Project

8-bit Carry Save Multiplier Design with and without Pipelining

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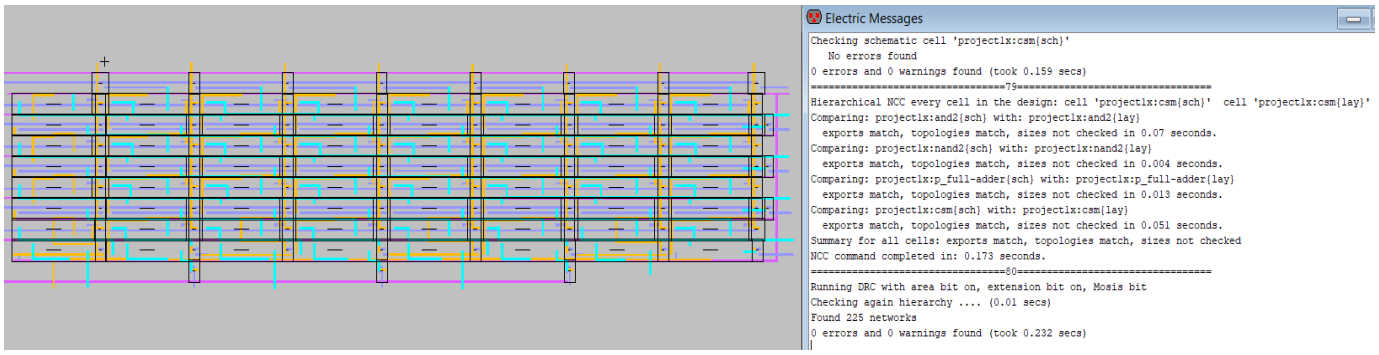
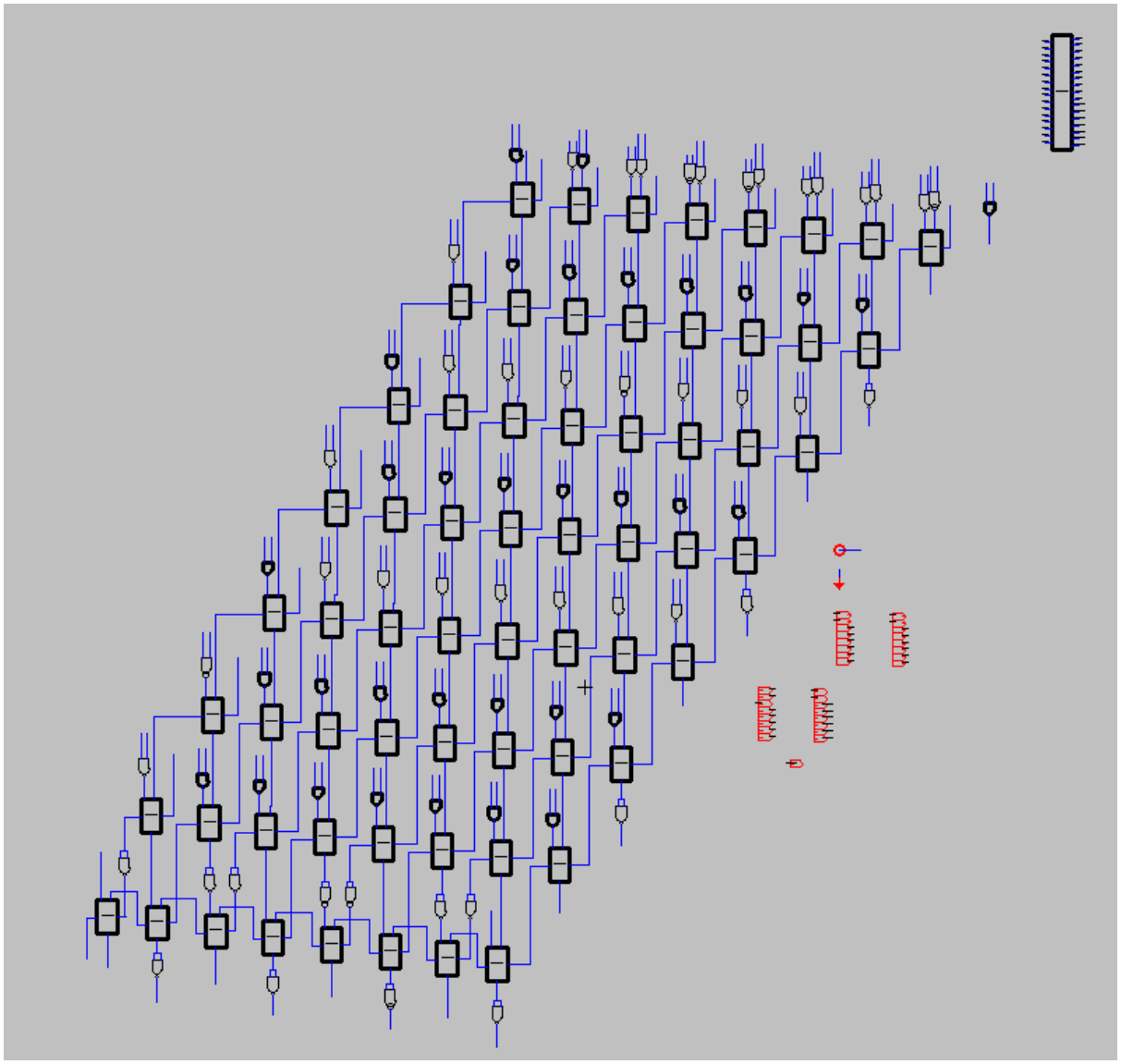
Brief Summary Table

