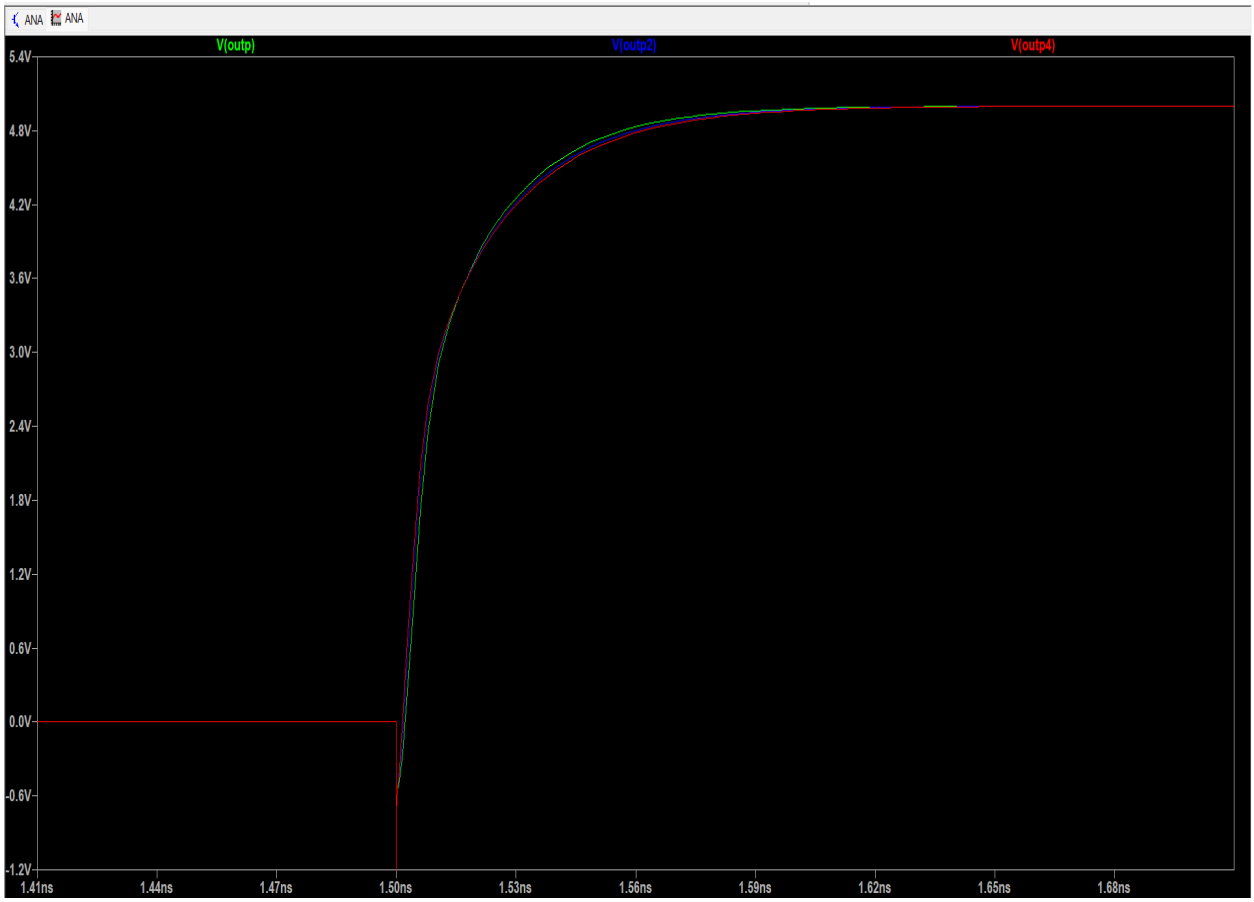


Fall and Rise time of Varying N with Capacitor

Size	Fall Time- n with cap	Rise Time- n with cap
1	220.21ps	156.78ps
2	100.59ps	154.89ps
4	49.99ps	153.76ps

