Team members:

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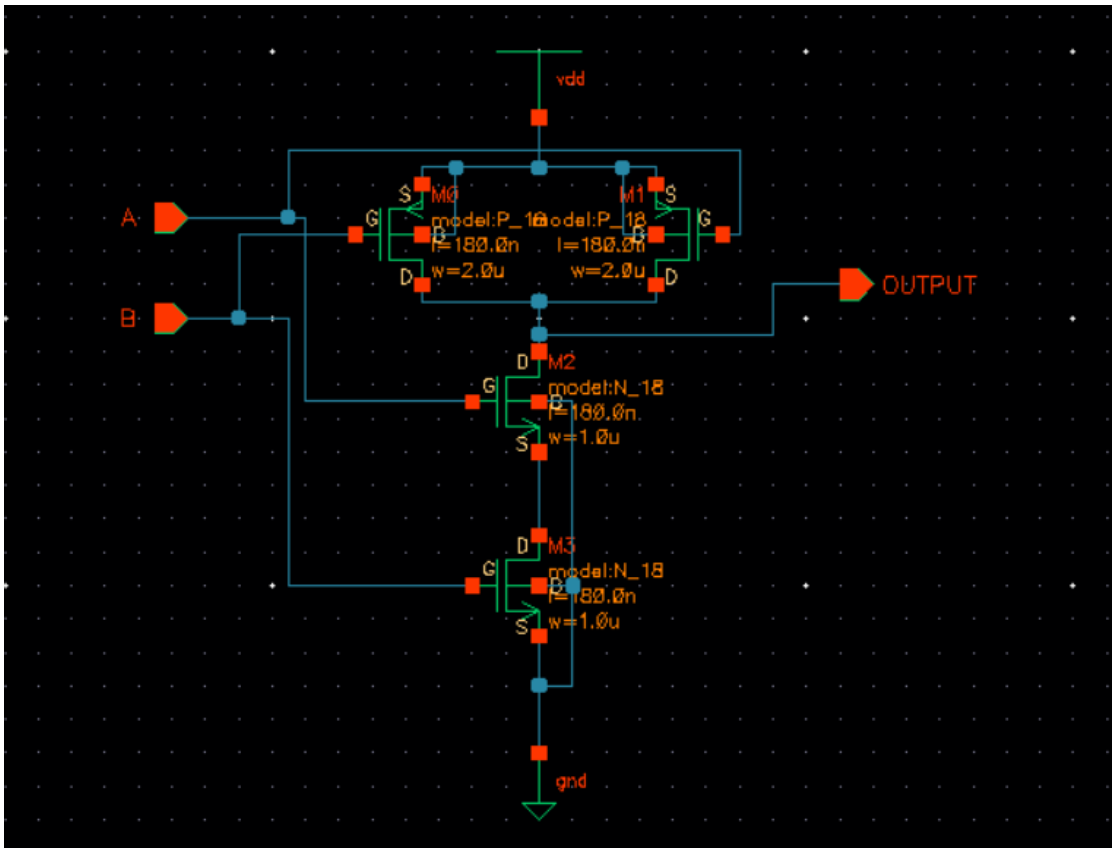
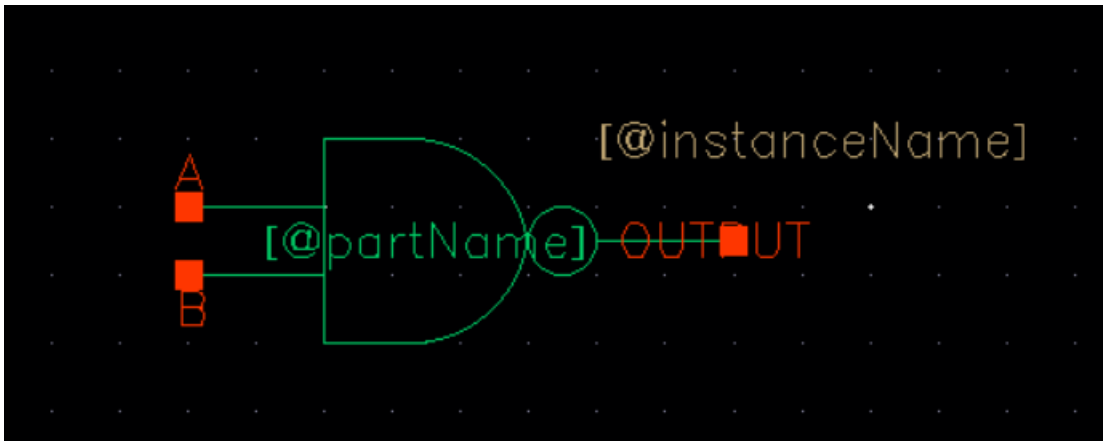
NAND gate:

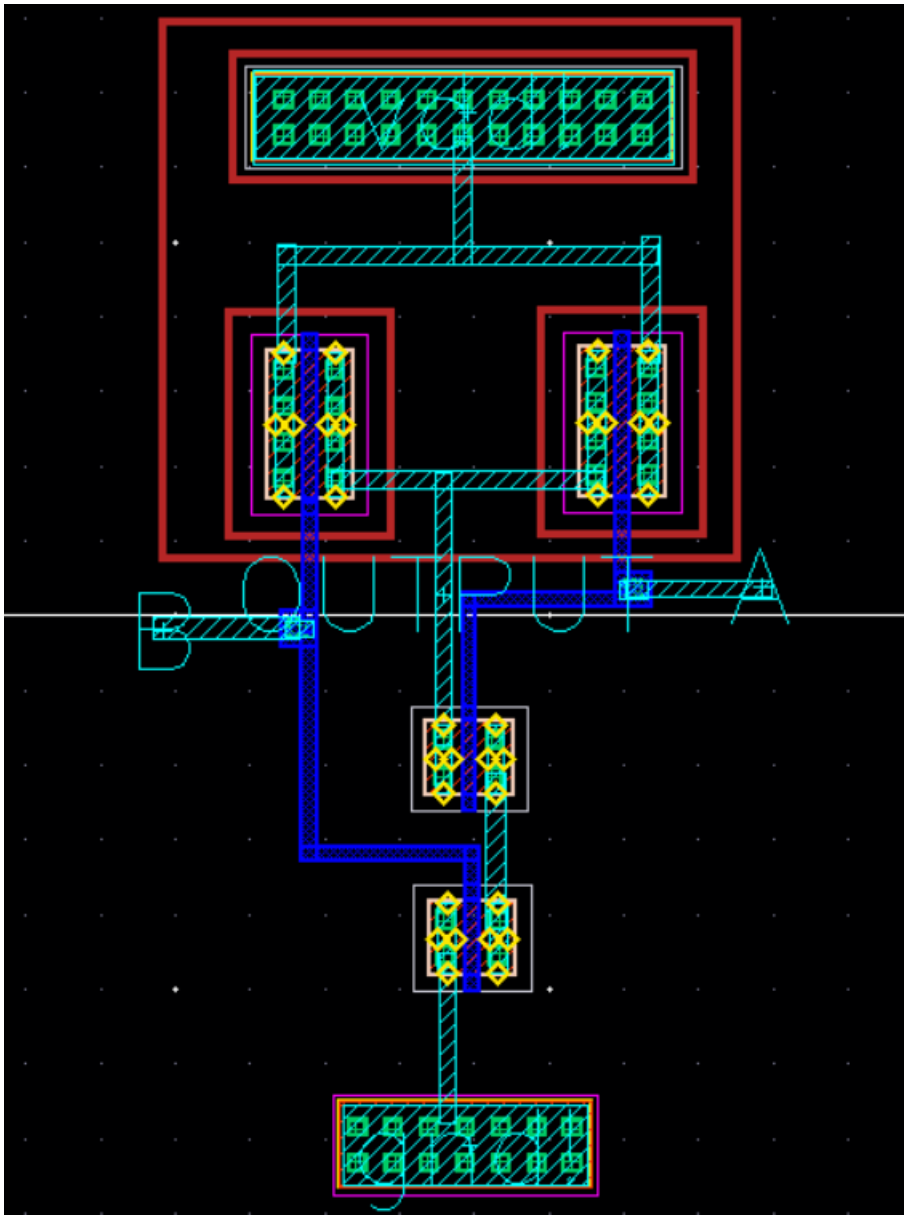
Schematic:



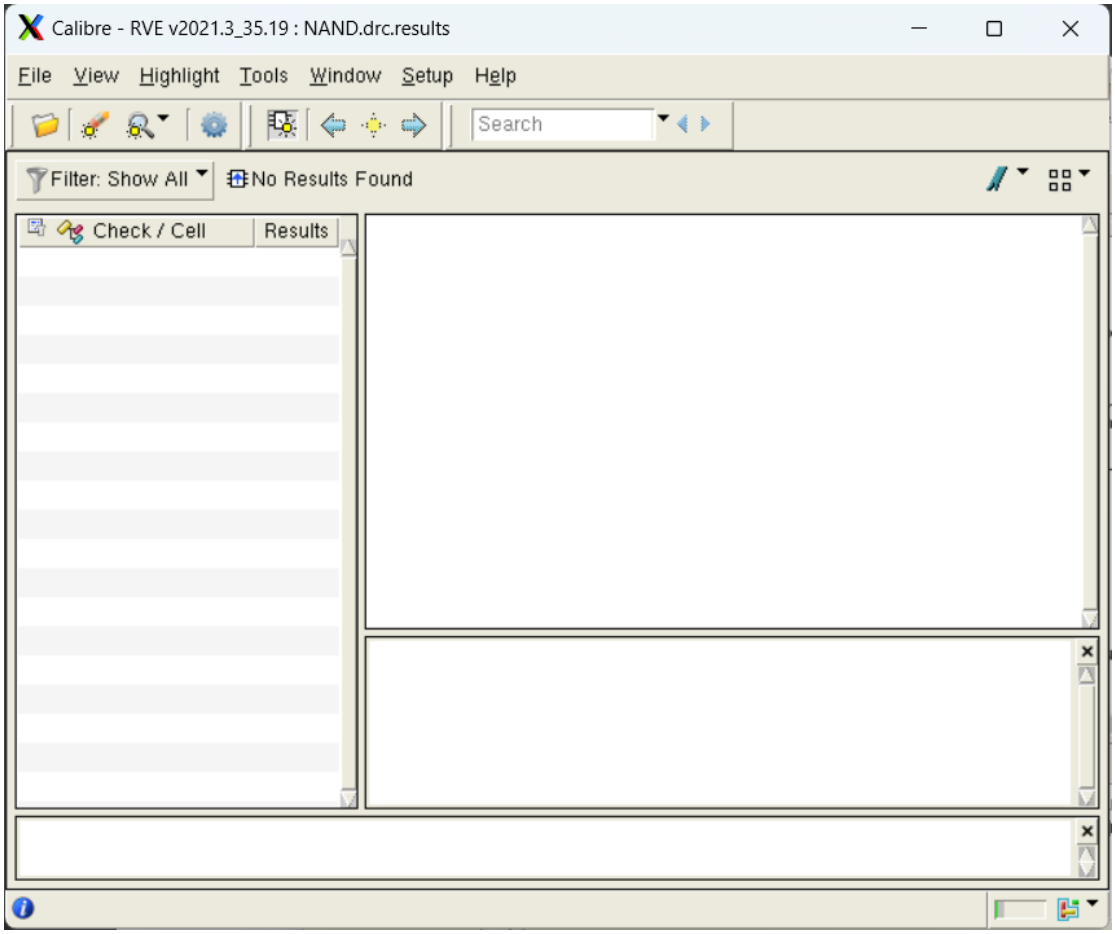
Symbol:



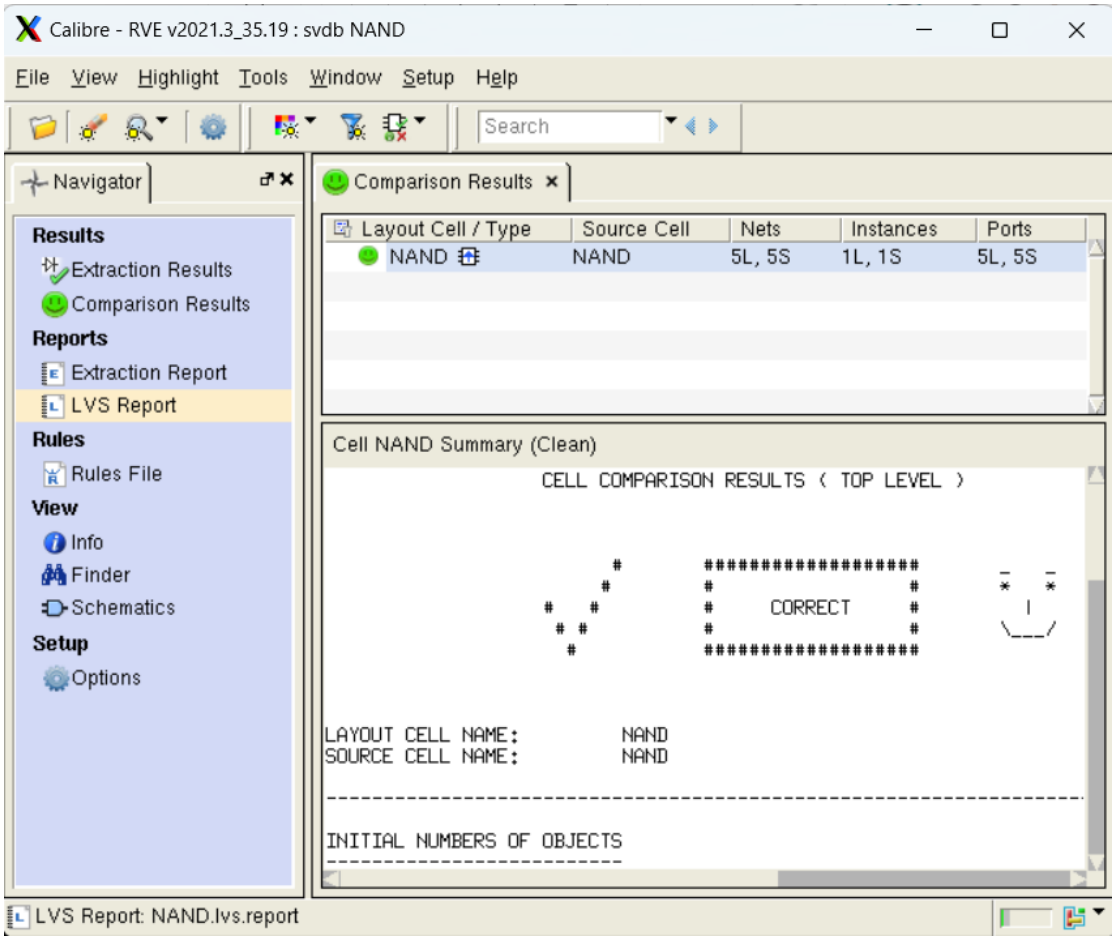
Layout:



DRC report:


Calibre - RVE v2021.3_35.19 : NAND.drc.results
File View Highlight Tools Window Setup Help
Search
Filter: Show All
No Results Found
Check / Cell
Results

LVS report:


Calibre - RVE v2021.3_35.19 : svdb NAND
File View Highlight Tools Window Setup Help
Search
Navigator
Results
Extraction Results
Comparison Results
Reports
Extraction Report
LVS Report
Rules
Rules File
View
Info
Finder
Schematics
Setup
Options
Comparison Results
Layout Cell / Type
Source Cell
Nets
Instances
Ports
NAND
NAND
5L, 5S
1L, 1S
5L, 5S
Cell NAND Summary (Clean)
CELL COMPARISON RESULTS (TOP LEVEL)
CORRECT
LAYOUT CELL NAME: NAND
SOURCE CELL NAME: NAND
INITIAL NUMBERS OF OBJECTS
LVS Report: NAND.lvs.report