DRS and LVS Status	Clean
Area of CSM Layout (In micro-meter square)	194.61171125
Number of test patterns used for functionality testing of CSM	8
Maximum Clock Frequency without pipelining for Schematic	2.76E+09 Hz
Maximum Clock Frequency without pipelining for Layout (RC – extracted)	1.56E+09 Hz
Maximum Clock Frequency with pipelining for Layout (RC – extracted)	5.03E +09 Hz

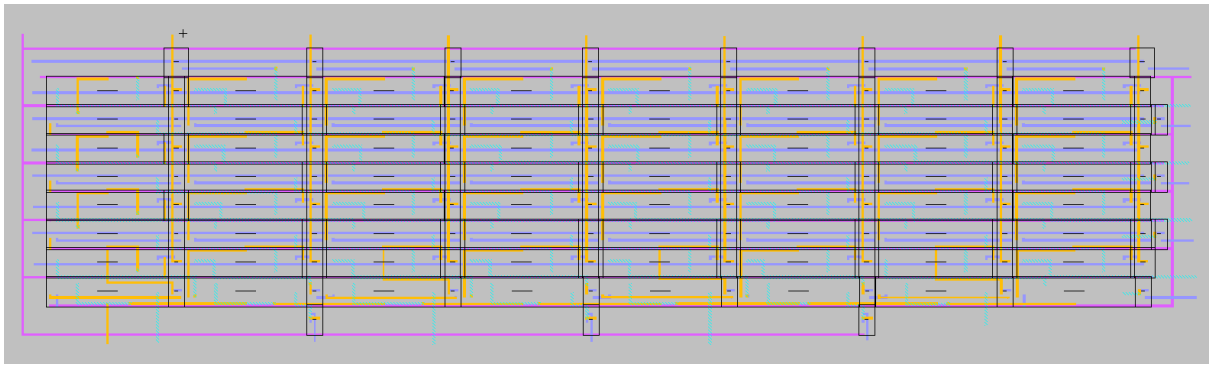
DRS and LVS Clean



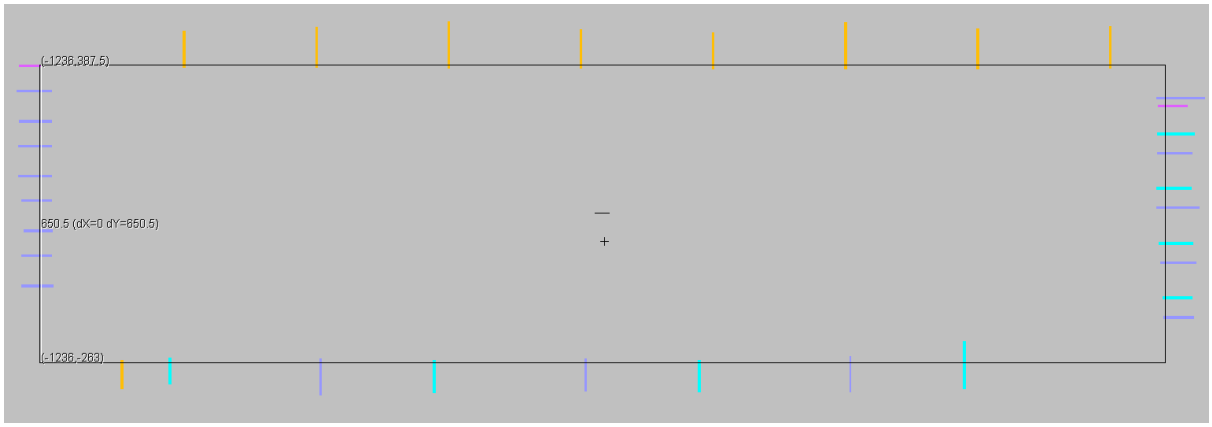
Unpipelined CSM Schematic

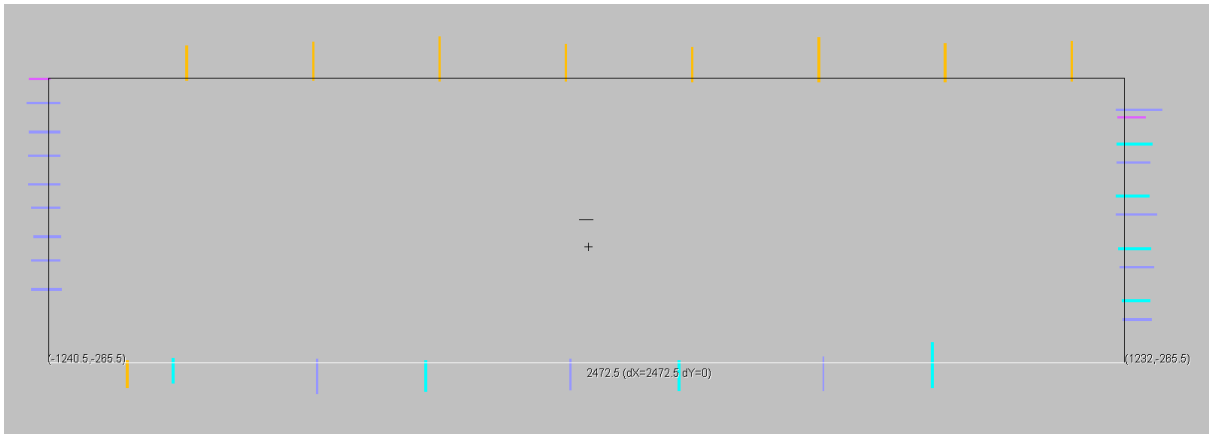


Unpipelined CSM Layout



Area of CSM Layout





Width = 2472.5 * (lambda)

Height = 650.5 * (lambda)

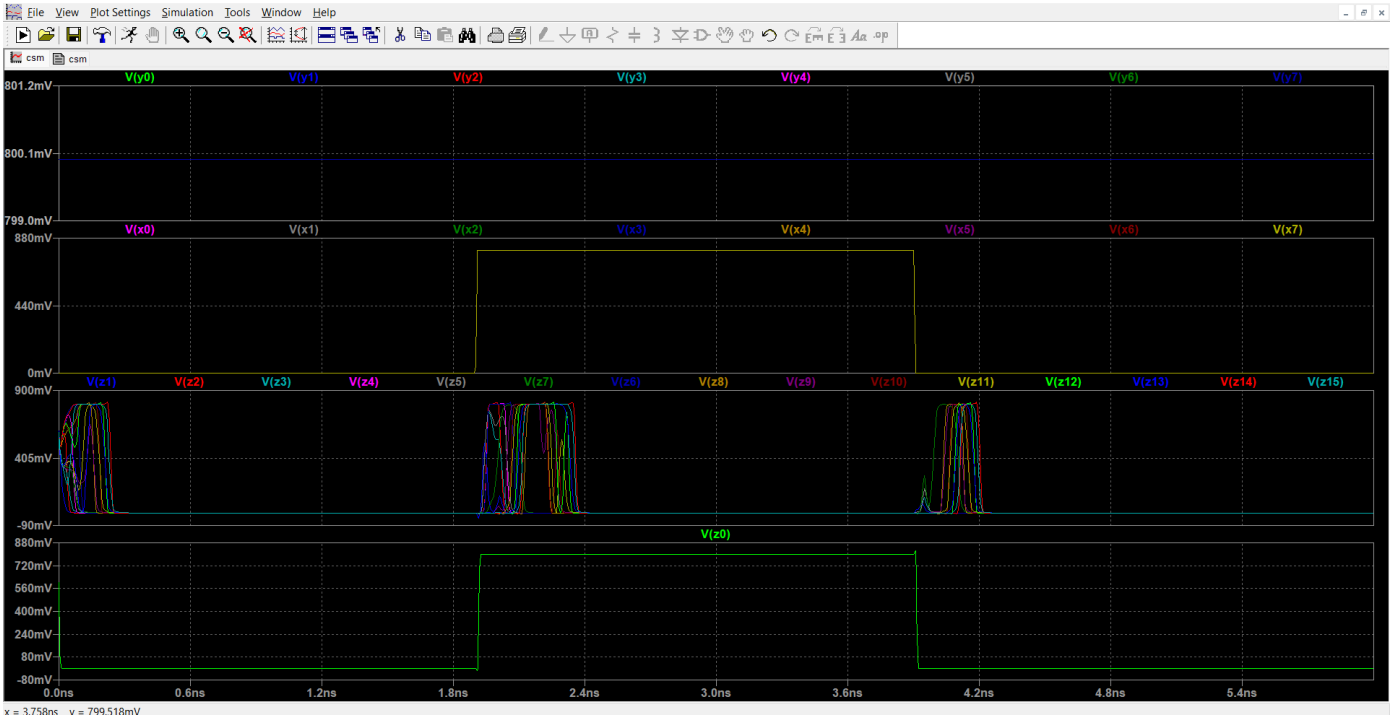
Area of CSM Layout = 2472.5*650.5*(11 nm * 11 nm)

