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[Netlist]

1. screenshot of adder.sp

```
≡ adder.sp ×
C: > Users > user > AppData > Roaming > MobaXterm > slash > RemoteFiles > 592252_2_20 > ≡ adder.sp
1 *Adder Spice
2
3 *.lib 'cic018.1' tt
4
5 .subckt FA A B CIN Carry gnd Sum vdd
6
7 Mp1 n1 A vdd vdd P_18 w=3u l=0.6u
8 Mp2 n1 B vdd vdd P_18 w=3u l=0.6u
9 Mp3 cob CIN n1 vdd P_18 w=3u l=0.6u
10
11 Mp4 n2 A vdd vdd P_18 w=3u l=0.6u
12 Mp5 cob B n2 vdd P_18 w=3u l=0.6u
13
14 Mp6 n3 A vdd vdd P_18 w=3u l=0.6u
15 Mp7 n3 B vdd vdd P_18 w=3u l=0.6u
16 Mp8 n3 CIN vdd vdd P_18 w=3u l=0.6u
17
18 Mp9 sb cob n3 vdd P_18 w=3u l=0.6u
19
20 Mp10 n5 A vdd vdd P_18 w=3u l=0.6u
21 Mp11 n6 B n5 vdd P_18 w=3u l=0.6u
22 Mp12 sb CIN n6 vdd P_18 w=3u l=0.6u
23
24 Mp13 Sum sb vdd vdd P_18 w=3u l=0.6u
25 Mp14 Carry cob vdd vdd P_18 w=3u l=0.6u
26
27
28
29
30 Mn1 n7 A gnd gnd N_18 w=1u l=0.6u
31 Mn2 n7 B gnd gnd N_18 w=1u l=0.6u
32 Mn3 cob CIN n7 gnd N_18 w=1u l=0.6u
33
34 Mn4 n8 A gnd gnd N_18 w=1u l=0.6u
35 Mn5 cob B n8 gnd N_18 w=1u l=0.6u
36
37 Mn6 n9 A gnd gnd N_18 w=1u l=0.6u
38 Mn7 n9 B gnd gnd N_18 w=1u l=0.6u
39 Mn8 n9 CIN gnd gnd N_18 w=1u l=0.6u
40
41 Mn9 sb cob n9 gnd N_18 w=1u l=0.6u
42
43 Mn10 n10 A gnd gnd N_18 w=1u l=0.6u
44 Mn11 n11 B n10 gnd N_18 w=1u l=0.6u
45 Mn12 sb CIN n11 gnd N_18 w=1u l=0.6u
46
47 Mn13 Sum sb gnd gnd N_18 w=1u l=0.6u
48 Mn14 Carry cob gnd gnd N_18 w=1u l=0.6u
49
50 .ends
51 |
52
53 .subckt adder A1 B1 A2 B2 A3 B3 A4 B4 Cin S1 S2 S3 S4 Cout vdd gnd
54 XFA1 A1 B1 Cin C1 gnd S1 vdd FA
55 XFA2 A2 B2 C1 C2 gnd S2 vdd FA
56 XFA3 A3 B3 C2 C3 gnd S3 vdd FA
57 XFA4 A4 B4 C3 Cout gnd S4 vdd FA
58 .ends
```

## 2. screenshot of adder.pex.sp

```
adder.pex.sp ×
C: > Users > user > Desktop > 積體電路hw3 > submit > adder.pex.sp
1  * File: adder.pex.sp
2  * Created: Sun Nov 10 00:17:27 2024
3  * Program "Calibre xRC"
4  * Version "v2022.3_33.19"
5  *
6  .include "adder.pex.sp.pex"
7  .subckt adder COUT A1 A2 A3 A4 B1 B2 B3 B4 CIN GND VDD S1 S2 S3 S4
8  *
9  * S4 S4
10 * S3 S3
11 * S2 S2
12 * S1 S1
13 * VDD VDD
14 * GND GND
15 * CIN CIN
16 * B4 B4
17 * B3 B3
18 * B2 B2
19 * B1 B1
20 * A4 A4
21 * A3 A3
22 * A2 A2
23 * A1 A1
24 * COUT COUT
25 mXFA1/Mn14 N_C1_XFA1/Mn14_d N_XFA1/COB_XFA1/Mn14_g N_GND_XFA1/Mn14_s
26 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.4e-12 AS=1.5e-12 PD=3.8e-06
27 + PS=4e-06
28 mXFA2/Mn14 N_C2_XFA2/Mn14_d N_XFA2/COB_XFA2/Mn14_g N_GND_XFA2/Mn14_s
29 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.4e-12 AS=1.5e-12 PD=3.8e-06
30 + PS=4e-06
31 mXFA3/Mn14 N_C3_XFA3/Mn14_d N_XFA3/COB_XFA3/Mn14_g N_GND_XFA3/Mn14_s
32 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.4e-12 AS=1.5e-12 PD=3.8e-06
33 + PS=4e-06
34 mXFA4/Mn14 N_COUT_XFA4/Mn14_d N_XFA4/COB_XFA4/Mn14_g N_GND_XFA4/Mn14_s
