

EXPERIMENT -05

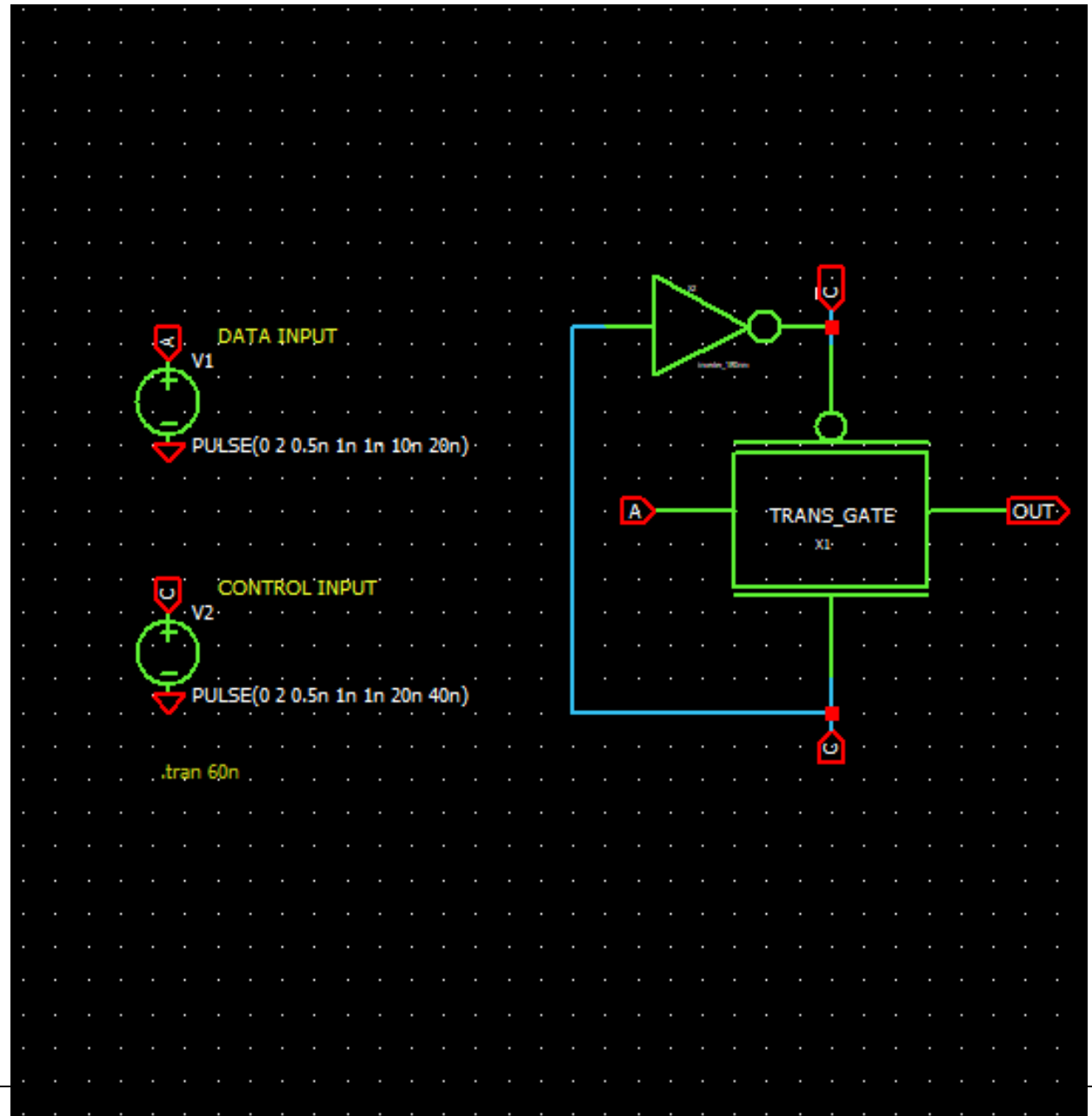
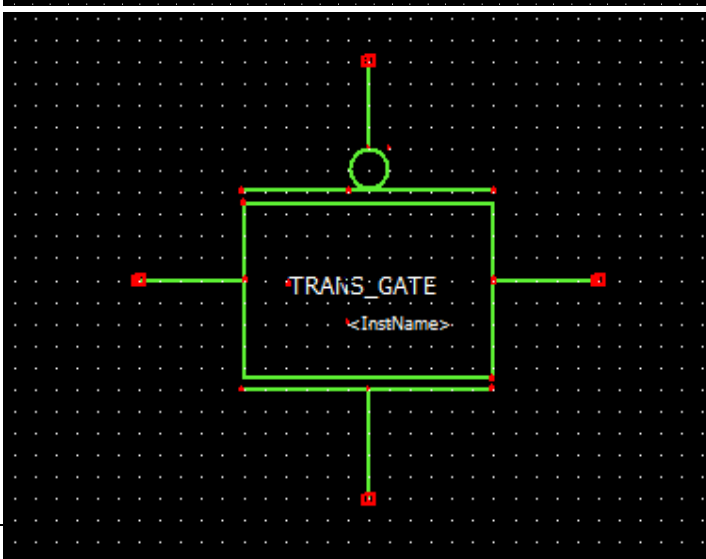
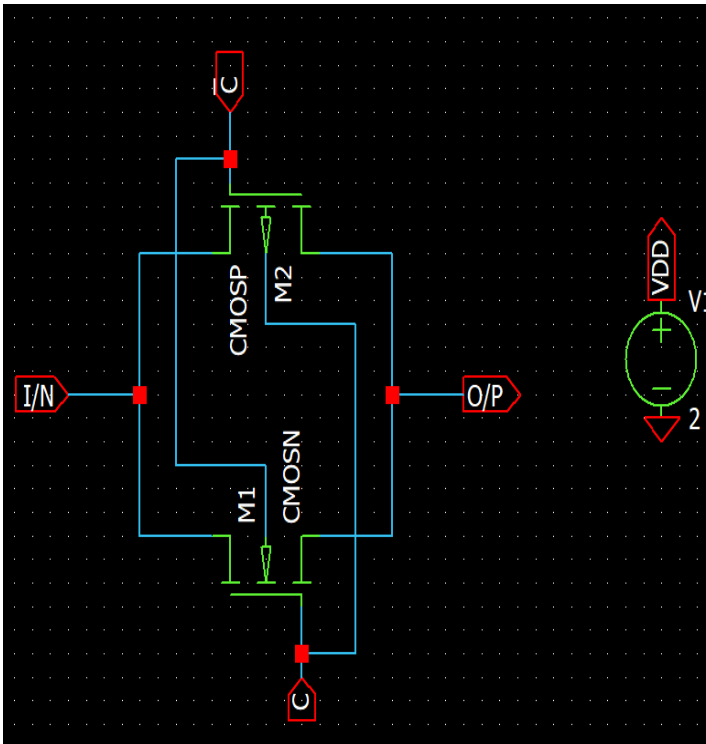
VLSI DESIGN - LAB (EEM 614)



