

Regfile

The full OpenLane flow is performed. According to reports/signoff/25-rcx_sta.rpt file:

No Violations

25-rcx_sta.rpt file shows there is no max slew or max cap violation :

```
=====
report_check_types -max_slew -max_cap -max_fanout -violators
=====
max_fanout

Pin                                     Limit Fanout  Slack
-----
_5957_/X                               10      24    -14 (VIOLATED)
input40/X                              10      24    -14 (VIOLATED)
_5167_/X                               10      19     -9 (VIOLATED)
_4690_/X                               10      17     -7 (VIOLATED)
_5627_/X                               10      17     -7 (VIOLATED)
_5681_/X                               10      17     -7 (VIOLATED)
_5762_/X                               10      17     -7 (VIOLATED)
_4466_/X                               10      16     -6 (VIOLATED)
clkbuf_0_clk/X                         10      16     -6 (VIOLATED)
_4671_/X                               10      15     -5 (VIOLATED)
_5396_/X                               10      15     -5 (VIOLATED)
clkbuf_leaf_61_clk/X                   10      15     -5 (VIOLATED)
_4669_/X                               10      14     -4 (VIOLATED)
_4723_/X                               10      14     -4 (VIOLATED)
clkbuf_leaf_114_clk/X                  10      14     -4 (VIOLATED)
clkbuf_leaf_22_clk/X                   10      14     -4 (VIOLATED)
clkbuf_leaf_5_clk/X                    10      14     -4 (VIOLATED)
_4558_/X                               10      13     -3 (VIOLATED)
_4654_/X                               10      13     -3 (VIOLATED)
_4672_/X                               10      13     -3 (VIOLATED)
_4708_/X                               10      13     -3 (VIOLATED)
_4750_/X                               10      13     -3 (VIOLATED)
_4926_/X                               10      13     -3 (VIOLATED)
_5788_/X                               10      13     -3 (VIOLATED)
_6277_/X                               10      13     -3 (VIOLATED)
clkbuf_leaf_31_clk/X                   10      13     -3 (VIOLATED)
clkbuf_leaf_39_clk/X                   10      13     -3 (VIOLATED)
```

clkbuf_leaf_45_clk/X	10	13	-3 (VIOLATED)
clkbuf_leaf_49_clk/X	10	13	-3 (VIOLATED)
4402/X	10	12	-2 (VIOLATED)
4704/X	10	12	-2 (VIOLATED)
4707/X	10	12	-2 (VIOLATED)
4756/X	10	12	-2 (VIOLATED)
4759/X	10	12	-2 (VIOLATED)
4792/X	10	12	-2 (VIOLATED)
5251/X	10	12	-2 (VIOLATED)
6221/X	10	12	-2 (VIOLATED)
6445/X	10	12	-2 (VIOLATED)
clkbuf_leaf_11_clk/X	10	12	-2 (VIOLATED)
clkbuf_leaf_17_clk/X	10	12	-2 (VIOLATED)
clkbuf_leaf_93_clk/X	10	12	-2 (VIOLATED)
4326/X	10	11	(VIOLATED)
4329/X	10	11	(VIOLATED)
4364/X	10	11	(VIOLATED)
4371/X	10	11	(VIOLATED)
4380/X	10	11	(VIOLATED)
4392/X	10	11	(VIOLATED)
4408/X	10	11	(VIOLATED)
4420/X	10	11	(VIOLATED)
4436/X	10	11	(VIOLATED)
4565/X	10	11	(VIOLATED)
4591/X	10	11	(VIOLATED)
4606/X	10	11	(VIOLATED)
4652/X	10	11	(VIOLATED)
4659/X	10	11	(VIOLATED)
4712/X	10	11	(VIOLATED)
4717/X	10	11	(VIOLATED)
4747/X	10	11	(VIOLATED)
4748/X	10	11	(VIOLATED)
4752/X	10	11	(VIOLATED)
4853/X	10	11	(VIOLATED)
4881/X	10	11	(VIOLATED)
4996/X	10	11	(VIOLATED)
5185/X	10	11	(VIOLATED)
5252/X	10	11	(VIOLATED)
5266/X	10	11	(VIOLATED)
5307/X	10	11	(VIOLATED)
5310/X	10	11	(VIOLATED)
6095/X	10	11	(VIOLATED)
6517/X	10	11	(VIOLATED)
6843/X	10	11	(VIOLATED)
7236/X	10	11	(VIOLATED)
8516/X	10	11	(VIOLATED)
clkbuf_leaf_101_clk/X	10	11	(VIOLATED)
clkbuf_leaf_18_clk/X	10	11	(VIOLATED)

```

clkbuf_leaf_34_clk/X          10    11    (VIOLATED)
clkbuf_leaf_37_clk/X          10    11    (VIOLATED)
clkbuf_leaf_56_clk/X          10    11    (VIOLATED)
clkbuf_leaf_81_clk/X          10    11    (VIOLATED)
clkbuf_leaf_87_clk/X          10    11    (VIOLATED)
clkbuf_leaf_94_clk/X          10    11    (VIOLATED)