35 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.4e-12 AS=1.5e-12 PD=3.8e-06
36 + PS=4e-06
37 mXFA1/Mn1 N_XFA1/N7_XFA1/Mn1_d N_A1_XFA1/Mn1_g N_GND_XFA1/Mn1_s
38 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.8e-12 AS=7e-13 PD=4.6e-06
39 + PS=1.4e-06
40 mXFA2/Mn1 N_XFA2/N7_XFA2/Mn1_d N_A2_XFA2/Mn1_g N_GND_XFA2/Mn1_s
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41 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.8e-12 AS=7e-13 PD=4.6e-06
42 + PS=1.4e-06
43 mXFA3/Mn1 N_XFA3/N7_XFA3/Mn1_d N_A3_XFA3/Mn1_g N_GND_XFA3/Mn1_s
44 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.8e-12 AS=7e-13 PD=4.6e-06
45 + PS=1.4e-06
46 mXFA4/Mn1 N_XFA4/N7_XFA4/Mn1_d N_A4_XFA4/Mn1_g N_GND_XFA4/Mn1_s
47 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.8e-12 AS=7e-13 PD=4.6e-06
48 + PS=1.4e-06
49 mXFA1/Mn2 N_XFA1/N7_XFA1/Mn2_d N_B1_XFA1/Mn2_g N_GND_XFA1/Mn2_s
50 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
51 mXFA2/Mn2 N_XFA2/N7_XFA2/Mn2_d N_B2_XFA2/Mn2_g N_GND_XFA2/Mn2_s
52 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
53 mXFA3/Mn2 N_XFA3/N7_XFA3/Mn2_d N_B3_XFA3/Mn2_g N_GND_XFA3/Mn2_s
54 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
55 mXFA4/Mn2 N_XFA4/N7_XFA4/Mn2_d N_B4_XFA4/Mn2_g N_GND_XFA4/Mn2_s
56 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
57 mXFA1/Mn3 N_XFA1/COB_XFA1/Mn3_d N_C1_XFA1/Mn3_g N_XFA1/N7_XFA1/Mn3_s
58 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
59 mXFA2/Mn3 N_XFA2/COB_XFA2/Mn3_d N_C1_XFA2/Mn3_g N_XFA2/N7_XFA2/Mn3_s
60 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
61 mXFA3/Mn3 N_XFA3/COB_XFA3/Mn3_d N_C2_XFA3/Mn3_g N_XFA3/N7_XFA3/Mn3_s
62 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
63 mXFA4/Mn3 N_XFA4/COB_XFA4/Mn3_d N_C3_XFA4/Mn3_g N_XFA4/N7_XFA4/Mn3_s
64 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
65 mXFA1/Mn5 N_XFA1/COB_XFA1/Mn5_d N_B1_XFA1/Mn5_g N_XFA1/N8_XFA1/Mn5_s
66 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
67 mXFA2/Mn5 N_XFA2/COB_XFA2/Mn5_d N_B2_XFA2/Mn5_g N_XFA2/N8_XFA2/Mn5_s
68 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
69 mXFA3/Mn5 N_XFA3/COB_XFA3/Mn5_d N_B3_XFA3/Mn5_g N_XFA3/N8_XFA3/Mn5_s
70 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
71 mXFA4/Mn5 N_XFA4/COB_XFA4/Mn5_d N_B4_XFA4/Mn5_g N_XFA4/N8_XFA4/Mn5_s
72 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
73 mXFA1/Mn4 N_XFA1/N8_XFA1/Mn4_d N_A1_XFA1/Mn4_g N_GND_XFA1/Mn4_s
74 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
75 mXFA2/Mn4 N_XFA2/N8_XFA2/Mn4_d N_A2_XFA2/Mn4_g N_GND_XFA2/Mn4_s
76 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
77 mXFA3/Mn4 N_XFA3/N8_XFA3/Mn4_d N_A3_XFA3/Mn4_g N_GND_XFA3/Mn4_s
78 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