Area of CSM Layout = 194.61171125 µm2

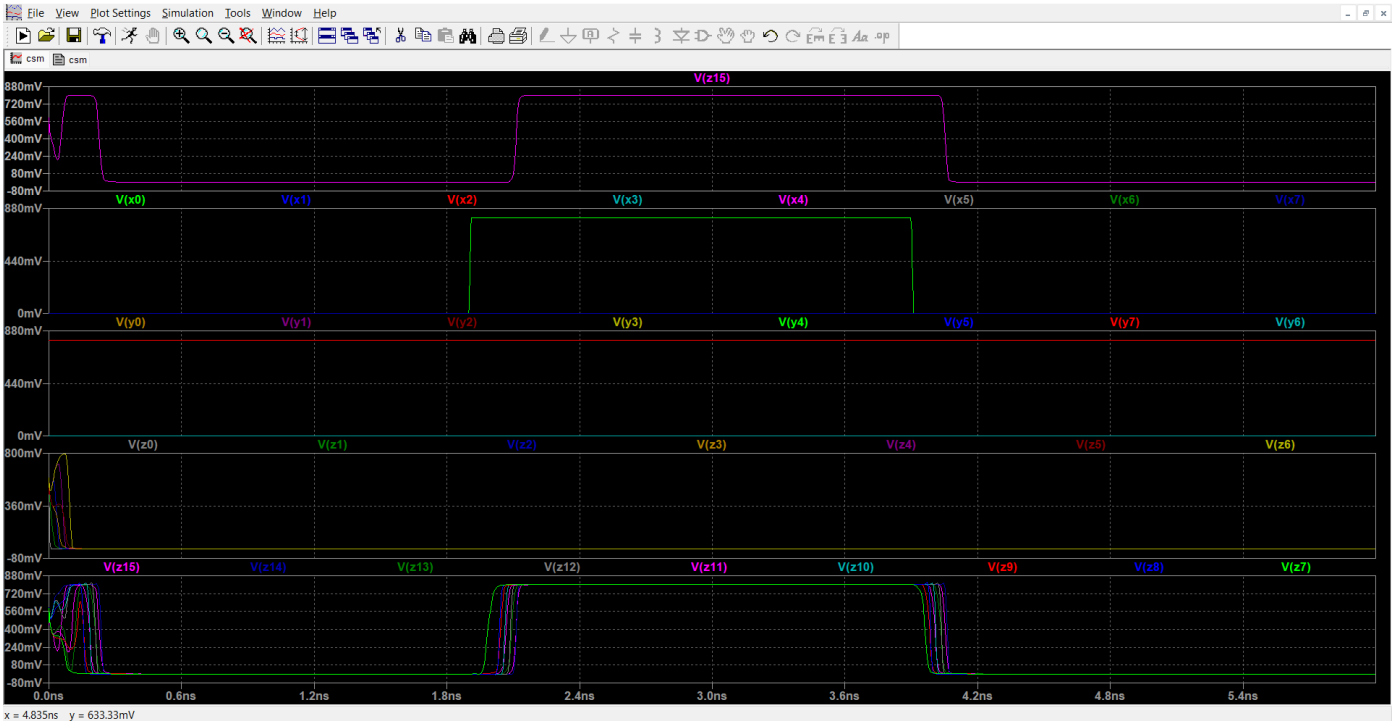
Functionality Testing (Input Combinations) Table

A (dec)	A (binary)	B (dec)	B (binary)	S (dec)	S (binary)	Functionality
-1	11111111	-1	11111111	1	0000000000000001	True
1	00000001	-128	10000000	-128	1111111110000000	True
17	00010001	28	00011100	476	0000000111011100	True
21	00010101	53	00110101	1113	0000010001011001	True
-11	11110101	-11	11110101	121	0000000001111001	True
127	01111111	-128	10000000	-16256	1100000010000000	True
-128	10000000	-1	11111111	128	0000000010000000	True
-69	10111011	119	01110111	-8211	1101111111101101	True