```

```

=====
max slew violation count 0
max fanout violation count 81
max cap violation count 0
=====

```

Results

- Design area 82279 u² 9% utilization. According to worst_slack reports:

```

=====
report_worst_slack -max (Setup)
=====

```

```
worst slack 1.75
```

```

=====
report_worst_slack -min (Hold)
=====

```

```
worst slack 0.30
```

As the worst slack from hold can be 0.30 the minimum clock period can be 10.30 ns which makes 97MHz the maximum clock frequency.

```

=====
report_checks -unconstrained
=====

```

```

Startpoint: rst (input port clocked by clk)
Endpoint: _9279_ (recovery check against rising-edge clock clk)
Path Group: **async_default**
Path Type: max

```

Fanout	Cap	Slew	Delay	Time	Description
			0.00	0.00	clock clk (rise edge)
			0.00	0.00	clock network delay (propagated)
			2.00	2.00	^ input external delay
	0.03		0.02	2.02	^ rst (in)

1	0.01					rst (net)
		0.03	0.00	2.02	^	input11/A (sky130_fd_sc_hd__buf
		0.22	0.21	2.23	^	input11/X (sky130_fd_sc_hd__buf
4	0.11					net11 (net)
		0.23	0.04	2.27	^	fanout246/A (sky130_fd_sc_hd__c
		0.24	0.35	2.62	^	fanout246/X (sky130_fd_sc_hd__c
5	0.08					net246 (net)
		0.25	0.01	2.64	^	fanout193/A (sky130_fd_sc_hd__bu
		0.22	0.31	2.95	^	fanout193/X (sky130_fd_sc_hd__bu
5	0.05					net193 (net)
		0.22	0.00	2.95	^	fanout178/A (sky130_fd_sc_hd__bu
		0.25	0.33	3.28	^	fanout178/X (sky130_fd_sc_hd__bu
7	0.05					net178 (net)
		0.25	0.00	3.28	^	fanout177/A (sky130_fd_sc_hd__c
		0.18	0.32	3.60	^	fanout177/X (sky130_fd_sc_hd__c
10	0.06					net177 (net)
		0.18	0.00	3.60	^	fanout176/A (sky130_fd_sc_hd__c
		0.17	0.29	3.89	^	fanout176/X (sky130_fd_sc_hd__c
10	0.05					net176 (net)
		0.17	0.00	3.89	^	_9279_/RESET_B (sky130_fd_sc_hd
				3.89		data arrival time
			10.00	10.00		clock clk (rise edge)
			0.00	10.00		clock source latency
		0.32	0.22	10.22	^	clk (in)
2	0.07					clk (net)
		0.32	0.00	10.22	^	clkbuf_0_clk/A (sky130_fd_sc_hd
		0.28	0.36	10.58	^	clkbuf_0_clk/X (sky130_fd_sc_hd
16	0.27					clknet_0_clk (net)
		0.28	0.01	10.59	^	clkbuf_4_8_0_clk/A (sky130_fd_sc
		0.19	0.29	10.88	^	clkbuf_4_8_0_clk/X (sky130_fd_sc
8	0.11					clknet_4_8_0_clk (net)
		0.19	0.01	10.89	^	clkbuf_leaf_16_clk/A (sky130_fd
		0.05	0.17	11.06	^	clkbuf_leaf_16_clk/X (sky130_fd
8	0.03					clknet_leaf_16_clk (net)
		0.05	0.00	11.06	^	_9279_/CLK (sky130_fd_sc_hd__df
			-0.25	10.81		clock uncertainty
			0.00	10.81		clock reconvergence pessimism
			0.20	11.01		library recovery time
				11.01		data required time