79 mXFA4/Mn4 N_XFA4/N8_XFA4/Mn4_d N_A4_XFA4/Mn4_g N_GND_XFA4/Mn4_s
80 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06

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81 mXFA1/Mn6 N_XFA1/N9_XFA1/Mn6_d N_A1_XFA1/Mn6_g N_GND_XFA1/Mn6_s
82 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
83 mXFA2/Mn6 N_XFA2/N9_XFA2/Mn6_d N_A2_XFA2/Mn6_g N_GND_XFA2/Mn6_s
84 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
85 mXFA3/Mn6 N_XFA3/N9_XFA3/Mn6_d N_A3_XFA3/Mn6_g N_GND_XFA3/Mn6_s
86 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
87 mXFA4/Mn6 N_XFA4/N9_XFA4/Mn6_d N_A4_XFA4/Mn6_g N_GND_XFA4/Mn6_s
88 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
89 mXFA1/Mn7 N_XFA1/N9_XFA1/Mn7_d N_B1_XFA1/Mn7_g N_GND_XFA1/Mn7_s
90 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
91 mXFA2/Mn7 N_XFA2/N9_XFA2/Mn7_d N_B2_XFA2/Mn7_g N_GND_XFA2/Mn7_s
92 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
93 mXFA3/Mn7 N_XFA3/N9_XFA3/Mn7_d N_B3_XFA3/Mn7_g N_GND_XFA3/Mn7_s
94 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
95 mXFA4/Mn7 N_XFA4/N9_XFA4/Mn7_d N_B4_XFA4/Mn7_g N_GND_XFA4/Mn7_s
96 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
97 mXFA1/Mn8 N_XFA1/N9_XFA1/Mn8_d N_C1N_XFA1/Mn8_g N_GND_XFA1/Mn8_s
98 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
99 mXFA2/Mn8 N_XFA2/N9_XFA2/Mn8_d N_C1_XFA2/Mn8_g N_GND_XFA2/Mn8_s
100 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
101 mXFA3/Mn8 N_XFA3/N9_XFA3/Mn8_d N_C2_XFA3/Mn8_g N_GND_XFA3/Mn8_s
102 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
103 mXFA4/Mn8 N_XFA4/N9_XFA4/Mn8_d N_C3_XFA4/Mn8_g N_GND_XFA4/Mn8_s
104 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
105 mXFA1/Mn9 N_XFA1/SB_XFA1/Mn9_d N_XFA1/COB_XFA1/Mn9_g N_XFA1/N9_XFA1/Mn9_s
106 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
107 mXFA2/Mn9 N_XFA2/SB_XFA2/Mn9_d N_XFA2/COB_XFA2/Mn9_g N_XFA2/N9_XFA2/Mn9_s
108 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
109 mXFA3/Mn9 N_XFA3/SB_XFA3/Mn9_d N_XFA3/COB_XFA3/Mn9_g N_XFA3/N9_XFA3/Mn9_s
110 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
111 mXFA4/Mn9 N_XFA4/SB_XFA4/Mn9_d N_XFA4/COB_XFA4/Mn9_g N_XFA4/N9_XFA4/Mn9_s
112 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
113 mXFA1/Mn12 N_XFA1/SB_XFA1/Mn12_d N_C1N_XFA1/Mn12_g N_XFA1/N11_XFA1/Mn12_s
114 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
115 mXFA2/Mn12 N_XFA2/SB_XFA2/Mn12_d N_C1_XFA2/Mn12_g N_XFA2/N11_XFA2/Mn12_s
116 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
117 mXFA3/Mn12 N_XFA3/SB_XFA3/Mn12_d N_C2_XFA3/Mn12_g N_XFA3/N11_XFA3/Mn12_s

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118 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