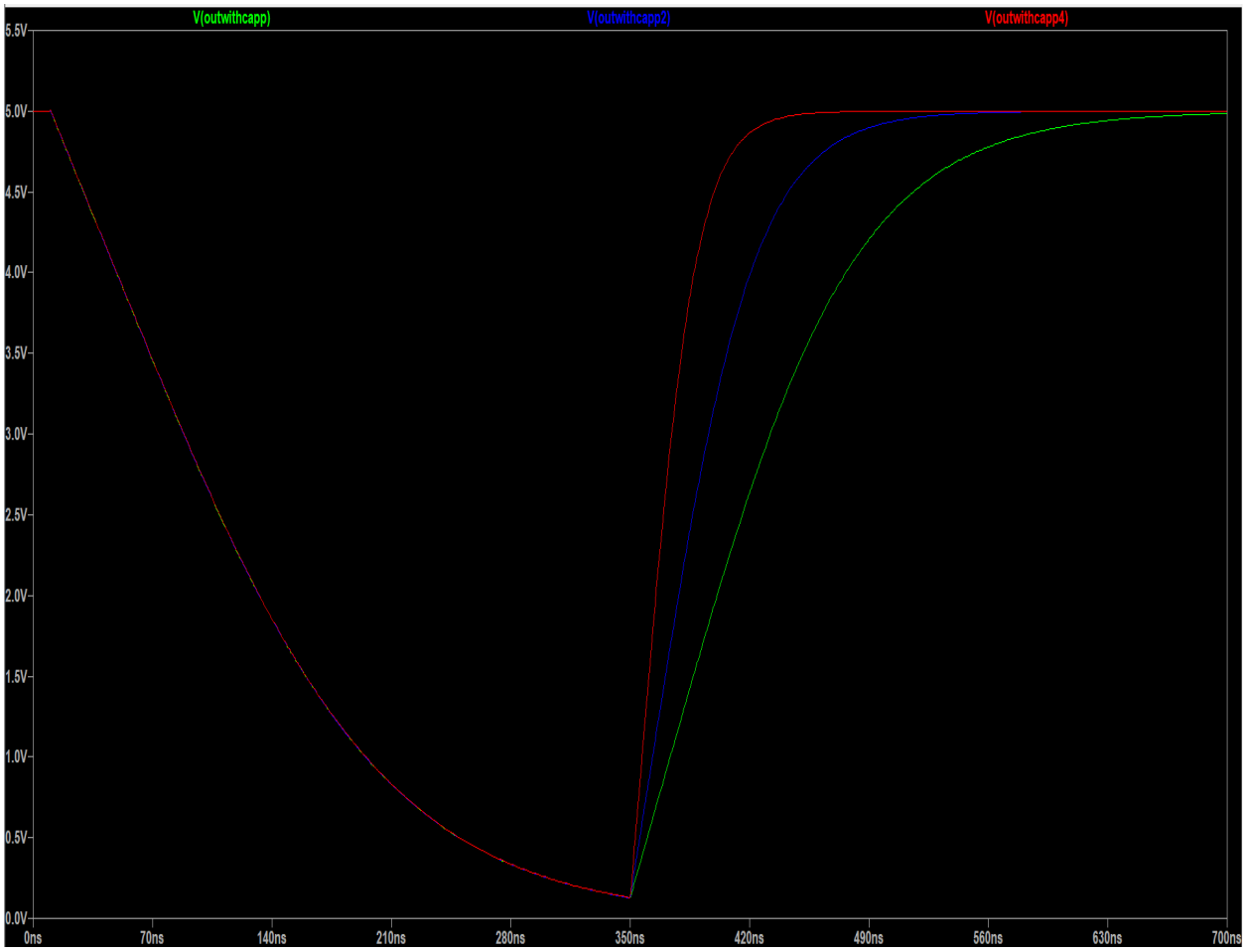


Fall time of Varying P without Capacitor



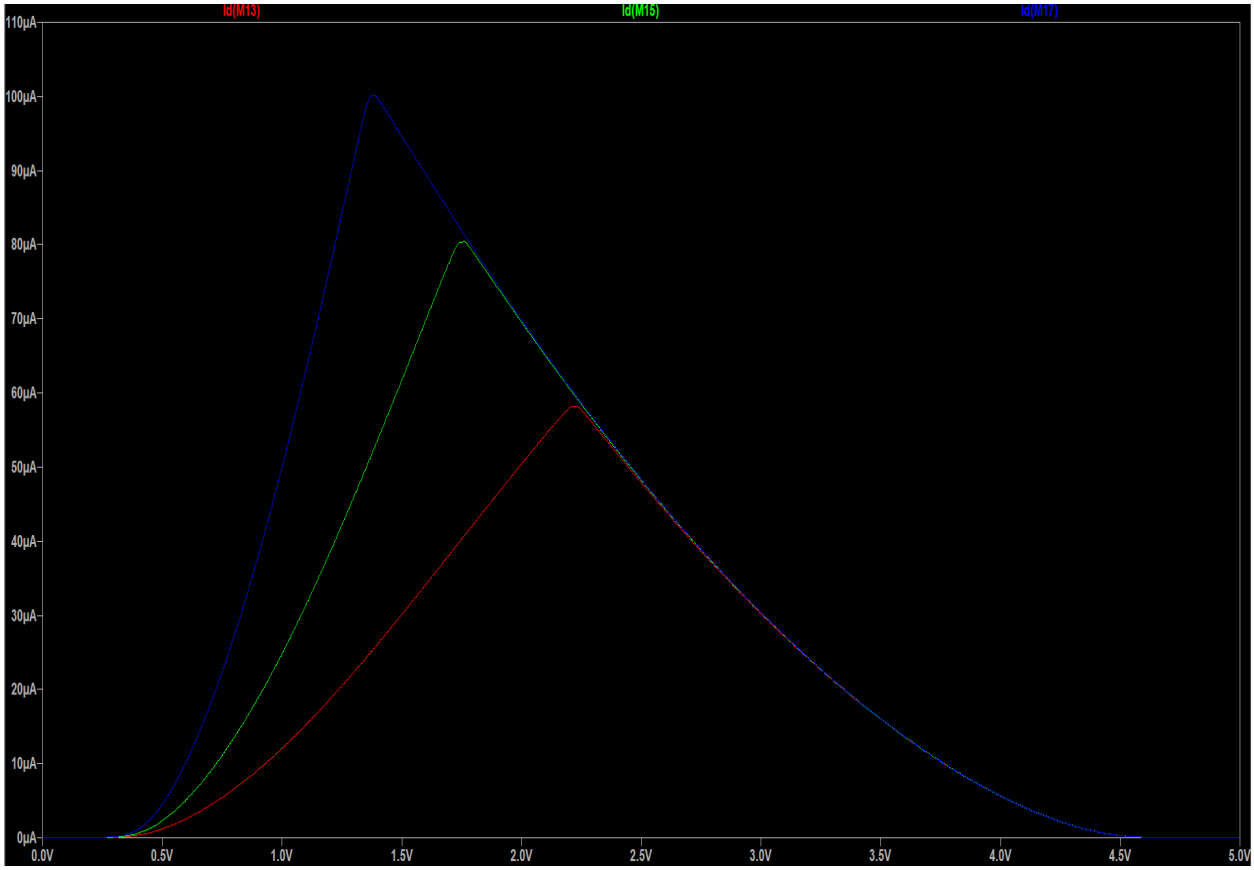
Rise time of Varying P without Capacitor

Size	Fall Time- p without cap	Rise Time- p without cap
1	30.798ps	39.190ps
2	43.00ps	38.404ps
4	67.159ps	38.766ps