Front-end spice:

```
************************************************
* Library Name: nand
* Cell Name:    NAND
* View Name:    schematic
************************************************

.SUBCKT NAND A B OUTPUT
*.PININFO A:I B:I OUTPUT:O
MM2 OUTPUT A net17 gnd! Nch m=1 l=180.0n w=1.0u
MM3 net17 B gnd! gnd! Nch m=1 l=180.0n w=1.0u
MM0 OUTPUT B vdd! vdd! Pch m=1 l=180.0n w=2.0u
MM1 OUTPUT A vdd! vdd! Pch m=1 l=180.0n w=2.0u
.ENDS

XNAND A B OUTPUT nand

Vvdd vdd! 0 1.8v
vinA A 0 pulse(0 1.8 0n 20p 20p 2n 4n)
vinB B 0 pulse(0 1.8 0n 20p 20p 4n 8n)

.measure t_rise
+TRIG v(OUTPUT) VAL=0.18v RISE=1
+TARG v(OUTPUT) VAL=1.62v RISE=1

.measure t_fall
+TRIG v(OUTPUT) VAL=1.62v FALL=1
+TARG v(OUTPUT) VAL=0.18v FALL=1

.measure t_propagation_r_A
+TRIG v(A) VAL=0.9v FALL=1
+TARG v(OUTPUT) VAL=0.9v RISE=1

.measure t_propagation_f_A
+TRIG v(A) VAL=0.9 RISE=1
+TARG V(OUTPUT) VAL=0.9 FALL=1

.measure t_propagation_r_B
+TRIG v(B) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_B
+TRIG v(B) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.option post
.trans 1p 20n
.END
```

Back-end spice:

```
.include "NAND.pex.sp.pex"
.subckt NAND  B OUTPUT GND! VDD! A
.lib 'hspice.lib' tt
*
* A     A
* VDD!  VDD!
* GND!  GND!
* OUTPUT        OUTPUT
* B     B
MM0 N_OUTPUT_MM0_d N_B_MM0_g N_VDD!_MM0_s N_VDD!_MM0_b Pch L=1.8e-07 W=2e-06
+ AD=9.8e-13 AS=9.8e-13 PD=2.98e-06 PS=2.98e-06
MM1 N_OUTPUT_MM1_d N_A_MM1_g N_VDD!_MM1_s N_VDD!_MM0_b Pch L=1.8e-07 W=2e-06
+ AD=9.8e-13 AS=9.8e-13 PD=2.98e-06 PS=2.98e-06
MM2 N_OUTPUT_MM2_d N_A_MM2_g N_NET17_MM2_s N_GND!_MM2_b Nch L=1.8e-07 W=1e-06
+ AD=4.9e-13 AS=4.9e-13 PD=1.98e-06 PS=1.98e-06
MM3 N_NET17_MM3_d N_B_MM3_g N_GND!_MM3_s N_GND!_MM2_b Nch L=1.8e-07 W=1e-06
+ AD=4.9e-13 AS=4.9e-13 PD=1.98e-06 PS=1.98e-06
*
.include "NAND.pex.sp.NAND.pxi"
*
.ends

XNAND B OUTPUT GND! VDD! A nand

Vvdd vdd! 0 1.8
vinA A 0 pulse(0 1.8 0 20p 20p 2n 4n)
vinB B 0 pulse(0 1.8 0 20p 20p 4n 8n)

.measure t_rise
+TRIG v(OUTPUT) VAL=0.18 RISE=1
+TARG v(OUTPUT) VAL=1.62 RISE=1

.measure t_fall
+TRIG v(OUTPUT) VAL=0.18 FALL=1
+TARG v(OUTPUT) VAL=1.62 FALL=1

.measure t_propagation_r_A
+TRIG v(A) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_A
+TRIG v(A) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.measure t_propagation_r_B
+TRIG v(B) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_B
+TRIG v(B) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.option post
.trans 1p 20n
.END
```

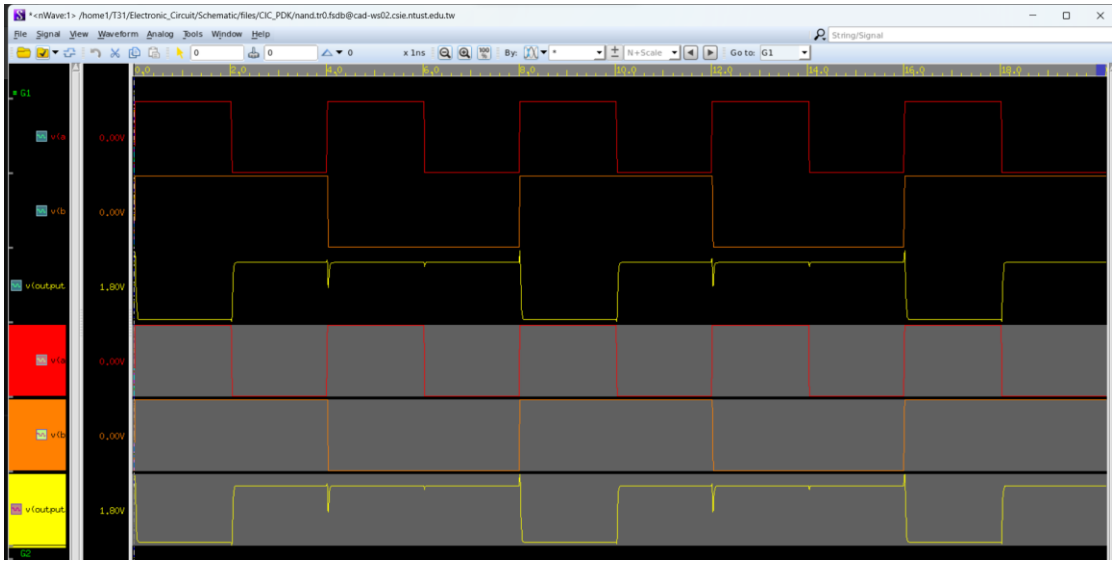
Front-end slew rate and propagation delay:

```
******
* file: nand.pex.sp

****** transient analysis tnom=  25.000 temp=  25.000 ******
t_rise=  34.1291p  targ=   2.0745n   trig=   2.0403n
t_fall= -34.3165p  targ=  30.4637p   trig=  64.7802p
t_propagation_r_a=  21.3891p  targ=   2.0514n   trig=   2.0300n
t_propagation_f_a=  33.5974p  targ=  43.5974p   trig=  10.0000p
t_propagation_r_b=  -1.9786n  targ=   2.0514n   trig=   4.0300n
t_propagation_f_b=  33.5974p  targ=  43.5974p   trig=  10.0000p

         ***** job concluded
```