				11.01		data required time
				-3.89		data arrival time

				7.13		slack (MET)

Startpoint: rd_addr0[2] (input port clocked by clk)

Endpoint: rd_dout0[10] (output port clocked by clk)

Path Group: clk

Path Type: max

Fanout	Cap	Slew	Delay	Time	Description

			0.00	0.00	clock clk (rise edge)
			0.00	0.00	clock network delay (propagated)
			2.00	2.00	^ input external delay
1	0.01	0.04	0.02	2.02	^ rd_addr0[2] (in)
					rd_addr0[2] (net)
		0.04	0.00	2.02	^ input3/A (sky130_fd_sc_hd__buf_6
					input3/X (sky130_fd_sc_hd__buf_6
9	0.12				net3 (net)
					^ _4854_/A (sky130_fd_sc_hd__buf_2
		0.25	0.24	2.26	^ input3/X (sky130_fd_sc_hd__buf_6
					net3 (net)
		0.25	0.02	2.29	^ _4854_/A (sky130_fd_sc_hd__buf_2
					^ _4854_/X (sky130_fd_sc_hd__buf_2
10	0.05				_1516_ (net)
					^ _4856_/A_N (sky130_fd_sc_hd__and
		0.15	0.33	2.94	v _4856_/X (sky130_fd_sc_hd__and2k
					1518 (net)
		0.15	0.00	2.94	v _4936_/A (sky130_fd_sc_hd__and2_
					v _4936_/X (sky130_fd_sc_hd__and2_
4	0.03				_1597_ (net)
					v _4937_/A (sky130_fd_sc_hd__clkbu
		0.15	0.29	3.52	v _4937_/X (sky130_fd_sc_hd__clkbu
					1598 (net)
10	0.07				v _5241_/A2 (sky130_fd_sc_hd__a211
					v _5241_/X (sky130_fd_sc_hd__a211
1	0.01				_1893_ (net)
					v _5255_/B (sky130_fd_sc_hd__or4_2
		0.11	0.57	4.58	v _5255_/X (sky130_fd_sc_hd__or4_2
					1907 (net)
		0.11	0.00	4.58	v _5269_/A (sky130_fd_sc_hd__or4_2
					v _5269_/X (sky130_fd_sc_hd__or4_2
1	0.04				_1921_ (net)
					v _5270_/A (sky130_fd_sc_hd__buf_4
		0.10	0.29	5.76	v _5270_/X (sky130_fd_sc_hd__buf_4
					net51 (net)
1	0.08		0.02	5.78	v output51/A (sky130_fd_sc_hd__buf1
					v output51/X (sky130_fd_sc_hd__buf1
1	0.03		0.09	6.00	rd_dout0[10] (net)
					v rd_dout0[10] (out)
				6.00	data arrival time
			10.00	10.00	clock clk (rise edge)
			0.00	10.00	clock network delay (propagated)
			-0.25	9.75	clock uncertainty
			0.00	9.75	clock reconvergence pessimism

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-2.00    7.75    output external delay
          7.75    data required time
-----
          7.75    data required time
        -6.00    data arrival time
-----
          1.75    slack (MET)

=====
report_checks --slack_max -0.01
=====
No paths found.

```

The critical path is caused by the reading of the memory. Reset takes less time, almost half of reading the memory. The reason for the critical path is high fan-in. Despite the synthesizer made use of buffers and used smaller input sized logic gates, to read 32 registers and direct it to the output requires high overall fan-in.