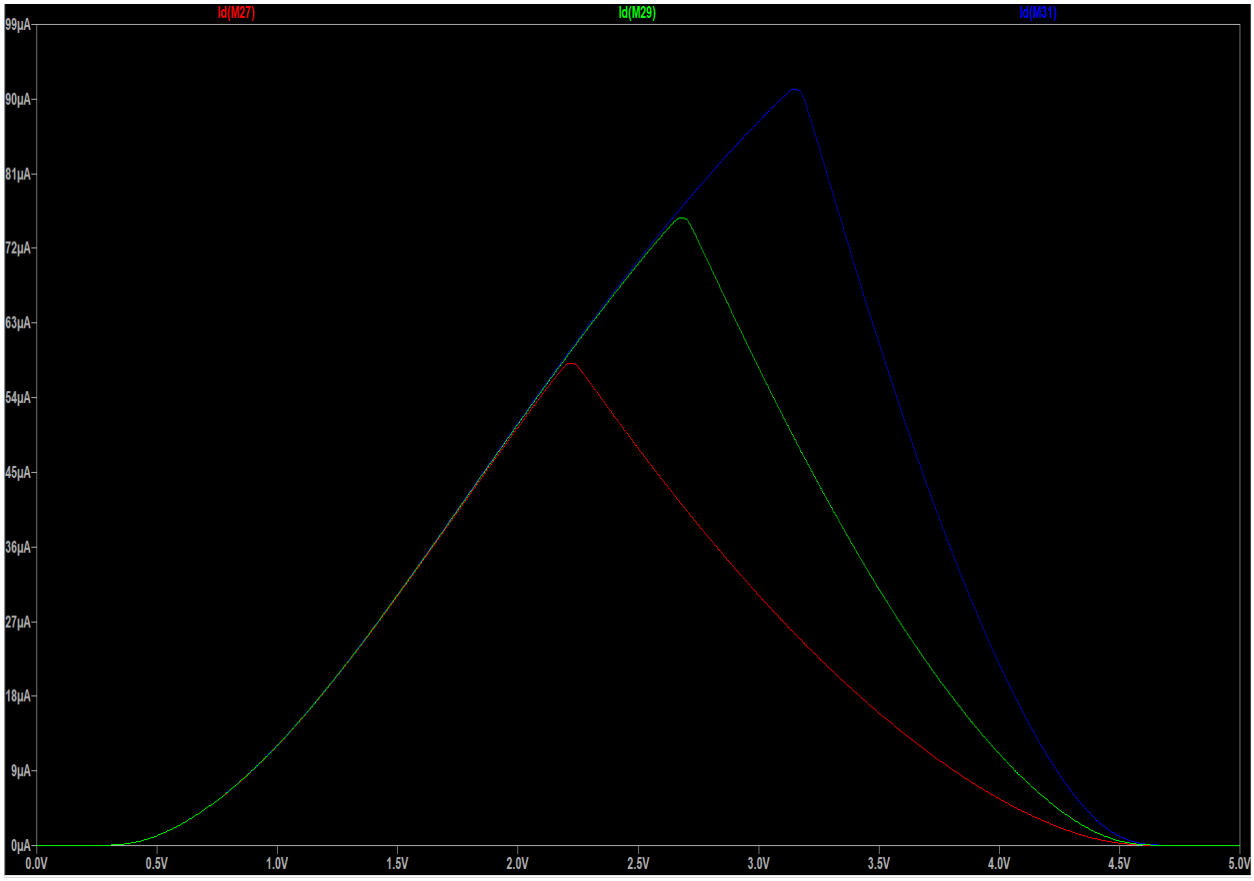


Fall and Rise time of Varying P with Capacitor

Size	Fall Time- n with cap	Rise Time- n with cap
1	220.21ps	156.77ps
2	219.08ps	86.27ps
4	218.7ps	45.78ps



DC Current of Varying N



DC Current of Varying P

Power Calculations

Size	Avg Current	Static Power
1	21.92pA	109.6 pW
2	31.382pA	156.6pW
4	51.933pA	259.665pW