Back-end slew rate and propagation delay:

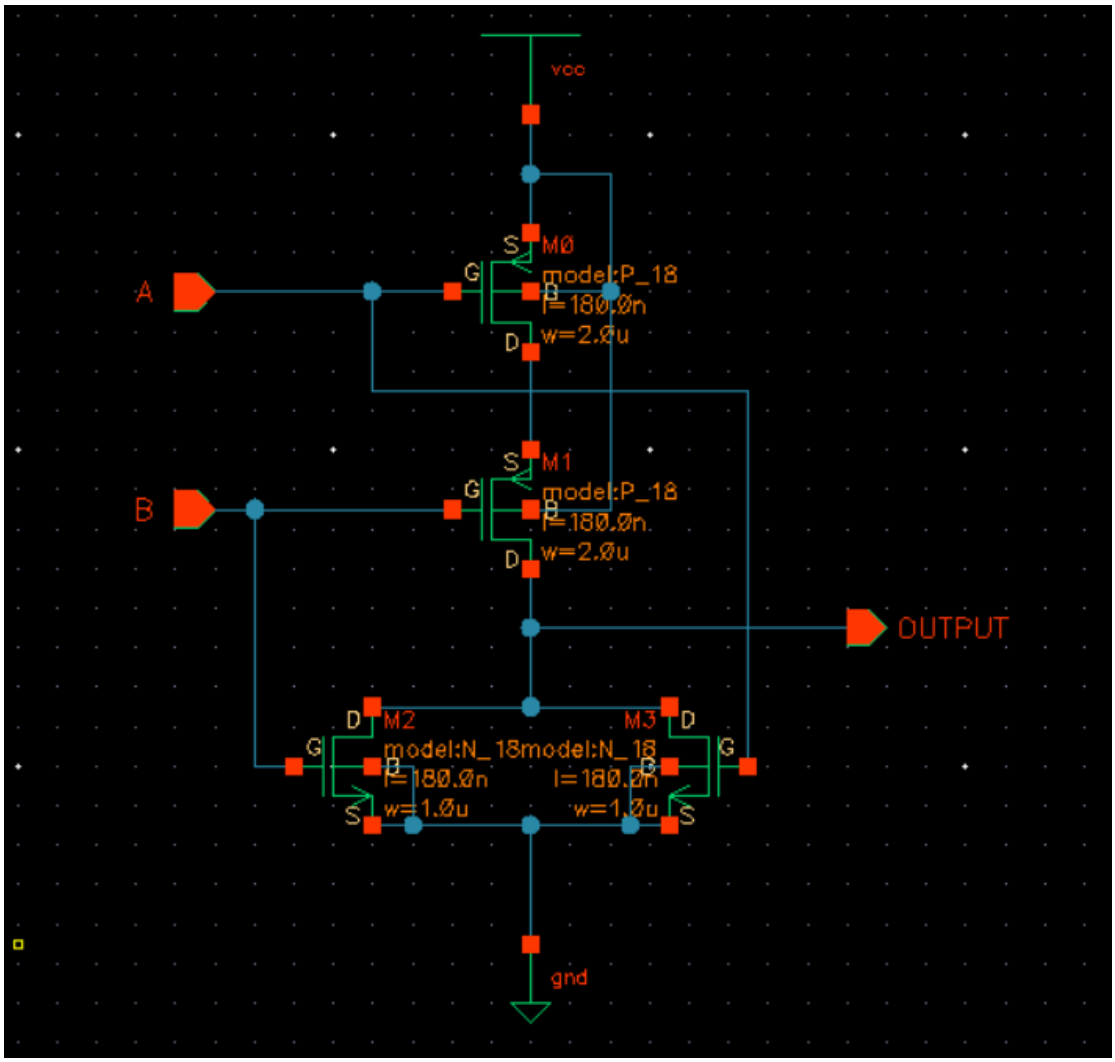
```
****** transient analysis tnom=  25.000 temp=  25.000 ******
t_rise=  31.6418p  targ=   2.0718n   trig=   2.0402n
t_fall=  31.1631p  targ=  60.6306p   trig=  29.4676p
t_propagation_r_a=  20.1076p  targ=   2.0501n   trig=   2.0300n
t_propagation_f_a=  31.8097p  targ=  41.8097p   trig=  10.0000p
t_propagation_r_b=  -1.9799n  targ=   2.0501n   trig=   4.0300n
t_propagation_f_b=  31.8097p  targ=  41.8097p   trig=  10.0000p

         ***** job concluded
******
********************************************************************************
```

Waveform(the top one is front-end, the other one is back-end):