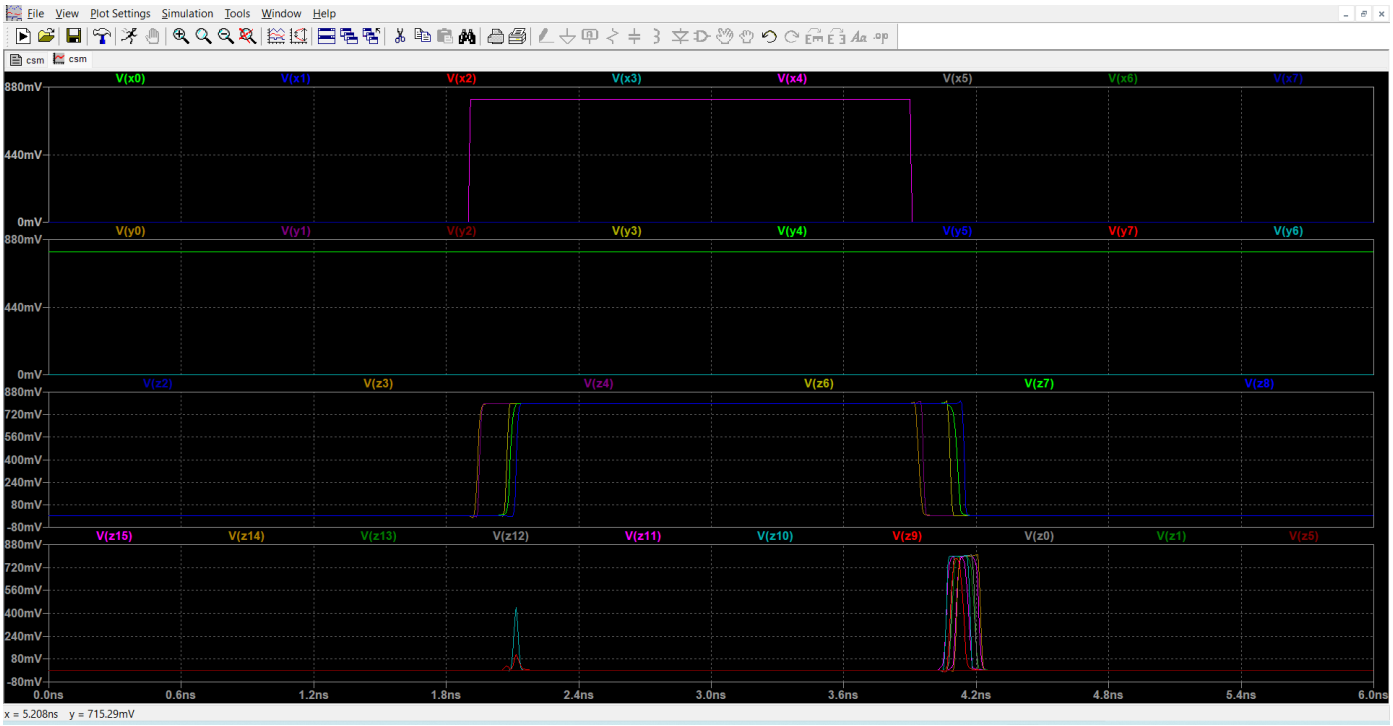
Case-1: A = -1, B = -1



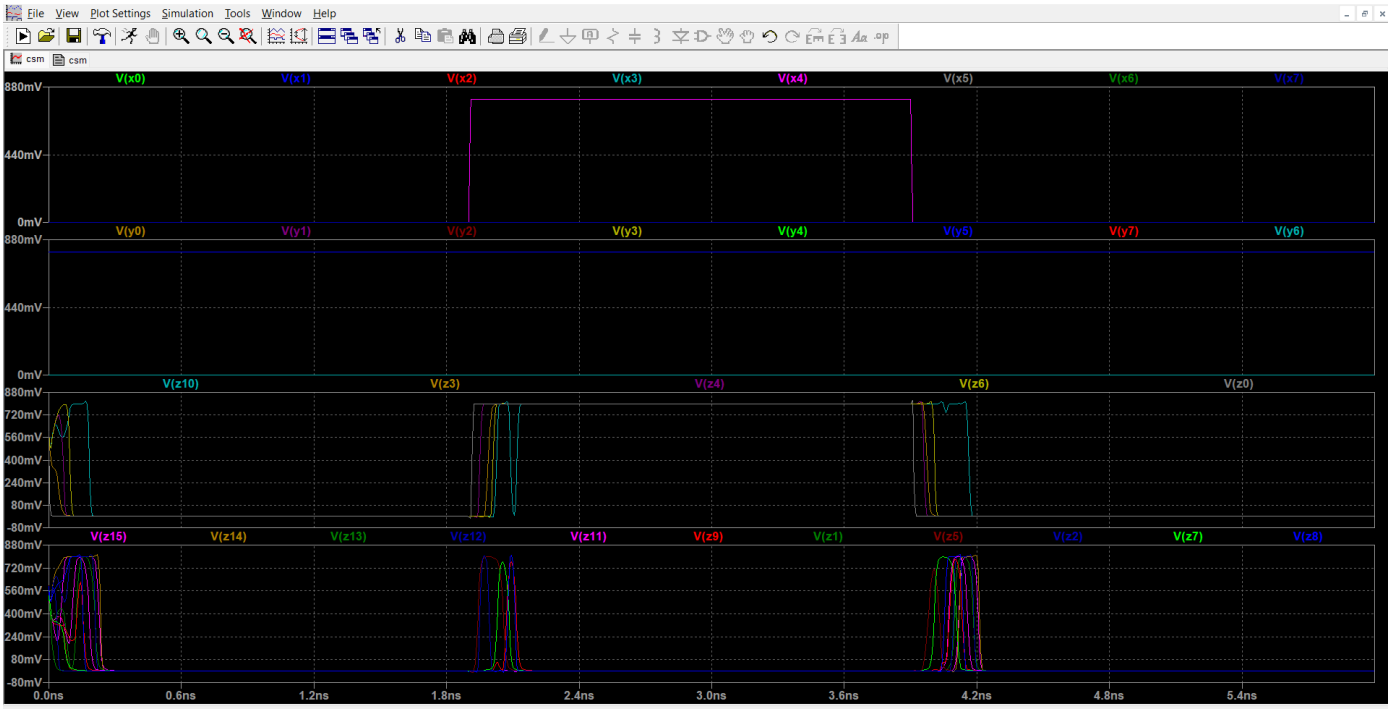
Case-2: A = 1, B = -128