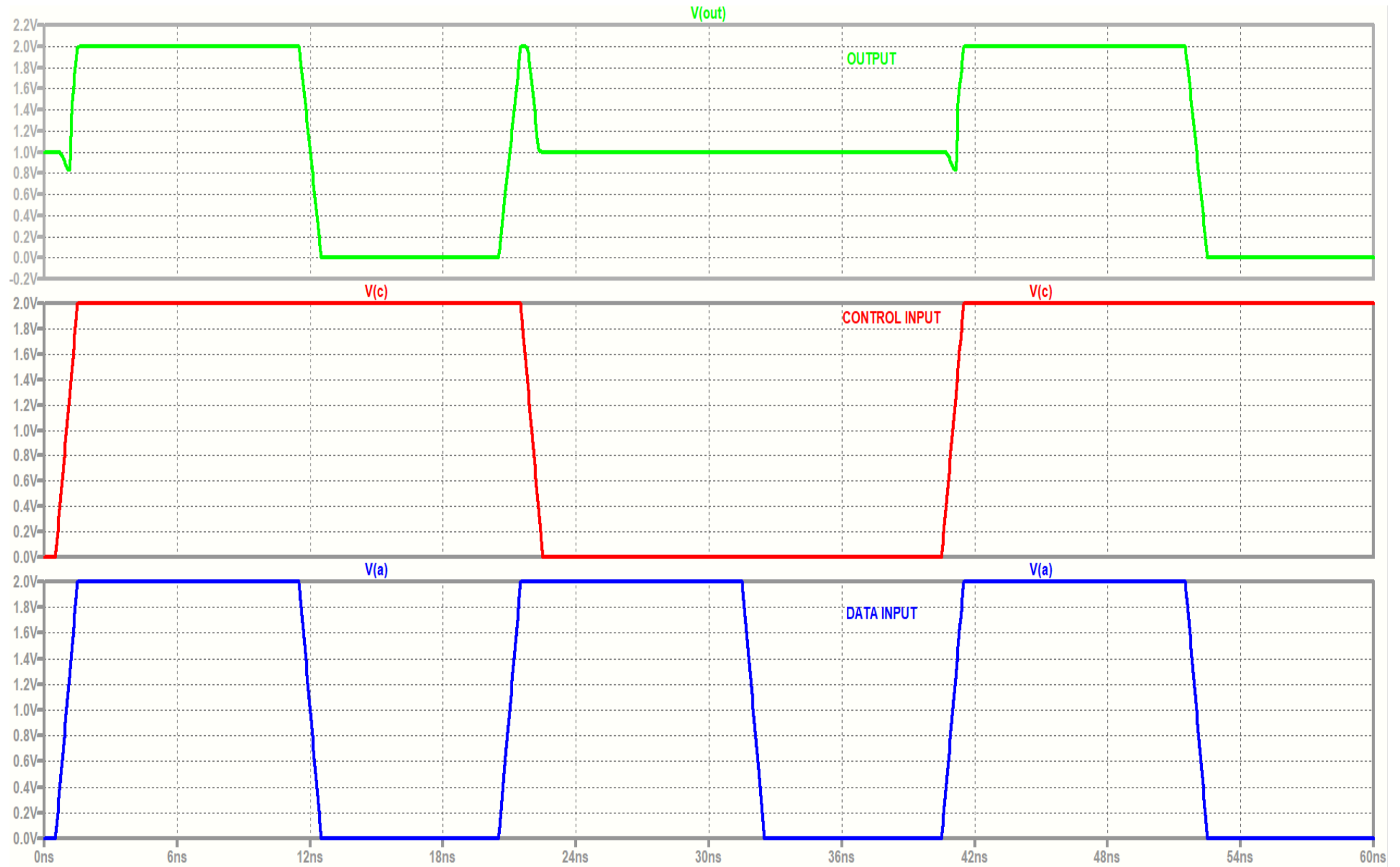
NAME – SURAJ

ROLL NO. -2201769

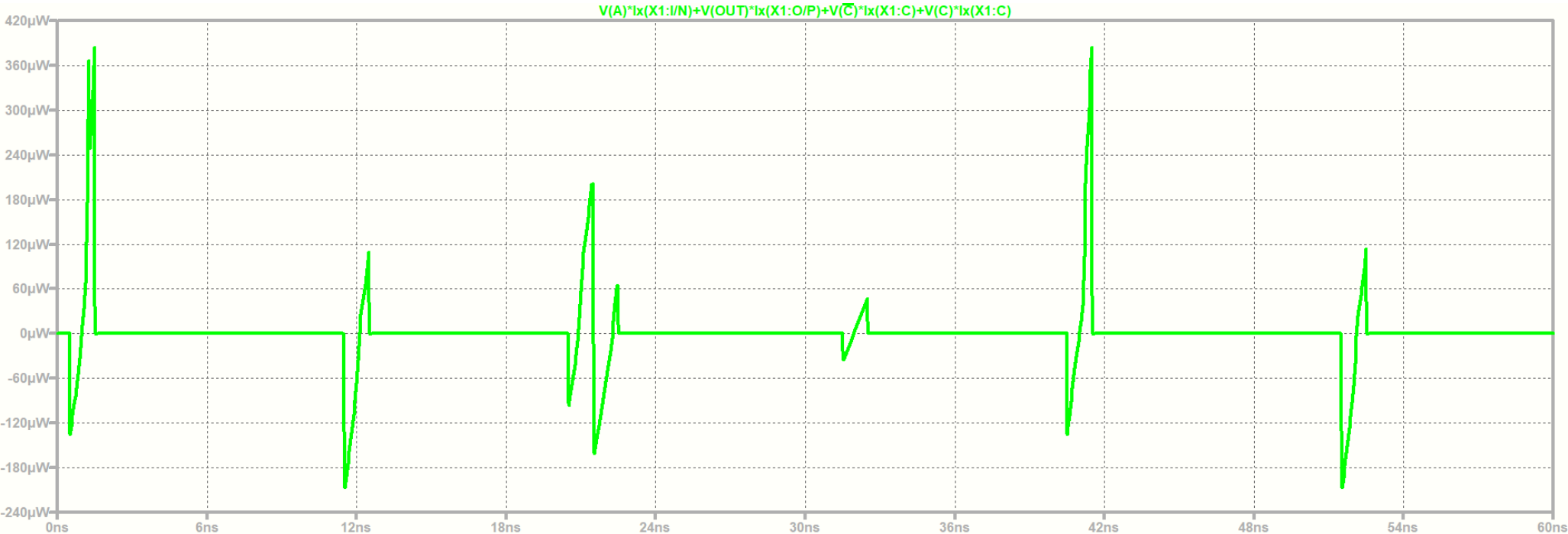
1.TRANSMISSION GATE



RESULT



POWER DISSIPATION



DATA INPUT	CONTROL INPUT	OUTPUT
0	0	x
0	1	0
1	0	x
1	1	1