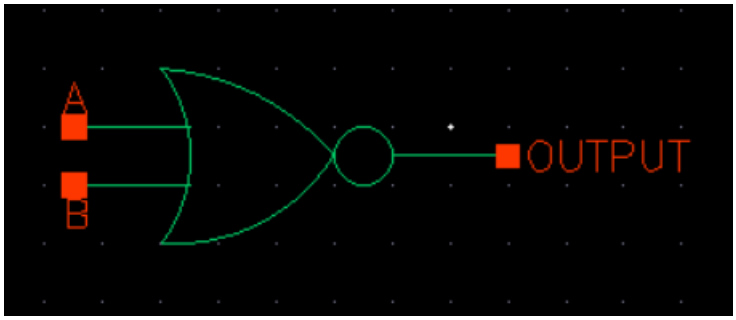


NOR gate:

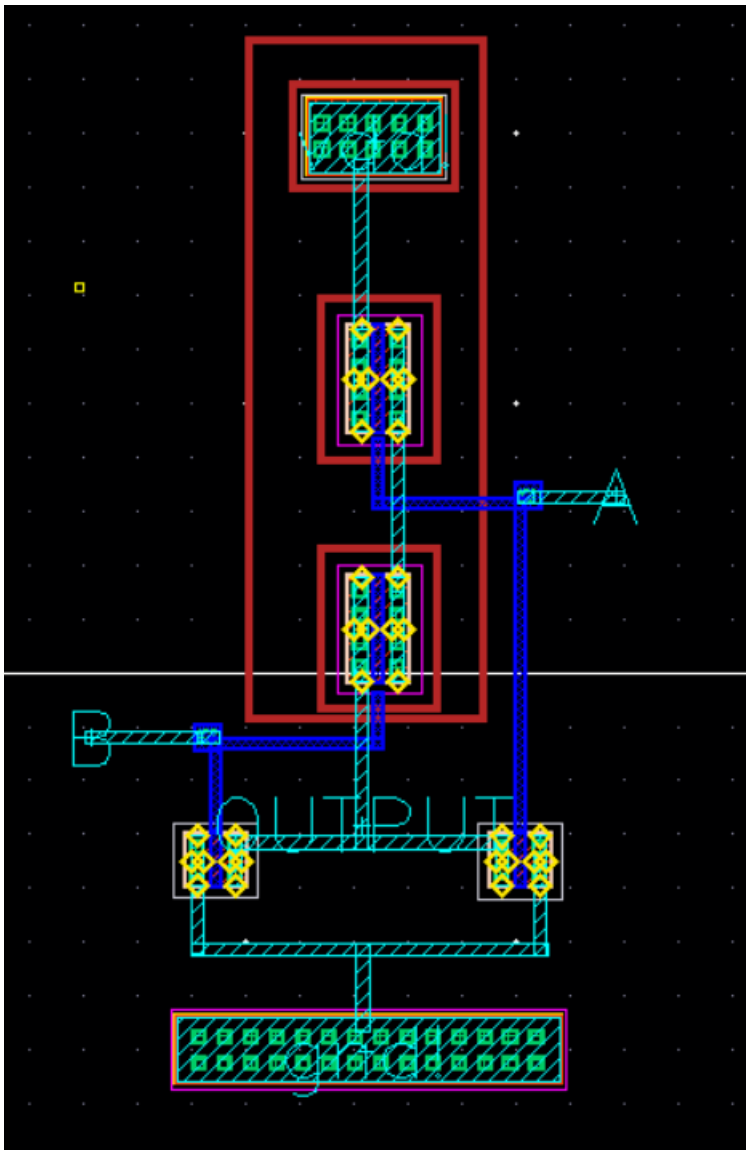
Schematic:



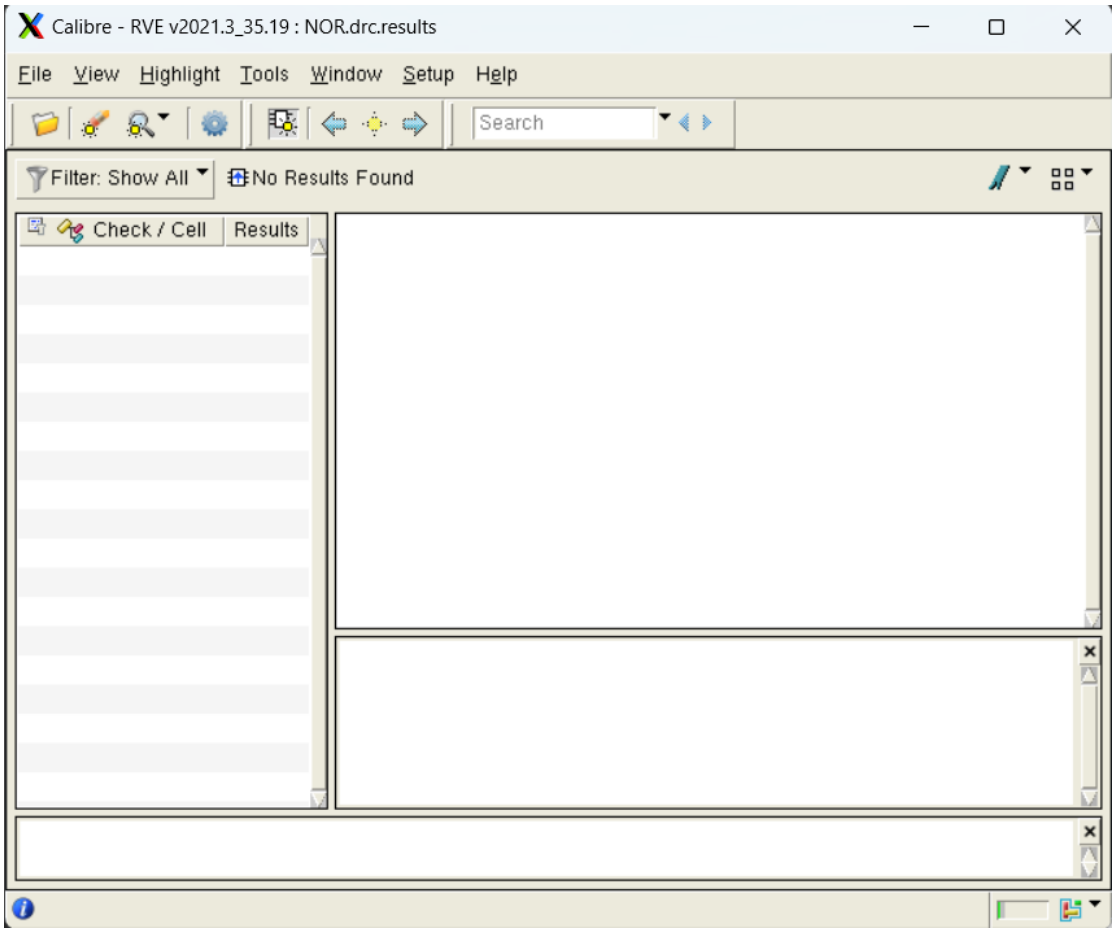
Symbol:



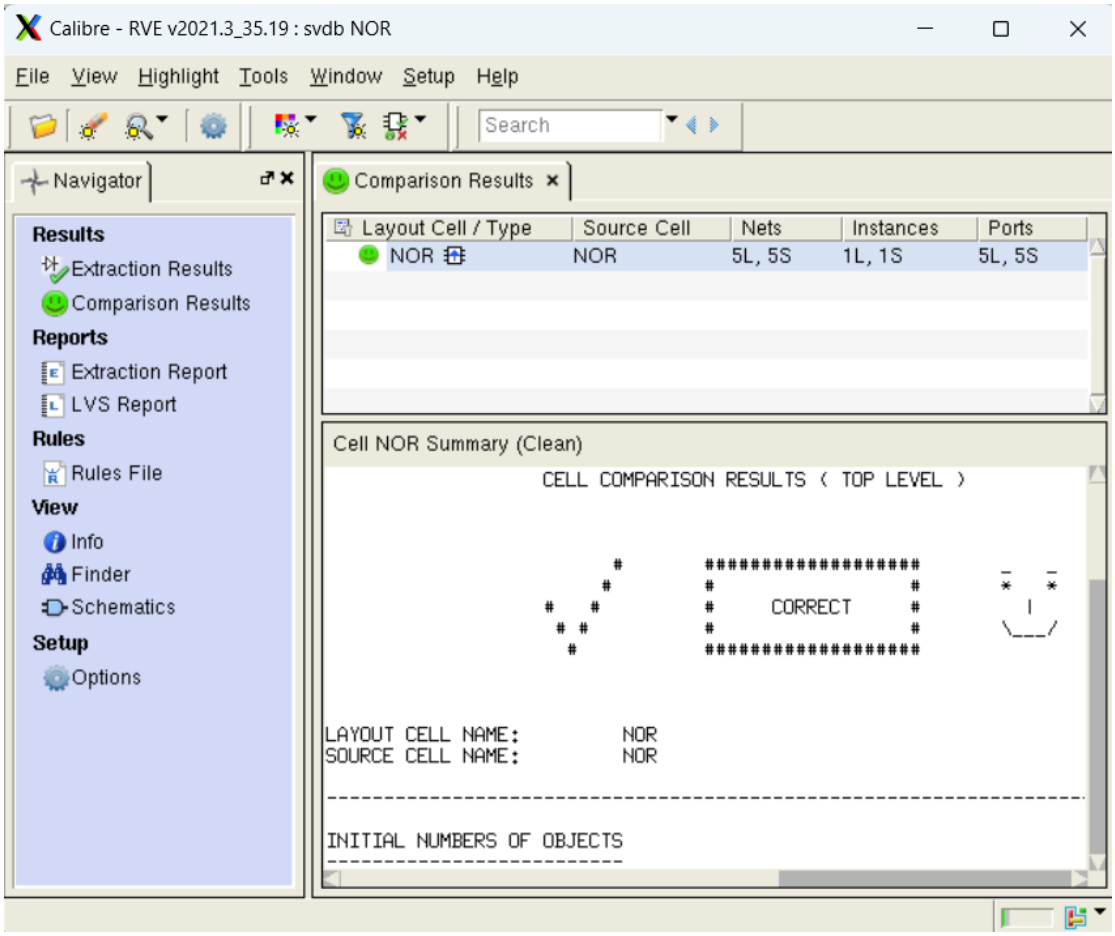
Layout:



DRC report:


Calibre - RVE v2021.3_35.19 : NOR.drc.results
File View Highlight Tools Window Setup Help
Search
Filter: Show All
No Results Found
Check / Cell
Results

LVS report:


Calibre - RVE v2021.3_35.19 : svdb NOR
File View Highlight Tools Window Setup Help
Search
Navigator
Results
Extraction Results
Comparison Results
Reports
Extraction Report
LVS Report
Rules
Rules File
View
Info
Finder
Schematics
Setup
Options
Comparison Results
Layout Cell / Type
Source Cell
Nets
Instances
Ports
NOR
NOR
5L, 5S
1L, 1S
5L, 5S
Cell NOR Summary (Clean)
CELL COMPARISON RESULTS (TOP LEVEL)
CORRECT
LAYOUT CELL NAME: NOR
SOURCE CELL NAME: NOR
INITIAL NUMBERS OF OBJECTS