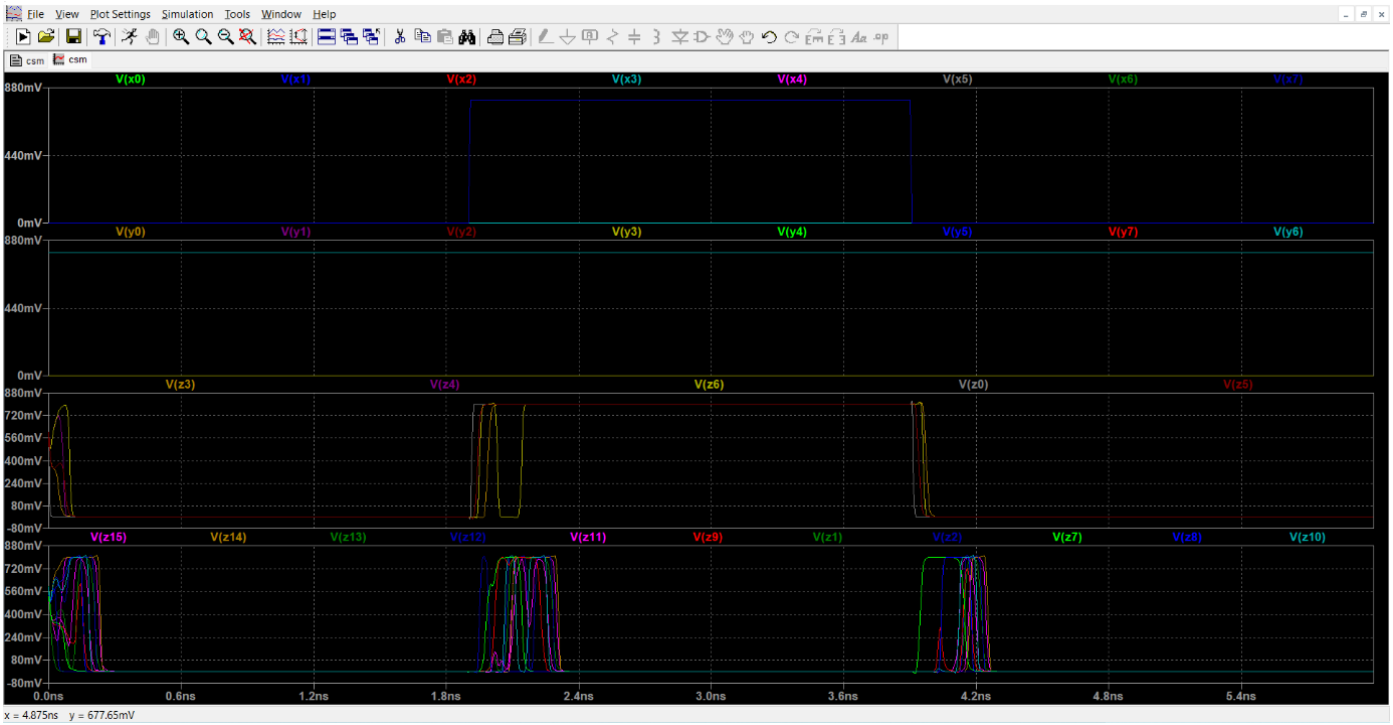
Case-3: A = 17, B = 28



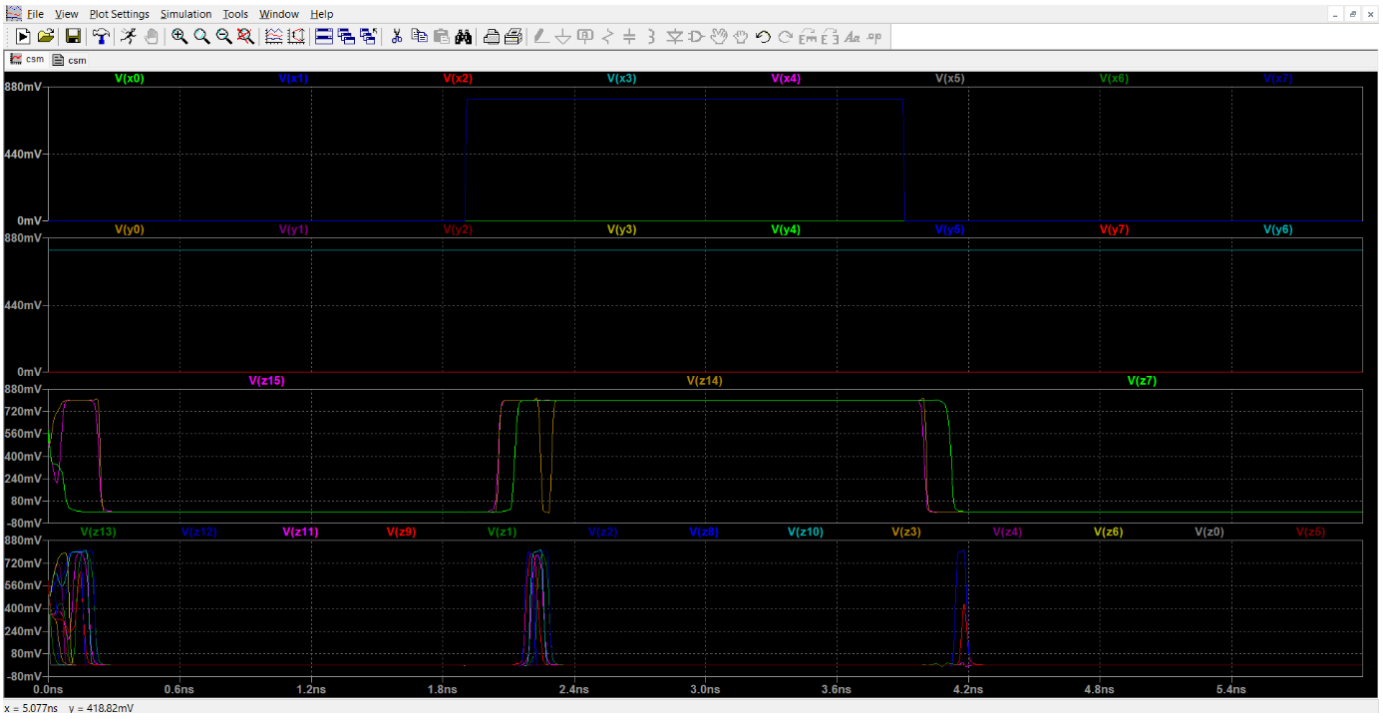