119 mXFA4/Mn12 N_XFA4/SB_XFA4/Mn12_d N_C3_XFA4/Mn12_g N_XFA4/N11_XFA4/Mn12_s
120 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
121 mXFA1/Mn11 N_XFA1/N11_XFA1/Mn11_d N_B1_XFA1/Mn11_g N_XFA1/N10_XFA1/Mn11_s
122 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
123 mXFA2/Mn11 N_XFA2/N11_XFA2/Mn11_d N_B2_XFA2/Mn11_g N_XFA2/N10_XFA2/Mn11_s
124 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
125 mXFA3/Mn11 N_XFA3/N11_XFA3/Mn11_d N_B3_XFA3/Mn11_g N_XFA3/N10_XFA3/Mn11_s
126 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
127 mXFA4/Mn11 N_XFA4/N11_XFA4/Mn11_d N_B4_XFA4/Mn11_g N_XFA4/N10_XFA4/Mn11_s
128 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
129 mXFA1/Mn10 N_XFA1/N10_XFA1/Mn10_d N_A1_XFA1/Mn10_g N_GND_XFA1/Mn10_s
130 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
131 mXFA2/Mn10 N_XFA2/N10_XFA2/Mn10_d N_A2_XFA2/Mn10_g N_GND_XFA2/Mn10_s
132 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
133 mXFA3/Mn10 N_XFA3/N10_XFA3/Mn10_d N_A3_XFA3/Mn10_g N_GND_XFA3/Mn10_s
134 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
135 mXFA4/Mn10 N_XFA4/N10_XFA4/Mn10_d N_A4_XFA4/Mn10_g N_GND_XFA4/Mn10_s
136 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=7e-13 AS=7e-13 PD=1.4e-06 PS=1.4e-06
137 mXFA1/Mn13 N_S1_XFA1/Mn13_d N_XFA1/SB_XFA1/Mn13_g N_GND_XFA1/Mn13_s
138 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.6e-12 AS=7e-13 PD=4.2e-06
139 + PS=1.4e-06
140 mXFA2/Mn13 N_S2_XFA2/Mn13_d N_XFA2/SB_XFA2/Mn13_g N_GND_XFA2/Mn13_s
141 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.6e-12 AS=7e-13 PD=4.2e-06
142 + PS=1.4e-06
143 mXFA3/Mn13 N_S3_XFA3/Mn13_d N_XFA3/SB_XFA3/Mn13_g N_GND_XFA3/Mn13_s
144 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.6e-12 AS=7e-13 PD=4.2e-06
145 + PS=1.4e-06
146 mXFA4/Mn13 N_S4_XFA4/Mn13_d N_XFA4/SB_XFA4/Mn13_g N_GND_XFA4/Mn13_s
147 + N_GND_XFA1/Mn14_b N_18 L=6e-07 W=1e-06 AD=1.6e-12 AS=7e-13 PD=4.2e-06
148 + PS=1.4e-06
149 mXFA1/Mp14 N_C1_XFA1/Mp14_d N_XFA1/COB_XFA1/Mp14_g N_VDD_XFA1/Mp14_s
150 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.2e-12 AS=4.5e-12 PD=5.8e-06
151 + PS=6e-06
152 mXFA2/Mp14 N_C2_XFA2/Mp14_d N_XFA2/COB_XFA2/Mp14_g N_VDD_XFA2/Mp14_s
153 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.2e-12 AS=4.5e-12 PD=5.8e-06
154 + PS=6e-06
155 mXFA3/Mp14 N_C3_XFA3/Mp14_d N_XFA3/COB_XFA3/Mp14_g N_VDD_XFA3/Mp14_s

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156 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.2e-12 AS=4.5e-12 PD=5.8e-06
157 + PS=6e-06
158 mXFA4/Mp14 N_COUT_XFA4/Mp14_d N_XFA4/COB_XFA4/Mp14_g N_VDD_XFA4/Mp14_s
159 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.2e-12 AS=4.5e-12 PD=5.8e-06
160 + PS=6e-06
161 mXFA1/Mp1 N_XFA1/N1_XFA1/Mp1_d N_A1_XFA1/Mp1_g N_VDD_XFA1/Mp1_s