Front-end spice:

```
*********************************************************
* Library Name: nor
* Cell Name:    NOR
* View Name:    schematic
*********************************************************

.SUBCKT NOR A B OUTPUT
*.PININFO A:I B:I OUTPUT:O
MM1 OUTPUT B net14 vdd! Pch m=1 l=180.0n w=2.0u
MM0 net14 A vdd! vdd! Pch m=1 l=180.0n w=2.0u
MM3 OUTPUT A gnd! gnd! Nch m=1 l=180.0n w=1.0u
MM2 OUTPUT B gnd! gnd! Nch m=1 l=180.0n w=1.0u
.ENDS

XNOR A B OUTPUT nor

Vvdd vdd! 0 1.8v
vinA A 0 pulse(0 1.8 0 20p 20p 4n 8n)
vinB B 0 pulse(0 1.8 0 20p 20p 2n 4n)

.measure t_rise
+TRIG v(OUTPUT) VAL=0.18 RISE=1
+TARG v(OUTPUT) VAL=1.62 RISE=1

.measure t_fall
+TRIG v(OUTPUT) VAL=0.18 FALL=1
+TARG v(OUTPUT) VAL=1.62 FALL=1

.measure t_propagation_r_A
+TRIG v(A) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_A
+TRIG v(A) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.measure t_propagation_r_B
+TRIG v(B) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_r_B
+TRIG v(B) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.option post
.trans 1p 20n
.END
```

Back-end spice:

```
.include "NOR.pex.sp.pex"
.subckt NOR  B OUTPUT VDD! A GND!
.lib 'hspice.lib' tt
*
* GND!   GND!
* A      A
* VDD!   VDD!
* OUTPUT         OUTPUT
* B      B
MM2 N_OUTPUT_MM2_d N_B_MM2_g N_GND!_MM2_s N_GND!_MM2_b Nch L=1.8e-07 W=1e-06
+ AD=4.9e-13 AS=4.9e-13 PD=1.98e-06 PS=1.98e-06
MM3 N_OUTPUT_MM3_d N_A_MM3_g N_GND!_MM3_s N_GND!_MM2_b Nch L=1.8e-07 W=1e-06
+ AD=4.9e-13 AS=4.9e-13 PD=1.98e-06 PS=1.98e-06
MM1 N_OUTPUT_MM1_d N_B_MM1_g N_NET14_MM1_s N_VDD!_MM1_b Pch L=1.8e-07 W=2e-06
+ AD=9.8e-13 AS=9.8e-13 PD=2.98e-06 PS=2.98e-06
MM0 N_NET14_MM0_d N_A_MM0_g N_VDD!_MM0_s N_VDD!_MM1_b Pch L=1.8e-07 W=2e-06
+ AD=9.8e-13 AS=9.8e-13 PD=2.98e-06 PS=2.98e-06
*
.include "NOR.pex.sp.NOR.pxi"
*
.ends
*
XNOR B OUTPUT VDD! A GND! NOR

Vvdd vdd! 0 1.8
vinA A 0 pulse(0 1.8 0 20p 20p 2n 4n)
vinB B 0 pulse(0 1.8 0 20p 20p 4n 8n)

.measure t_rise
+TRIG v(OUTPUT) VAL=0.18 RISE=1
+TARG v(OUTPUT) VAL=1.62 RISE=1

.measure t_fall
+TRIG v(OUTPUT) VAL=0.18 FALL=1
+TARG v(OUTPUT) VAL=1.62 FALL=1

.measure t_propagation_r_A
+TRIG v(A) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_A
+TRIG v(A) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.measure t_propagation_r_B
+TRIG v(B) VAL=0.9 FALL=1
+TARG v(OUTPUT) VAL=0.9 RISE=1

.measure t_propagation_f_B
+TRIG v(B) VAL=0.9 RISE=1
+TARG v(OUTPUT) VAL=0.9 FALL=1

.option post
.trans 1p 20n
.END
"NOR.pex.sp" 60L, 1444C
```

Front-end slew rate and the propagation delay:

```
****** transient analysis tnom=  25.000 temp=  25.000 ******
t_rise=  57.6030p  targ=   6.0999n   trig=   6.0423n
t_fall=  -9.4988p  targ=  16.2985p   trig=  25.7973p
t_propagation_r_a=   2.0281n  targ=   6.0581n   trig=   4.0300n
t_propagation_f_a=  10.4912p  targ=  20.4912p   trig=  10.0000p
t_propagation_r_b=  10.4912p  targ=  20.4912p   trig=  10.0000p

         ***** job concluded
******
********************************************************************************
```

Back-end slew rate and the propagation delay:

```
******
* file: nor.pex.sp

****** transient analysis tnom=  25.000 temp=  25.000 ******
t_rise=  65.4598p  targ=   6.1212n   trig=   6.0558n
t_fall= -10.4776p  targ=  17.4168p   trig=  27.8944p
t_propagation_r_a=   4.0465n  targ=   6.0765n   trig=   2.0300n
t_propagation_f_a=  11.8075p  targ=  21.8075p   trig=  10.0000p
t_propagation_r_b=   2.0465n  targ=   6.0765n   trig=   4.0300n
t_propagation_f_b=  11.8075p  targ=  21.8075p   trig=  10.0000p

         ***** job concluded
******
```

Waveform(the top one is front-end, the other one is back-end):