Case-4: A = 21, B = 53



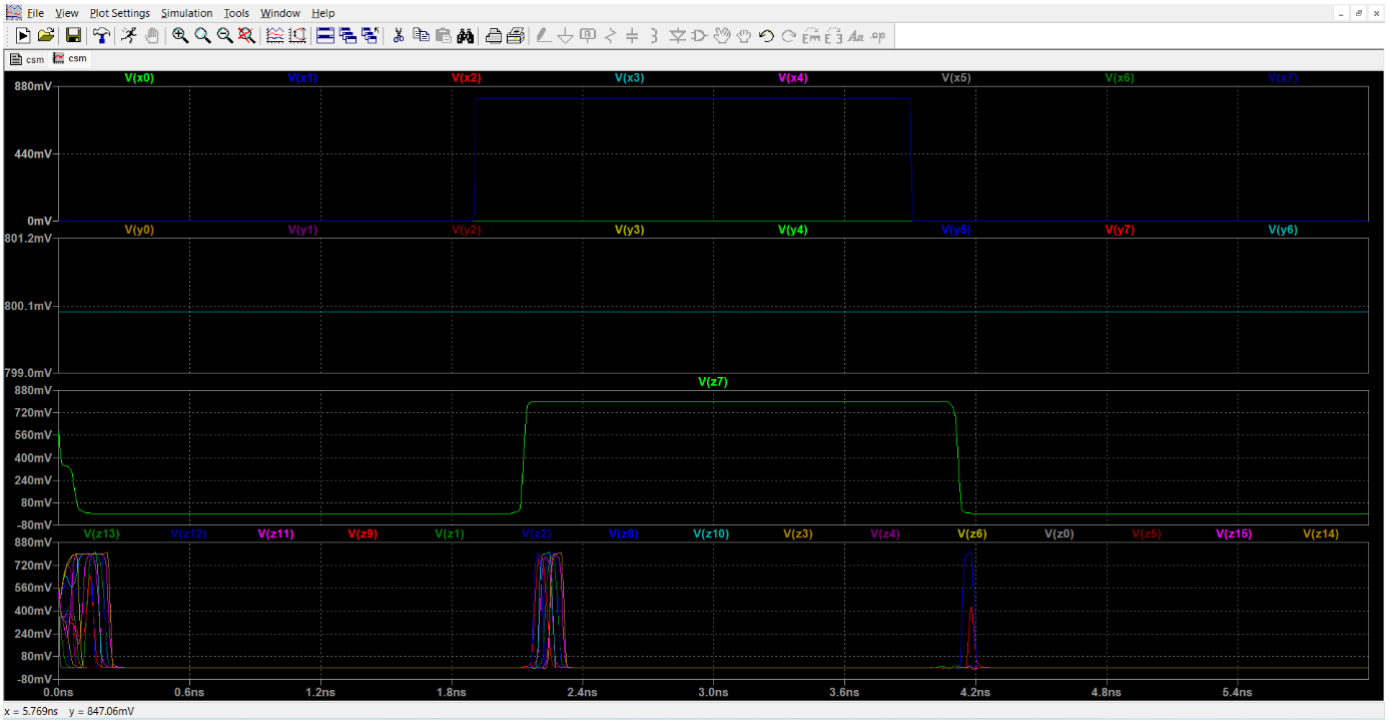
Case-5: A = -11, B = -11



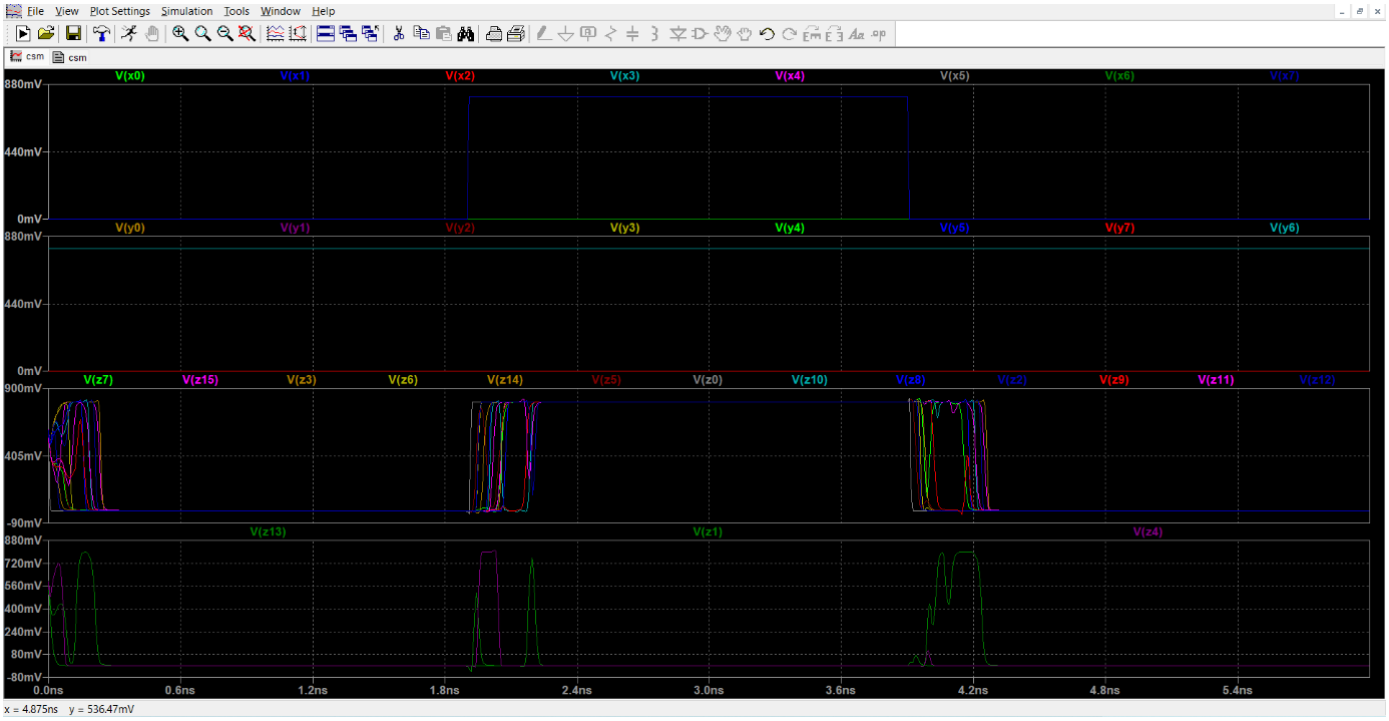