162 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=5.4e-12 AS=2.1e-12 PD=6.6e-06
163 + PS=1.4e-06
164 mXFA2/Mp1 N_XFA2/N1_XFA2/Mp1_d N_A2_XFA2/Mp1_g N_VDD_XFA2/Mp1_s
165 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=5.4e-12 AS=2.1e-12 PD=6.6e-06
166 + PS=1.4e-06
167 mXFA3/Mp1 N_XFA3/N1_XFA3/Mp1_d N_A3_XFA3/Mp1_g N_VDD_XFA3/Mp1_s
168 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=5.4e-12 AS=2.1e-12 PD=6.6e-06
169 + PS=1.4e-06
170 mXFA4/Mp1 N_XFA4/N1_XFA4/Mp1_d N_A4_XFA4/Mp1_g N_VDD_XFA4/Mp1_s
171 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=5.4e-12 AS=2.1e-12 PD=6.6e-06
172 + PS=1.4e-06
173 mXFA1/Mp2 N_XFA1/N1_XFA1/Mp2_d N_B1_XFA1/Mp2_g N_VDD_XFA1/Mp2_s
174 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
175 + PS=1.4e-06
176 mXFA2/Mp2 N_XFA2/N1_XFA2/Mp2_d N_B2_XFA2/Mp2_g N_VDD_XFA2/Mp2_s
177 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
178 + PS=1.4e-06
179 mXFA3/Mp2 N_XFA3/N1_XFA3/Mp2_d N_B3_XFA3/Mp2_g N_VDD_XFA3/Mp2_s
180 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
181 + PS=1.4e-06
182 mXFA4/Mp2 N_XFA4/N1_XFA4/Mp2_d N_B4_XFA4/Mp2_g N_VDD_XFA4/Mp2_s
183 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
184 + PS=1.4e-06
185 mXFA1/Mp3 N_XFA1/COB_XFA1/Mp3_d N_CIN_XFA1/Mp3_g N_XFA1/N1_XFA1/Mp3_s
186 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
187 + PS=1.4e-06
188 mXFA2/Mp3 N_XFA2/COB_XFA2/Mp3_d N_C1_XFA2/Mp3_g N_XFA2/N1_XFA2/Mp3_s
189 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
190 + PS=1.4e-06
191 mXFA3/Mp3 N_XFA3/COB_XFA3/Mp3_d N_C2_XFA3/Mp3_g N_XFA3/N1_XFA3/Mp3_s
192 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
193 + PS=1.4e-06
194 mXFA4/Mp3 N_XFA4/COB_XFA4/Mp3_d N_C3_XFA4/Mp3_g N_XFA4/N1_XFA4/Mp3_s

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195 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
196 + PS=1.4e-06
197 mXFA1/Mp5 N_XFA1/COB_XFA1/Mp5_d N_B1_XFA1/Mp5_g N_XFA1/N2_XFA1/Mp5_s
198 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
199 + PS=1.4e-06
200 mXFA2/Mp5 N_XFA2/COB_XFA2/Mp5_d N_B2_XFA2/Mp5_g N_XFA2/N2_XFA2/Mp5_s
201 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
202 + PS=1.4e-06
203 mXFA3/Mp5 N_XFA3/COB_XFA3/Mp5_d N_B3_XFA3/Mp5_g N_XFA3/N2_XFA3/Mp5_s
204 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
205 + PS=1.4e-06
206 mXFA4/Mp5 N_XFA4/COB_XFA4/Mp5_d N_B4_XFA4/Mp5_g N_XFA4/N2_XFA4/Mp5_s
207 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
208 + PS=1.4e-06
209 mXFA1/Mp4 N_XFA1/N2_XFA1/Mp4_d N_A1_XFA1/Mp4_g N_VDD_XFA1/Mp4_s
210 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
211 + PS=1.4e-06
212 mXFA2/Mp4 N_XFA2/N2_XFA2/Mp4_d N_A2_XFA2/Mp4_g N_VDD_XFA2/Mp4_s
213 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
214 + PS=1.4e-06