Waveform: $V(A)*I_x(X1:I/N)+V(OUT)*I_x(X1:O/P)+V(\overline{C})*I_x(X1:C)+V(C)*I_x(X1:C)$

Interval Start:

0s

Interval End:

60ns

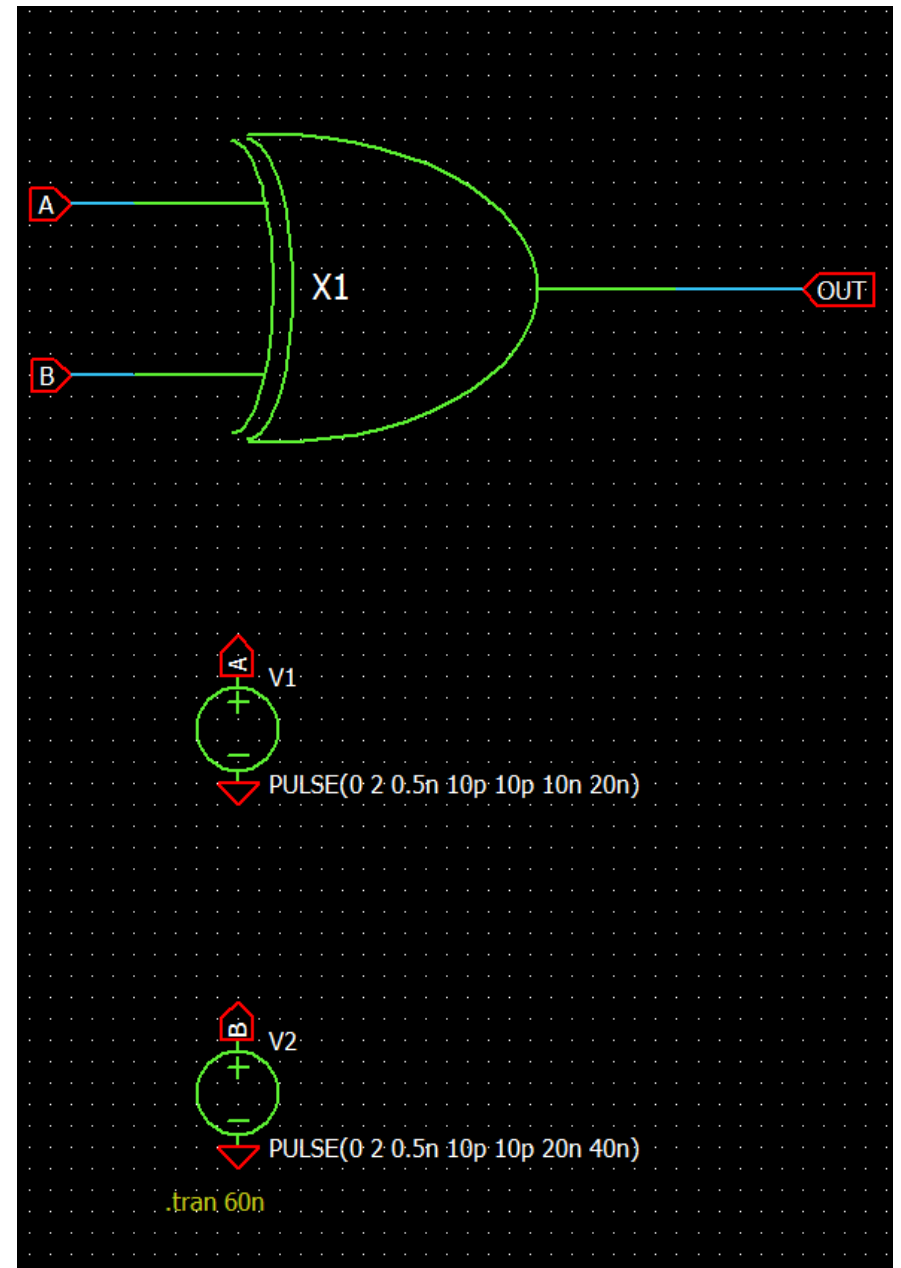
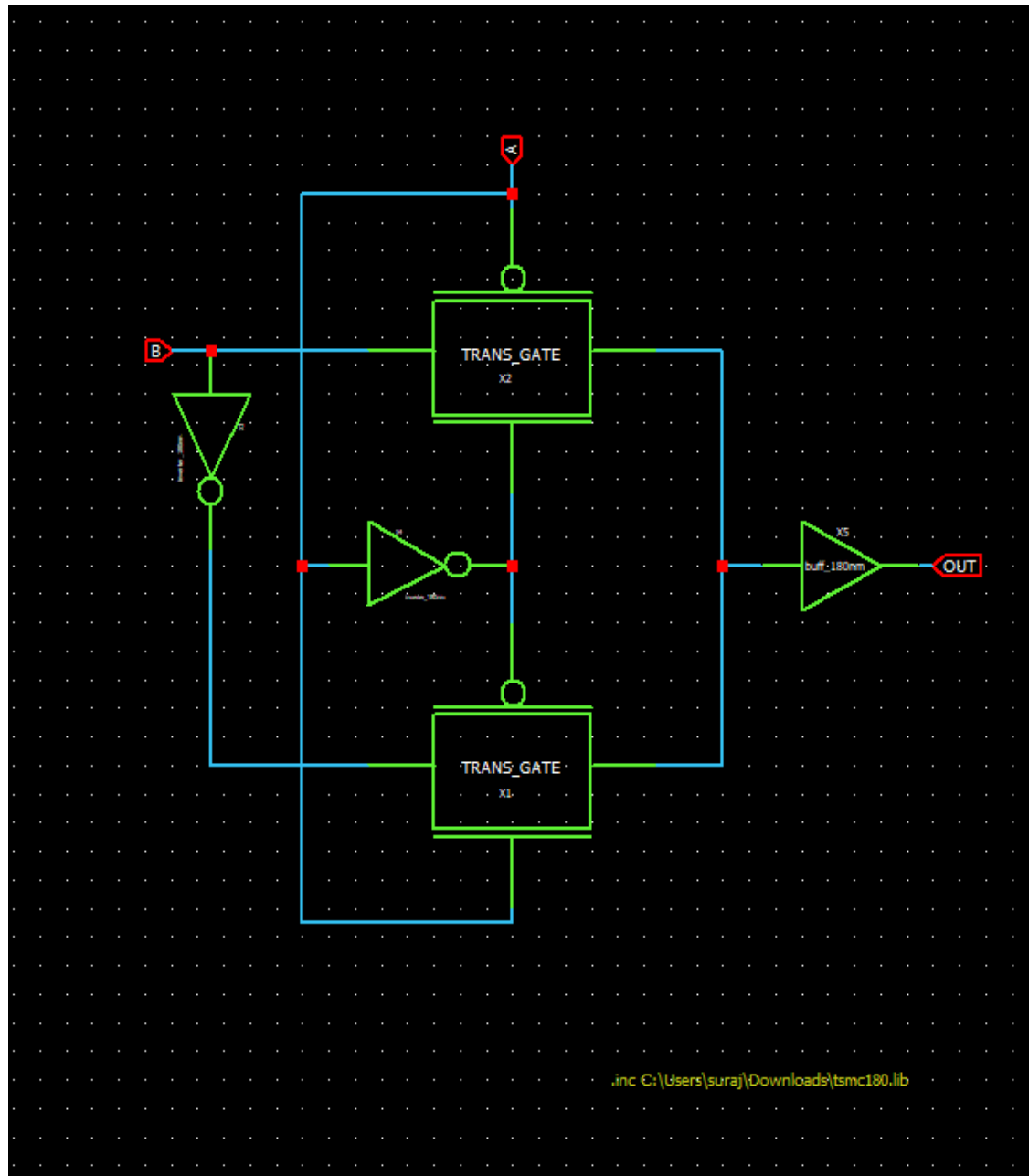
Average:

598.3nW

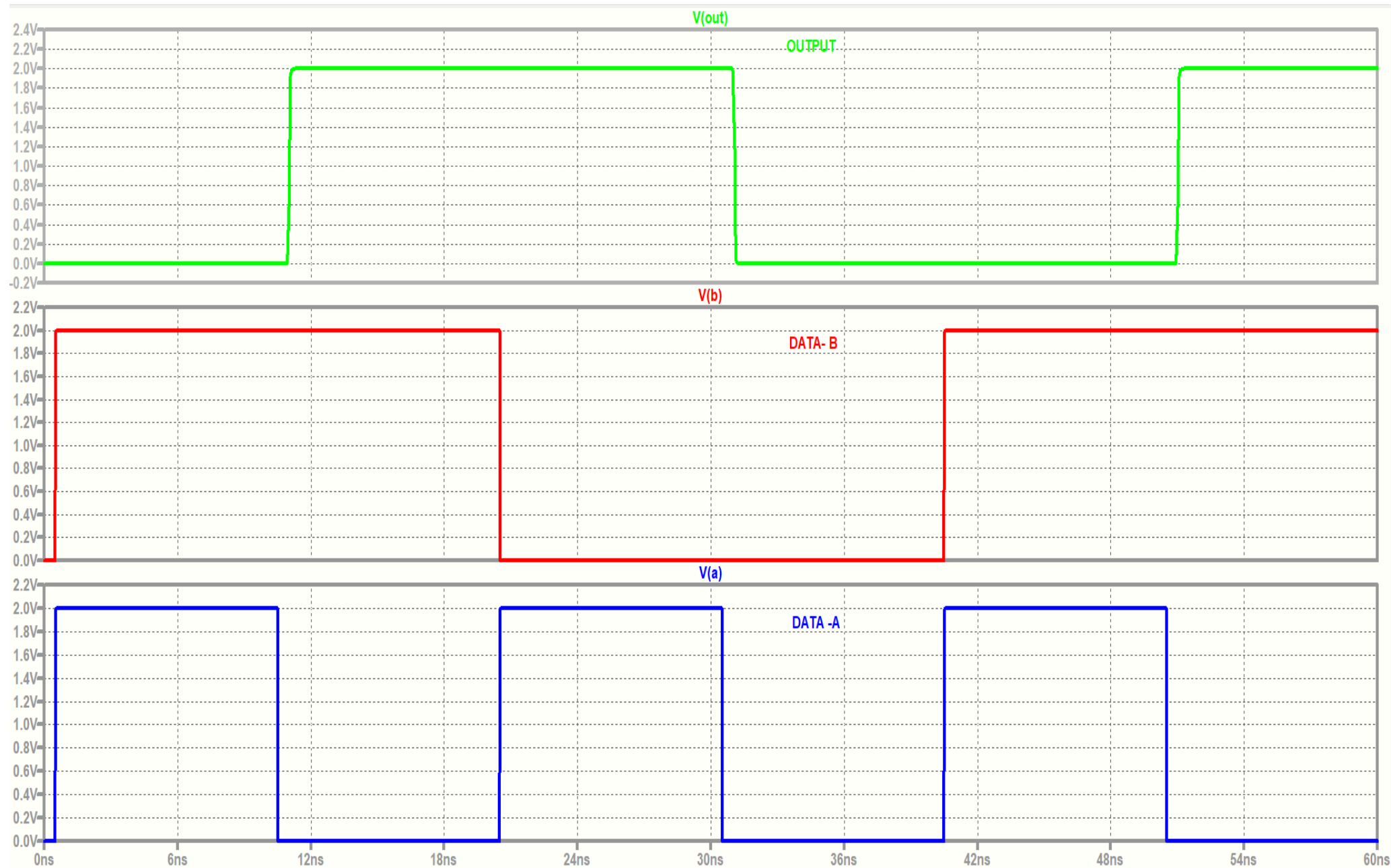
Integral:

35.898fJ

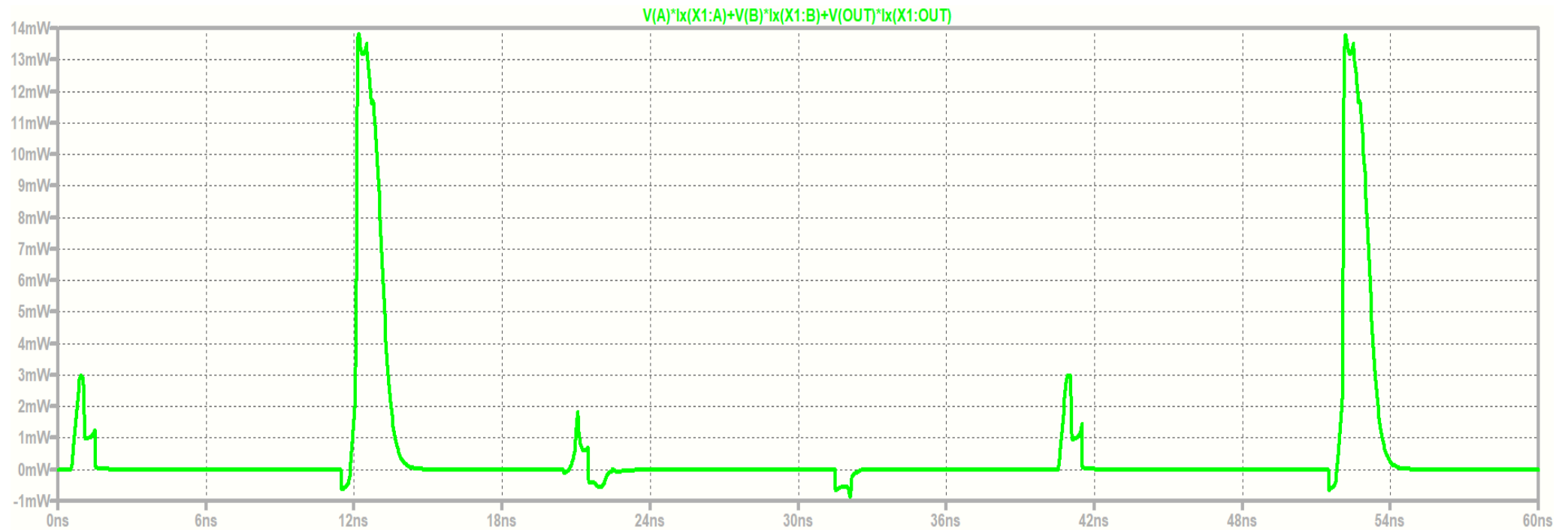
2. XOR GATE USING TRANSMISSION GATES



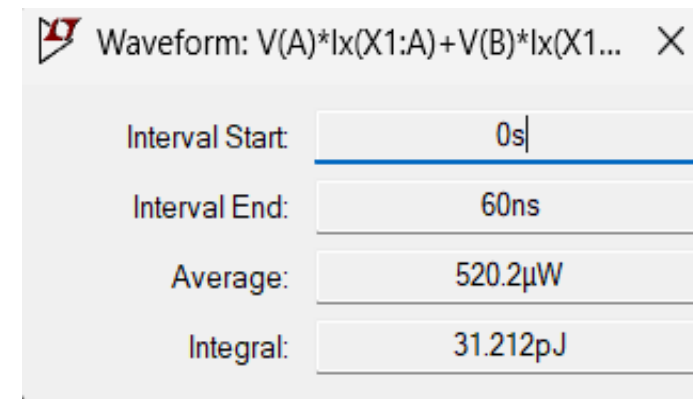
RESULT



POWER DISSIPATION



INPUT - A	INPUT - B	OUTPUT
0	0	0
0	1	1
1	0	1
1	1	0



DELAY

```
.meas TRAN t_rise FIND time WHEN V(out)=0.9 RISE=1
.meas TRAN t_fall FIND time WHEN V(out)=0.9 FALL=1
.meas TRAN t_a_rise FIND time WHEN V(a)=0.9 RISE=1
.meas TRAN t_a_fall FIND time WHEN V(a)=0.9 FALL=1