215 mXFA3/Mp4 N_XFA3/N2_XFA3/Mp4_d N_A3_XFA3/Mp4_g N_VDD_XFA3/Mp4_s
216 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
217 + PS=1.4e-06
218 mXFA4/Mp4 N_XFA4/N2_XFA4/Mp4_d N_A4_XFA4/Mp4_g N_VDD_XFA4/Mp4_s
219 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
220 + PS=1.4e-06
221 mXFA1/Mp6 N_XFA1/N3_XFA1/Mp6_d N_A1_XFA1/Mp6_g N_VDD_XFA1/Mp6_s
222 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
223 + PS=1.4e-06
224 mXFA2/Mp6 N_XFA2/N3_XFA2/Mp6_d N_A2_XFA2/Mp6_g N_VDD_XFA2/Mp6_s
225 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
226 + PS=1.4e-06
227 mXFA3/Mp6 N_XFA3/N3_XFA3/Mp6_d N_A3_XFA3/Mp6_g N_VDD_XFA3/Mp6_s
228 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
229 + PS=1.4e-06
230 mXFA4/Mp6 N_XFA4/N3_XFA4/Mp6_d N_A4_XFA4/Mp6_g N_VDD_XFA4/Mp6_s
231 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
232 + PS=1.4e-06
233 - XFA1/M-7 N_XFA1/N2_XFA1/M-7 + N_B1_XFA1/M-7 + N_VDD_XFA1/M-7

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233 mXFA1/Mp7 N_XFA1/N3_XFA1/Mp7_d N_B1_XFA1/Mp7_g N_VDD_XFA1/Mp7_s
234 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
235 + PS=1.4e-06
236 mXFA2/Mp7 N_XFA2/N3_XFA2/Mp7_d N_B2_XFA2/Mp7_g N_VDD_XFA2/Mp7_s
237 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
238 + PS=1.4e-06
239 mXFA3/Mp7 N_XFA3/N3_XFA3/Mp7_d N_B3_XFA3/Mp7_g N_VDD_XFA3/Mp7_s
240 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
241 + PS=1.4e-06
242 mXFA4/Mp7 N_XFA4/N3_XFA4/Mp7_d N_B4_XFA4/Mp7_g N_VDD_XFA4/Mp7_s
243 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
244 + PS=1.4e-06
245 mXFA1/Mp8 N_XFA1/N3_XFA1/Mp8_d N_CIN_XFA1/Mp8_g N_VDD_XFA1/Mp8_s
246 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
247 + PS=1.4e-06
248 mXFA2/Mp8 N_XFA2/N3_XFA2/Mp8_d N_C1_XFA2/Mp8_g N_VDD_XFA2/Mp8_s
249 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
250 + PS=1.4e-06
251 mXFA3/Mp8 N_XFA3/N3_XFA3/Mp8_d N_C2_XFA3/Mp8_g N_VDD_XFA3/Mp8_s
252 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
253 + PS=1.4e-06
254 mXFA4/Mp8 N_XFA4/N3_XFA4/Mp8_d N_C3_XFA4/Mp8_g N_VDD_XFA4/Mp8_s
255 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
256 + PS=1.4e-06
257 mXFA1/Mp9 N_XFA1/SB_XFA1/Mp9_d N_XFA1/COB_XFA1/Mp9_g N_XFA1/N3_XFA1/Mp9_s
258 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
259 + PS=1.4e-06
260 mXFA2/Mp9 N_XFA2/SB_XFA2/Mp9_d N_XFA2/COB_XFA2/Mp9_g N_XFA2/N3_XFA2/Mp9_s
261 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
262 + PS=1.4e-06
263 mXFA3/Mp9 N_XFA3/SB_XFA3/Mp9_d N_XFA3/COB_XFA3/Mp9_g N_XFA3/N3_XFA3/Mp9_s
264 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
265 + PS=1.4e-06
266 mXFA4/Mp9 N_XFA4/SB_XFA4/Mp9_d N_XFA4/COB_XFA4/Mp9_g N_XFA4/N3_XFA4/Mp9_s
267 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
268 + PS=1.4e-06