.meas TRAN t_dar PARAM t_rise - t_a_rise
.meas TRAN t_daf PARAM t_fall - t_a_fall
.meas TRAN tda PARAM (t_dar+t_daf)/2

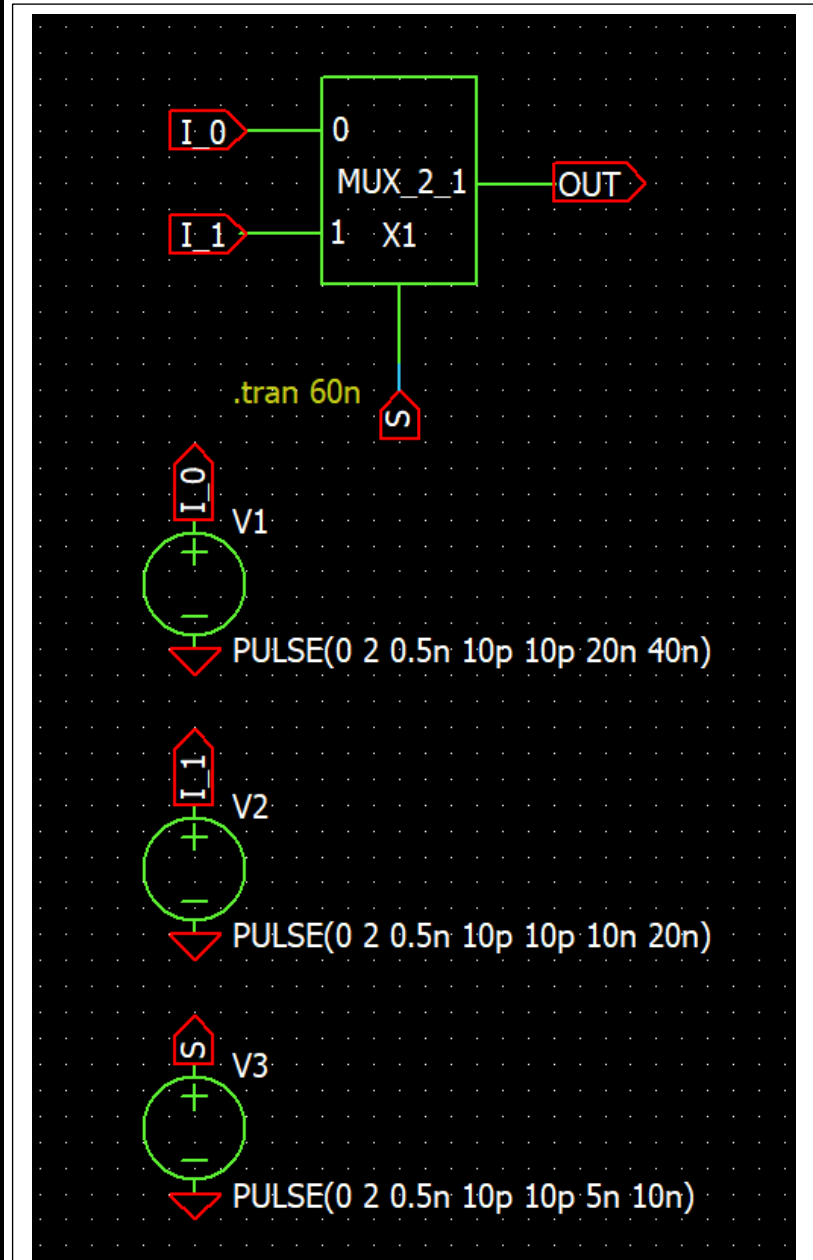
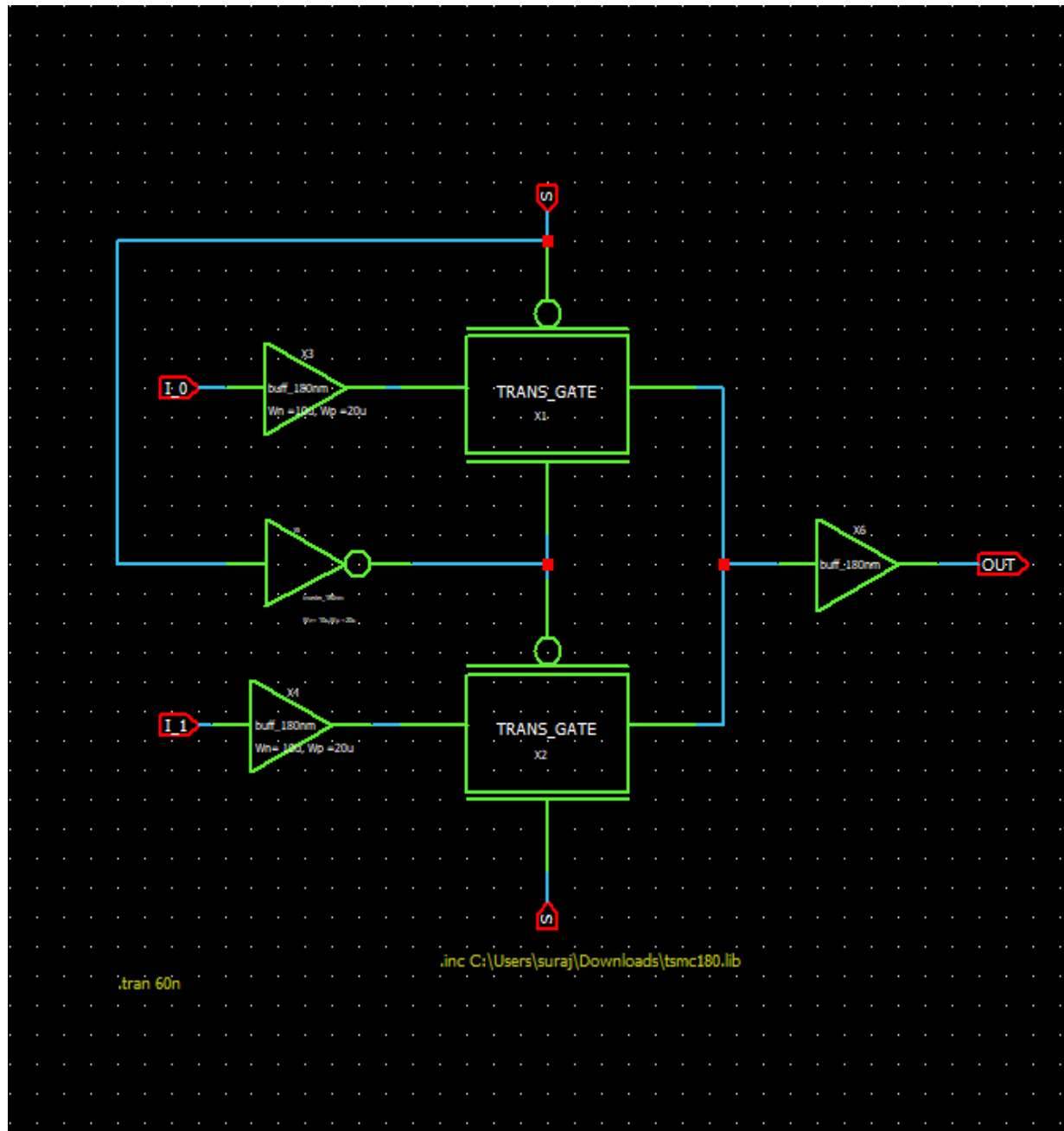
.meas TRAN t_b_rise FIND time WHEN V(a)=0.9 RISE=1
.meas TRAN t_b_fall FIND time WHEN V(a)=0.9 FALL=1

.meas TRAN t_dbr PARAM t_rise - t_b_rise
.meas TRAN t_dbf PARAM t_fall - t_b_fall
.meas TRAN tdb PARAM (t_dbr+t_dbf)/2
```