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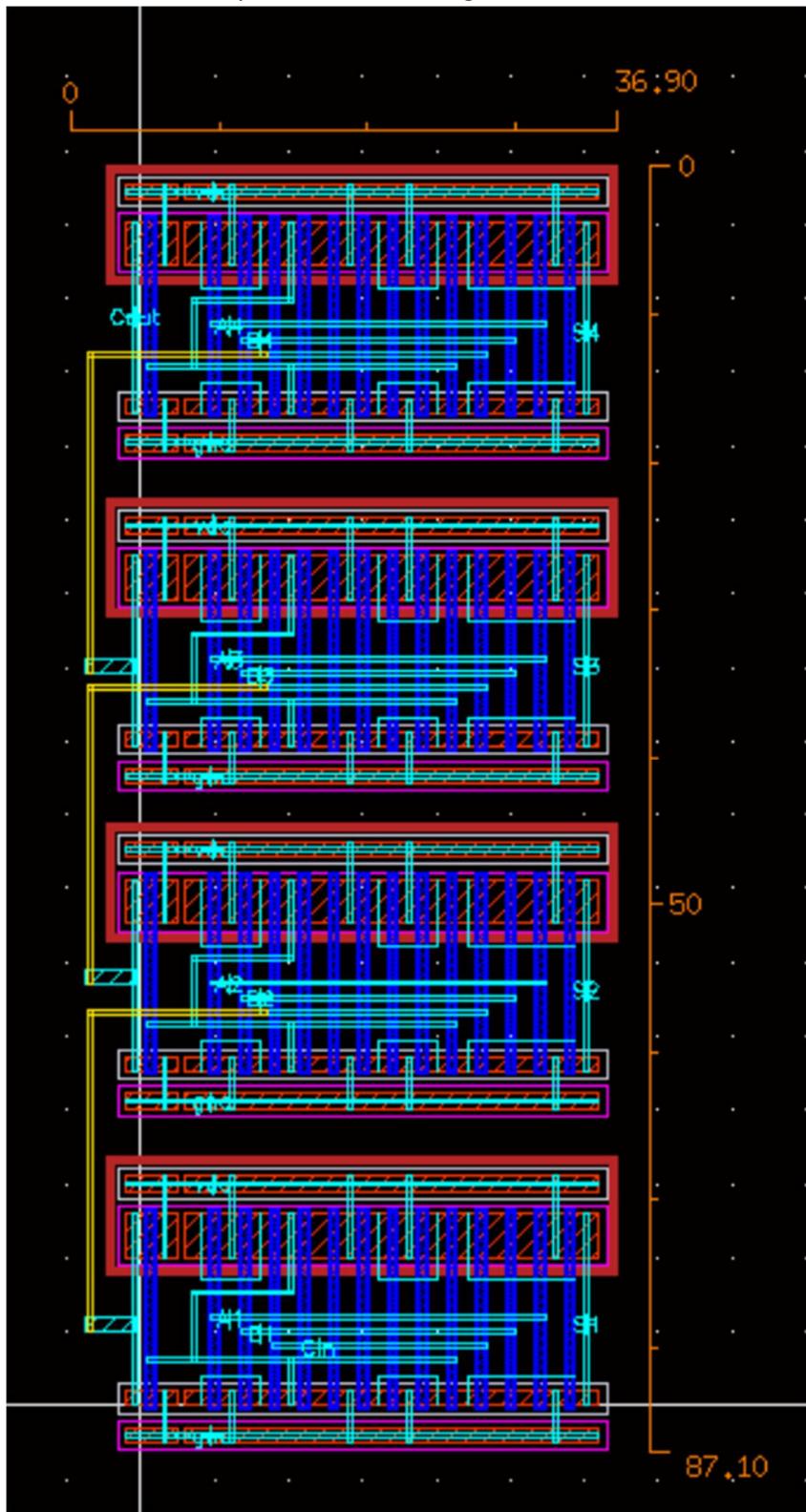
269 mXFA1/Mp12 N_XFA1/SB_XFA1/Mp12_d N_CIN_XFA1/Mp12_g N_XFA1/N6_XFA1/Mp12_s
270 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
271 + PS=1.4e-06
272 mXFA2/Mp12 N_XFA2/SB_XFA2/Mp12_d N_C1_XFA2/Mp12_g N_XFA2/N6_XFA2/Mp12_s
273 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
274 + PS=1.4e-06
275 mXFA3/Mp12 N_XFA3/SB_XFA3/Mp12_d N_C2_XFA3/Mp12_g N_XFA3/N6_XFA3/Mp12_s
276 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
277 + PS=1.4e-06
278 mXFA4/Mp12 N_XFA4/SB_XFA4/Mp12_d N_C3_XFA4/Mp12_g N_XFA4/N6_XFA4/Mp12_s
279 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
280 + PS=1.4e-06
281 mXFA1/Mp11 N_XFA1/N6_XFA1/Mp11_d N_B1_XFA1/Mp11_g N_XFA1/N5_XFA1/Mp11_s
282 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
283 + PS=1.4e-06
284 mXFA2/Mp11 N_XFA2/N6_XFA2/Mp11_d N_B2_XFA2/Mp11_g N_XFA2/N5_XFA2/Mp11_s
285 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
286 + PS=1.4e-06
287 mXFA3/Mp11 N_XFA3/N6_XFA3/Mp11_d N_B3_XFA3/Mp11_g N_XFA3/N5_XFA3/Mp11_s
288 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
289 + PS=1.4e-06
290 mXFA4/Mp11 N_XFA4/N6_XFA4/Mp11_d N_B4_XFA4/Mp11_g N_XFA4/N5_XFA4/Mp11_s
291 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
292 + PS=1.4e-06
293 mXFA1/Mp10 N_XFA1/N5_XFA1/Mp10_d N_A1_XFA1/Mp10_g N_VDD_XFA1/Mp10_s
294 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
295 + PS=1.4e-06
296 mXFA2/Mp10 N_XFA2/N5_XFA2/Mp10_d N_A2_XFA2/Mp10_g N_VDD_XFA2/Mp10_s
297 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
298 + PS=1.4e-06
299 mXFA3/Mp10 N_XFA3/N5_XFA3/Mp10_d N_A3_XFA3/Mp10_g N_VDD_XFA3/Mp10_s
300 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
301 + PS=1.4e-06
302 mXFA4/Mp10 N_XFA4/N5_XFA4/Mp10_d N_A4_XFA4/Mp10_g N_VDD_XFA4/Mp10_s
303 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=2.1e-12 AS=2.1e-12 PD=1.4e-06
304 + PS=1.4e-06

305 mXFA1/Mp13 N_S1_XFA1/Mp13_d N_XFA1/SB_XFA1/Mp13_g N_VDD_XFA1/Mp13_s
306 + N_VDD_XFA1/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.8e-12 AS=2.1e-12 PD=6.2e-06
307 + PS=1.4e-06
308 mXFA2/Mp13 N_S2_XFA2/Mp13_d N_XFA2/SB_XFA2/Mp13_g N_VDD_XFA2/Mp13_s
309 + N_VDD_XFA2/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.8e-12 AS=2.1e-12 PD=6.2e-06
310 + PS=1.4e-06
311 mXFA3/Mp13 N_S3_XFA3/Mp13_d N_XFA3/SB_XFA3/Mp13_g N_VDD_XFA3/Mp13_s
312 + N_VDD_XFA3/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.8e-12 AS=2.1e-12 PD=6.2e-06
313 + PS=1.4e-06
314 mXFA4/Mp13 N_S4_XFA4/Mp13_d N_XFA4/SB_XFA4/Mp13_g N_VDD_XFA4/Mp13_s
315 + N_VDD_XFA4/Mp14_b P_18 L=6e-07 W=3e-06 AD=4.8e-12 AS=2.1e-12 PD=6.2e-06
316 + PS=1.4e-06
317 *
318 .include "adder.pex.sp.ADDER.pkl"
319 *
320 .ends
321 *
322 *
323