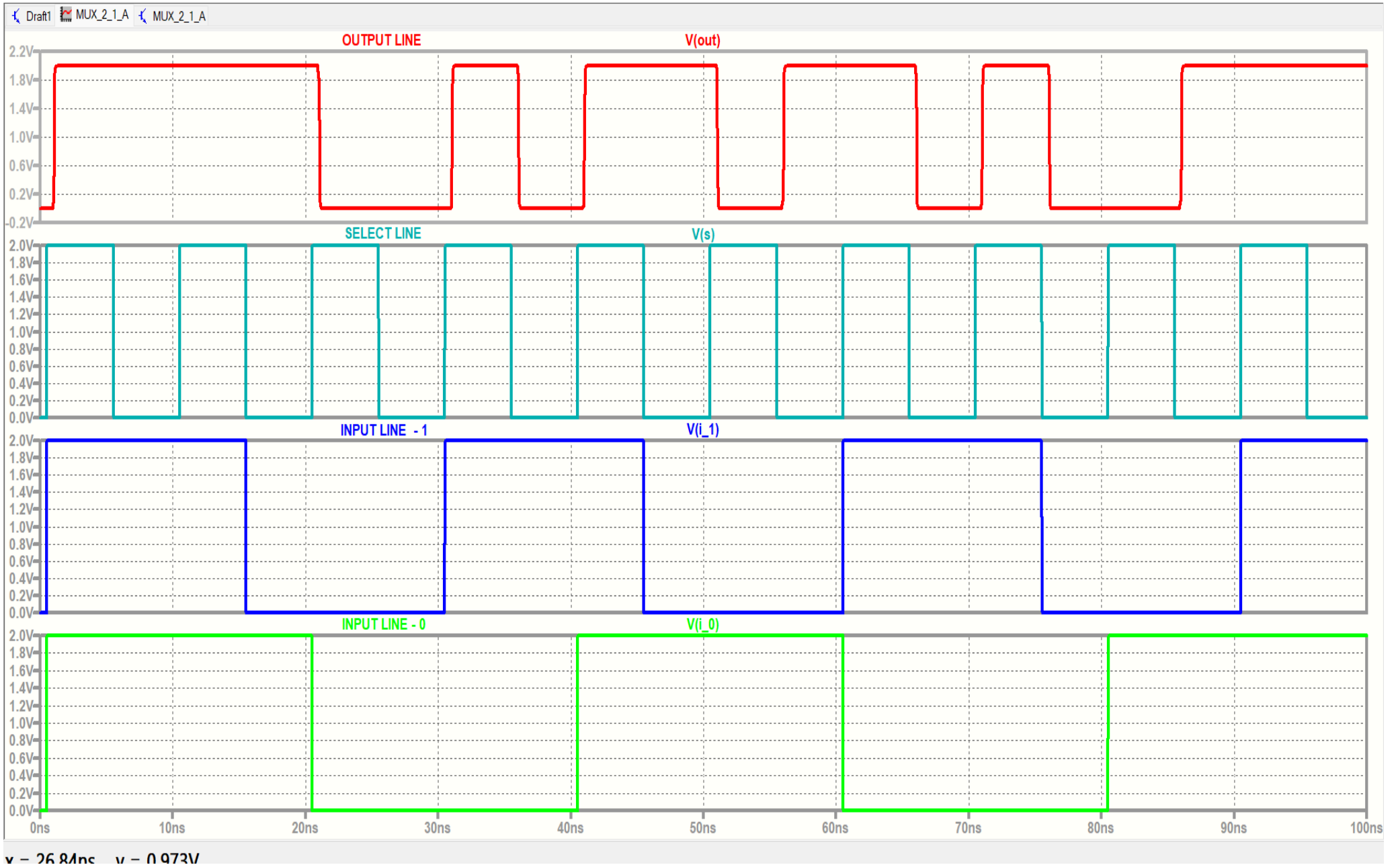
```
t_rise: time=1.26704e-08 at 1.26704e-08
t_fall: time=2.18054e-08 at 2.18054e-08
t_a_rise: time=9.5e-10 at 9.5e-10
t_a_fall: time=1.205e-08 at 1.205e-08
t_dar: t_rise - t_a_rise=1.17204e-08
t_daf: t_fall - t_a_fall=9.75537e-09
tda: (t_dar+t_daf)/2=1.07379e-08
t_b_rise: time=9.5e-10 at 9.5e-10
t_b_fall: time=1.205e-08 at 1.205e-08
t_dbr: t_rise - t_b_rise=1.17204e-08
t_dbf: t_fall - t_b_fall=9.75537e-09
tdb: (t_dbr+t_dbf)/2=1.07379e-08
```

DELAY	INPUT - A	INPUT - B
RISE	1.17204e-08	1.17204e-08
FALL	9.75537e-09	9.75537e-09
TOTAL	1.07379e-08	1.07379e-08

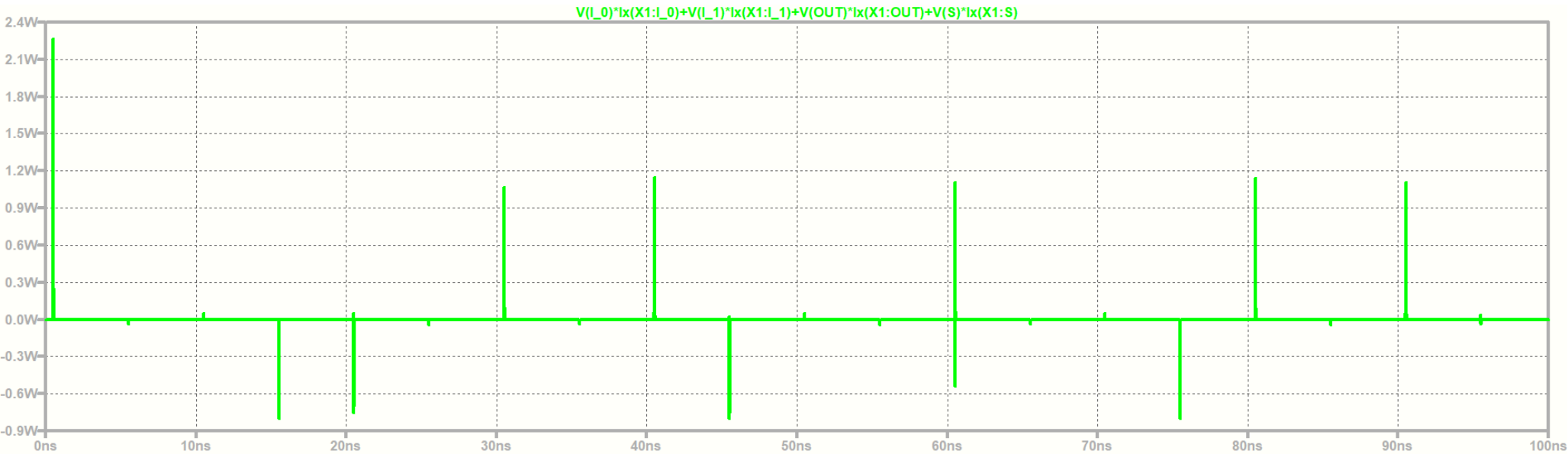
2 x1 MUX USING TRANSMISSION GATES



RESULT



POWER DISSIPATION



INPUT - 0	INPUT - 1	SELECT	OUTPUT
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

Waveform: $V(I_0) \cdot I_x(X1:I_0) + V(I_1) \cdot I_x(X1:I_1) + V(OUT) \cdot I_x(X1:OUT) + V(S) \cdot I_x(X1:S)$ X

Interval Start:

0s

Interval End:

100ns

Average:

439.51µW

Integral:

43.951pJ

DELAY

```
* Measure output transition times at 50% of VDD (0.9V)
.meas TRAN t_rise FIND time WHEN V(out)=0.9 RISE=1
.meas TRAN t_fall FIND time WHEN V(out)=0.9 FALL=1

* Measure delay with respect to select line (V(s))
.meas TRAN t_sel_rise FIND time WHEN V(s)=0.9 RISE=1
.meas TRAN t_sel_fall FIND time WHEN V(s)=0.9 FALL=1
.meas TRAN t_pdr_sel PARAM t_rise - t_sel_rise
.meas TRAN t_pdf_sel PARAM t_fall - t_sel_fall

* Measure delay with respect to data inputs (V(i_0) and V(i_1))
.meas TRAN t_in0_rise FIND time WHEN V(i_0)=0.9 RISE=1
.meas TRAN t_in0_fall FIND time WHEN V(i_0)=0.9 FALL=1
.meas TRAN t_pdr_in0 PARAM t_rise - t_in0_rise
.meas TRAN t_pdf_in0 PARAM t_fall - t_in0_fall

.meas TRAN t_in1_rise FIND time WHEN V(i_1)=0.9 RISE=1
.meas TRAN t_in1_fall FIND time WHEN V(i_1)=0.9 FALL=1
.meas TRAN t_pdr_in1 PARAM t_rise - t_in1_rise
.meas TRAN t_pdf_in1 PARAM t_fall - t_in1_fall
```

```
t_rise: time=1.0558e-09 at 1.0558e-09
t_fall: time=2.10635e-08 at 2.10635e-08
t_sel_rise: time=5.045e-10 at 5.045e-10
t_sel_fall: time=5.5155e-09 at 5.5155e-09
t_pdr_sel: t_rise - t_sel_rise=5.51301e-10
t_pdf_sel: t_fall - t_sel_fall=1.5548e-08
t_in0_rise: time=5.045e-10 at 5.045e-10
t_in0_fall: time=2.05155e-08 at 2.05155e-08
t_pdr_in0: t_rise - t_in0_rise=5.51301e-10
t_pdf_in0: t_fall - t_in0_fall=5.48028e-10
t_in1_rise: time=5.045e-10 at 5.045e-10
t_in1_fall: time=1.55155e-08 at 1.55155e-08
t_pdr_in1: t_rise - t_in1_rise=5.51301e-10
t_pdf_in1: t_fall - t_in1_fall=5.54803e-09
```

DEALY	INPUT -0	INPUT-1	SELECT PIN
RISE	5.51301e-10	5.51301e-10	5.51301e-10
FALL	5.48028e-10	5.48028e-10	1.5548e-08
TOTAL	5.49795e-10	5.49795e-10	8.04965e-09