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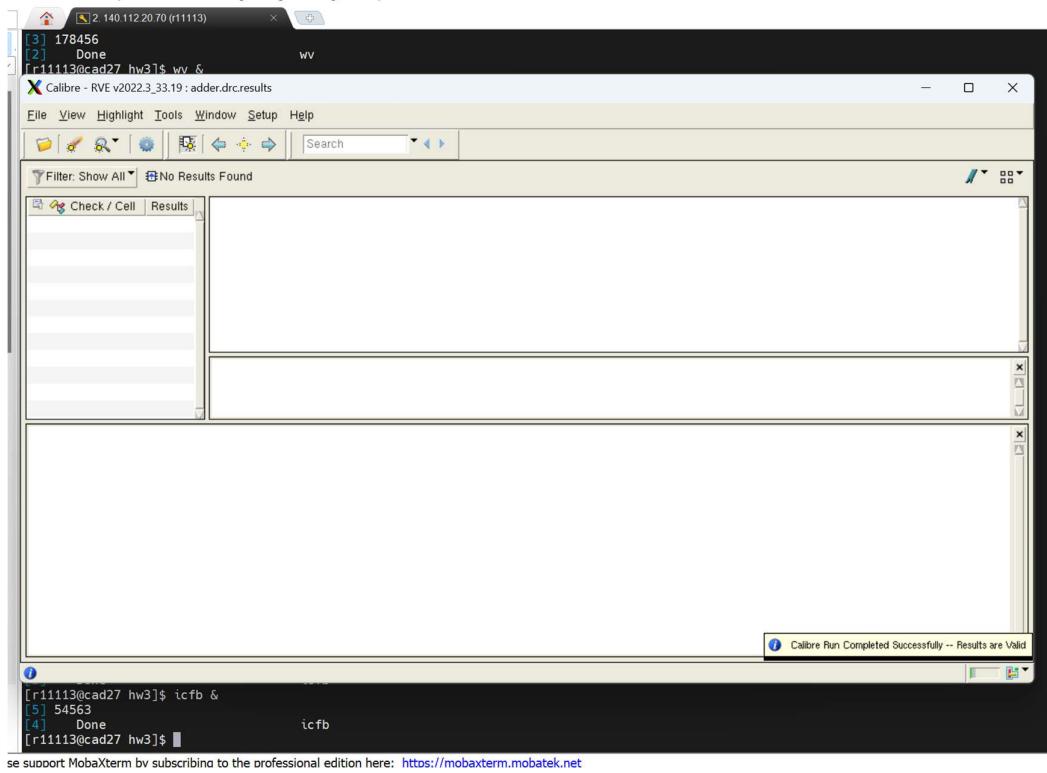
[Layout]

1. Screenshot of layout with measuring the area

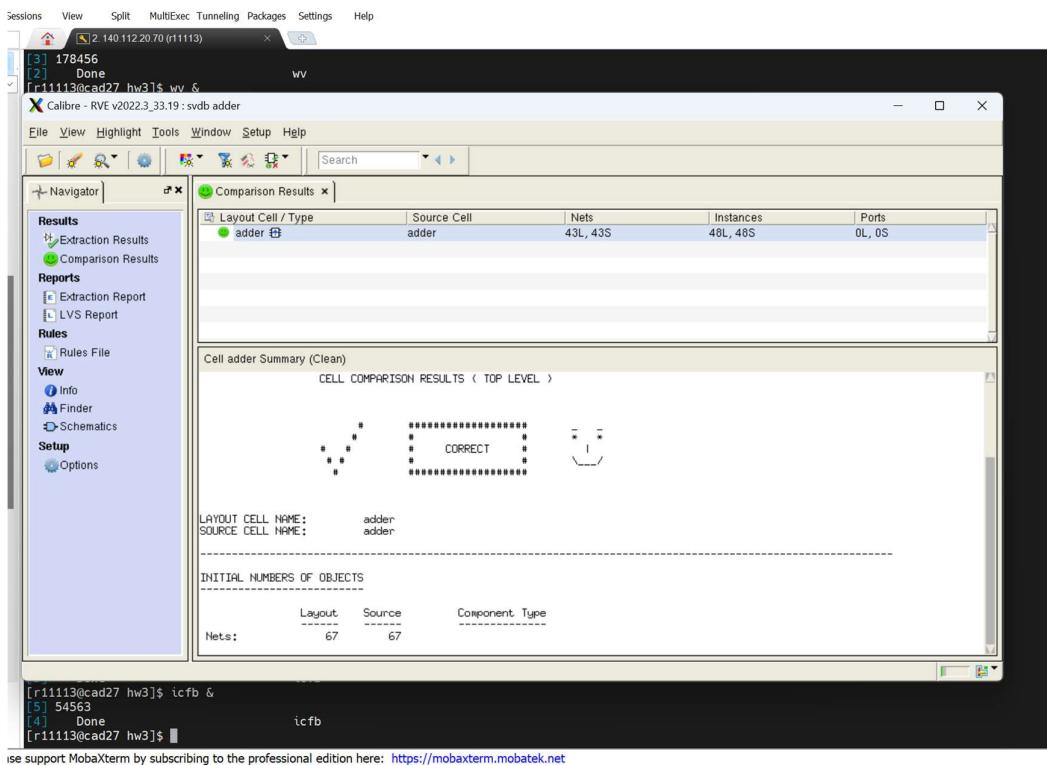


Area = 3213.99  $\mu\text{m}^2$

## 2. Screenshot of successful DRC (with your account)



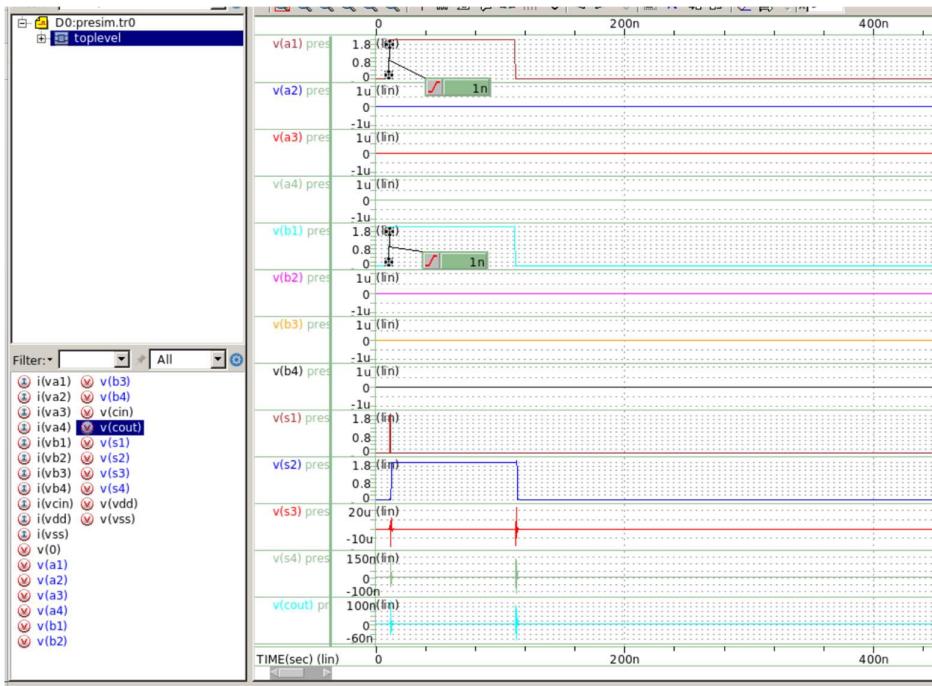
## 3. Screenshot of successful LVS (with your account)



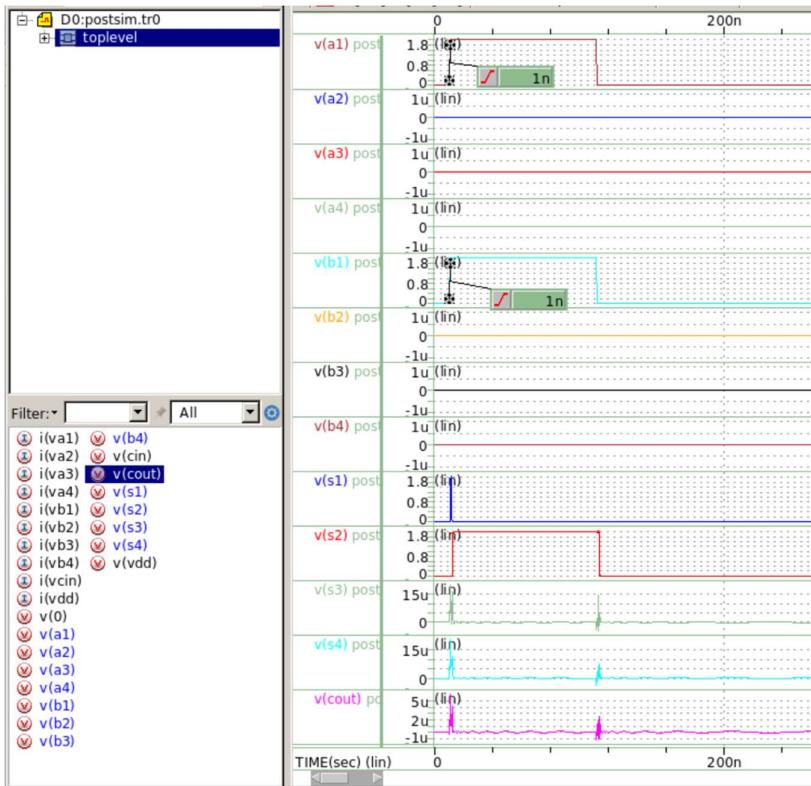
## [Simulation]

a. 0001+0001

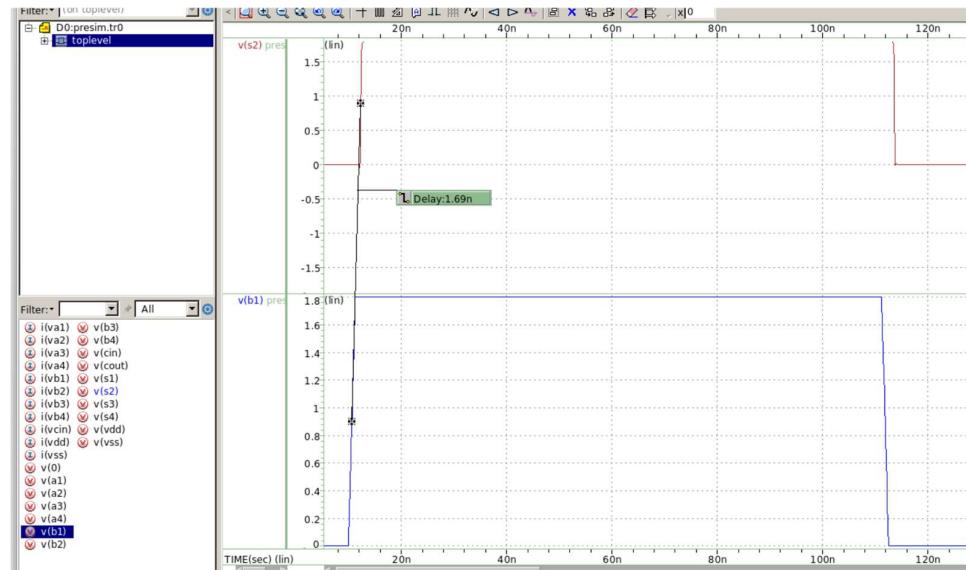
1.waveform of A1~A4, B1~B4, S1~S4 and Cout in pre-sim



2.waveform of A1~A4, B1~B4, S1~S4 and Cout in post-sim

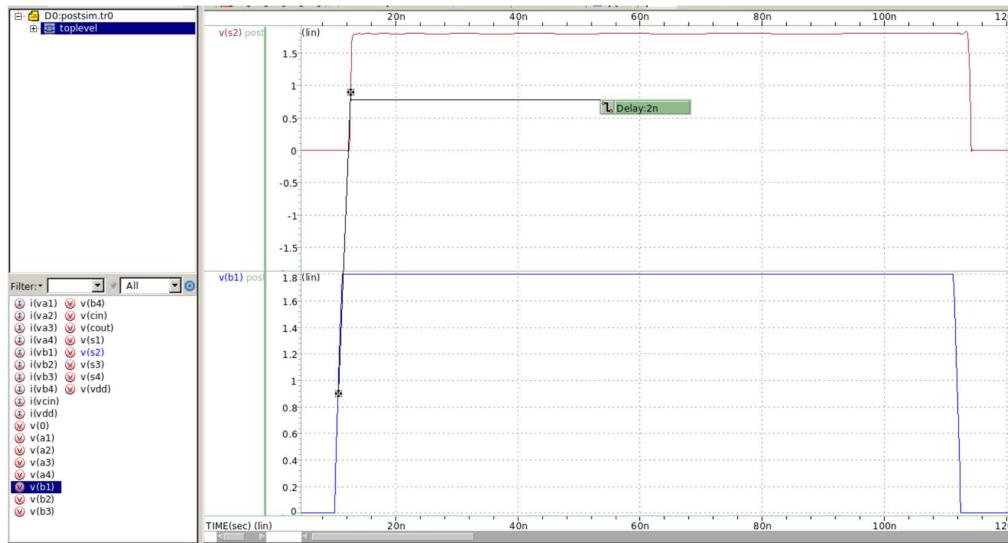


### 3. waveform of output delay in pre-sim



在 0001+0001 的例子中，最後一個 input 是 B1，最後一個 output 是 S2，可以看到 output delay 是 1.69ns。

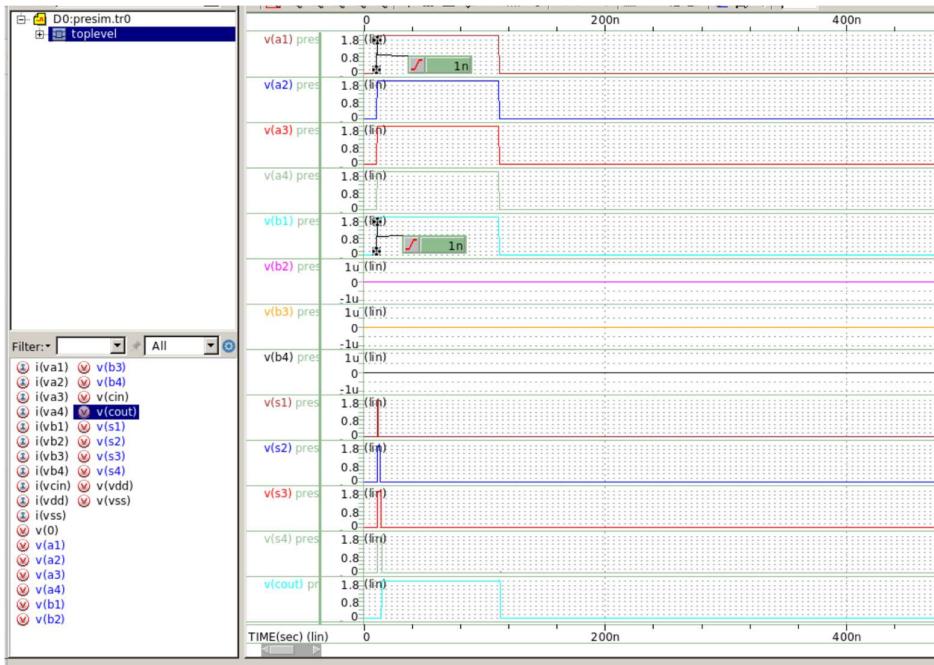
### 4. waveform of output delay in post-sim



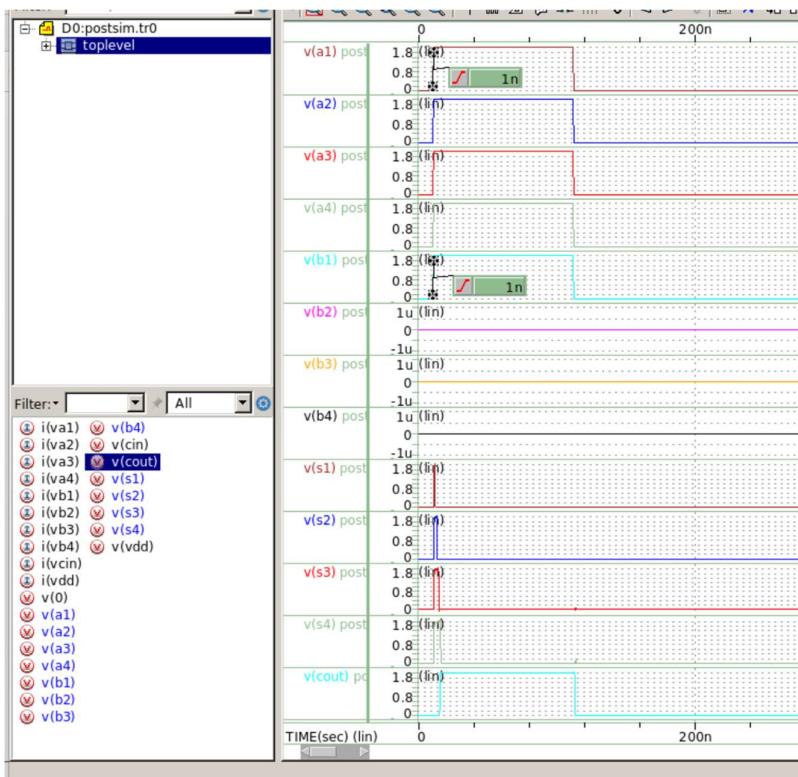
在 0001+0001 的例子中，最後一個 input 是 B1，最後一個 output 是 S2，可以看到 output delay 是 2ns。

b. 1111+0001

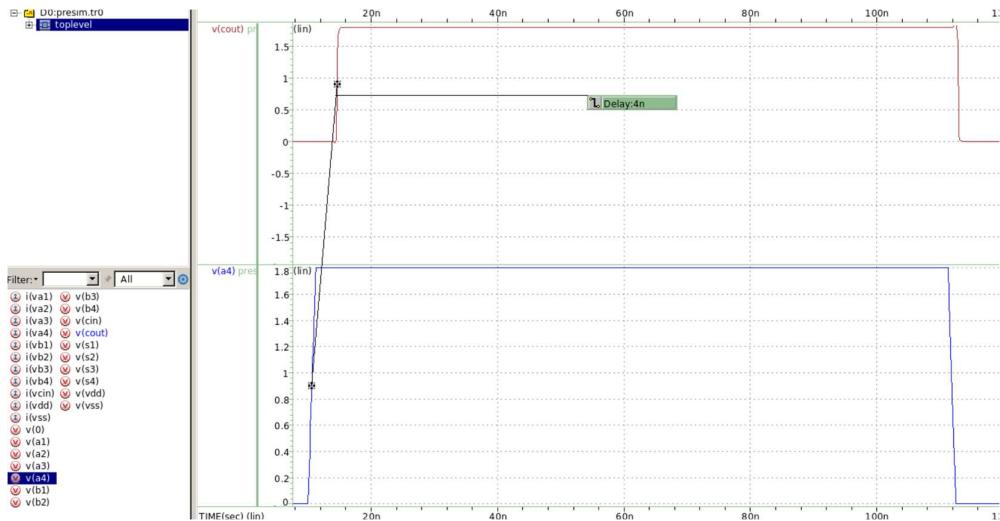
1.waveform of A1~A4, B1~B4, S1~S4 and Cout in pre-sim



2.waveform of A1~A4, B1~B4, S1~S4 and Cout in post-sim

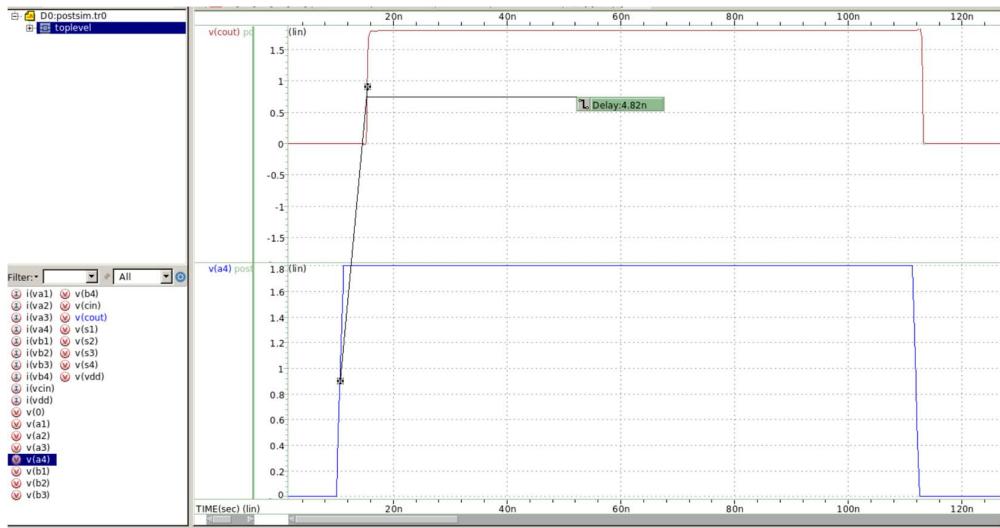


### 3. waveform of output delay in pre-sim



在  $1111+0001$  的例子中，最後一個 input 是  $A_4$ ，最後一個 output 是  $cout$ ，可以看到 output delay 是 4 ns。

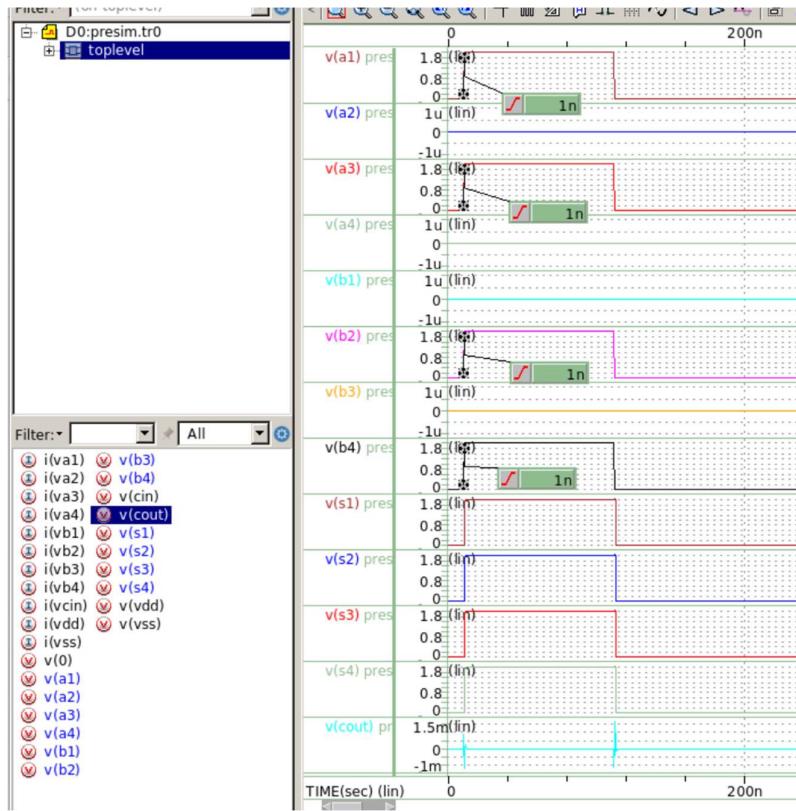
### 4. waveform of output delay in post-sim



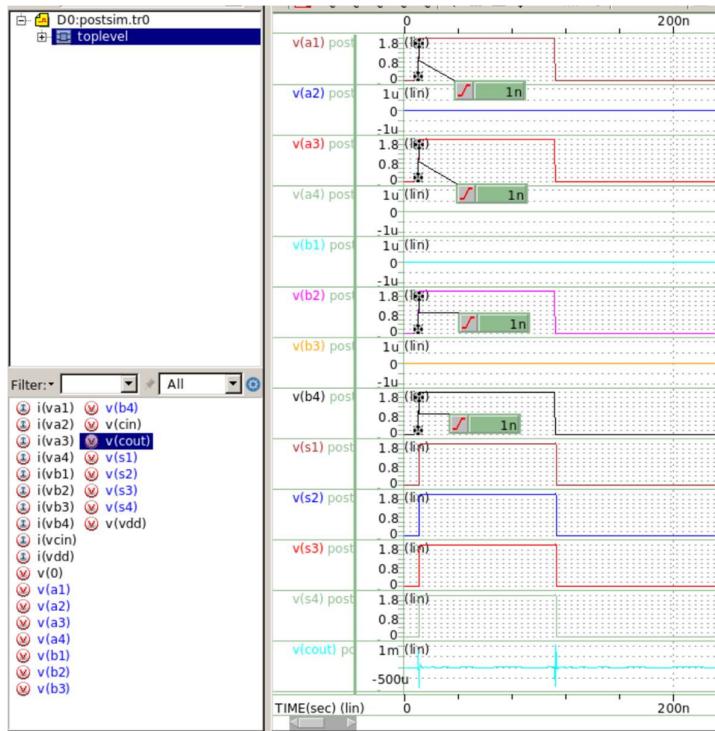
在  $1111+0001$  的例子中，最後一個 input 是  $A_4$ ，最後一個 output 是  $cout$ ，可以看到 output delay 是 4.82 ns。

c. 0101+1010

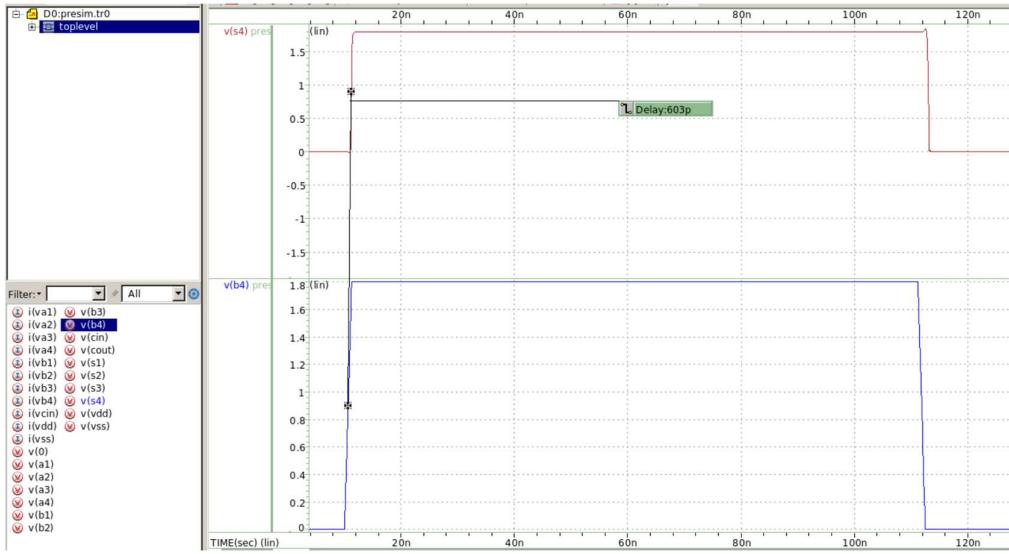
1.waveform of A1~A4, B1~B4, S1~S4 and Cout in pre-sim



2.waveform of A1~A4, B1~B4, S1~S4 and Cout in post-sim

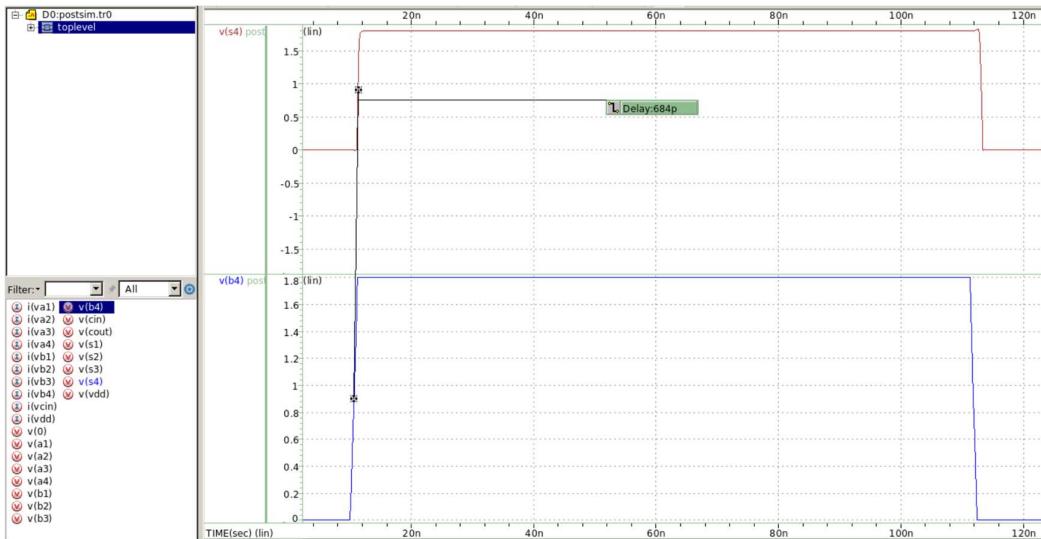


### 3.waveform of output delay in pre-sim



在 0101+1010 的例子中，最後一個 input 是 B4，最後一個 output 是 S4，可以看到 output delay 是 603 ps。

### 4.waveform of output delay in post-sim



在 0101+1010 的例子中，最後一個 input 是 B4，最後一個 output 是 S4，可以看到 output delay 是 684 ps。

[Analysis] Compare the results of pre-sim and post-sim. What is the difference and what is the reason?

我們可以觀察到不管是哪一種 testcase，普遍來講，post-sim 的 output delay 都比 pre-sim 的 output delay 時間長。

在 0001+0001 的例子中，presim 的 output delay 是 1.69ns，而 postsim 的 output delay 是 2ns。

在 1111+0001 的例子中，presim 的 output delay 是 4ns，而 postsim 的 output delay 是 4.82ns。

在 0101+1010 的例子中，presim 的 output delay 是 603ps，而 postsim 的 output delay 是 684ps。

Presim 所 include 的是 adder.sp，adder.sp 是一個理想狀況下 circuit 的連接狀況，不考慮 layout 的情況所推算的模擬結果。

post-sim 是去 include adder.pex.sp，adder.pex.sp 是根據你所產生的 layout 來去生成的連接狀況，中間有考量到因為 layout 所產生的寄生電阻等等。

因此，由於 pre-sim 僅考量到理想化的狀況，而 post-sim 有考量到 layout 所產生電阻的實際繞線狀況，post-sim 的 output delay 時間會比較長。