Case-6: A = 127, B = -128



Case-7: A = -128, B = -1

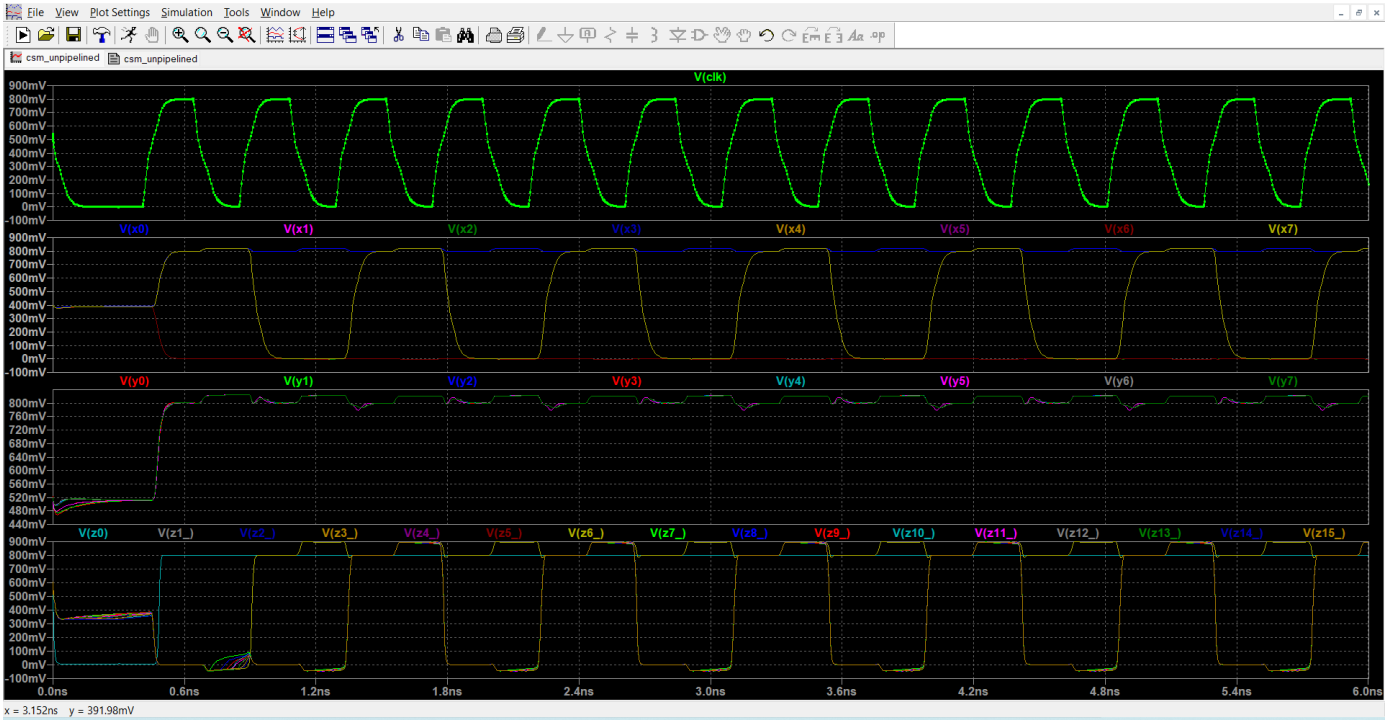


Case-8: A = -69, B = 119

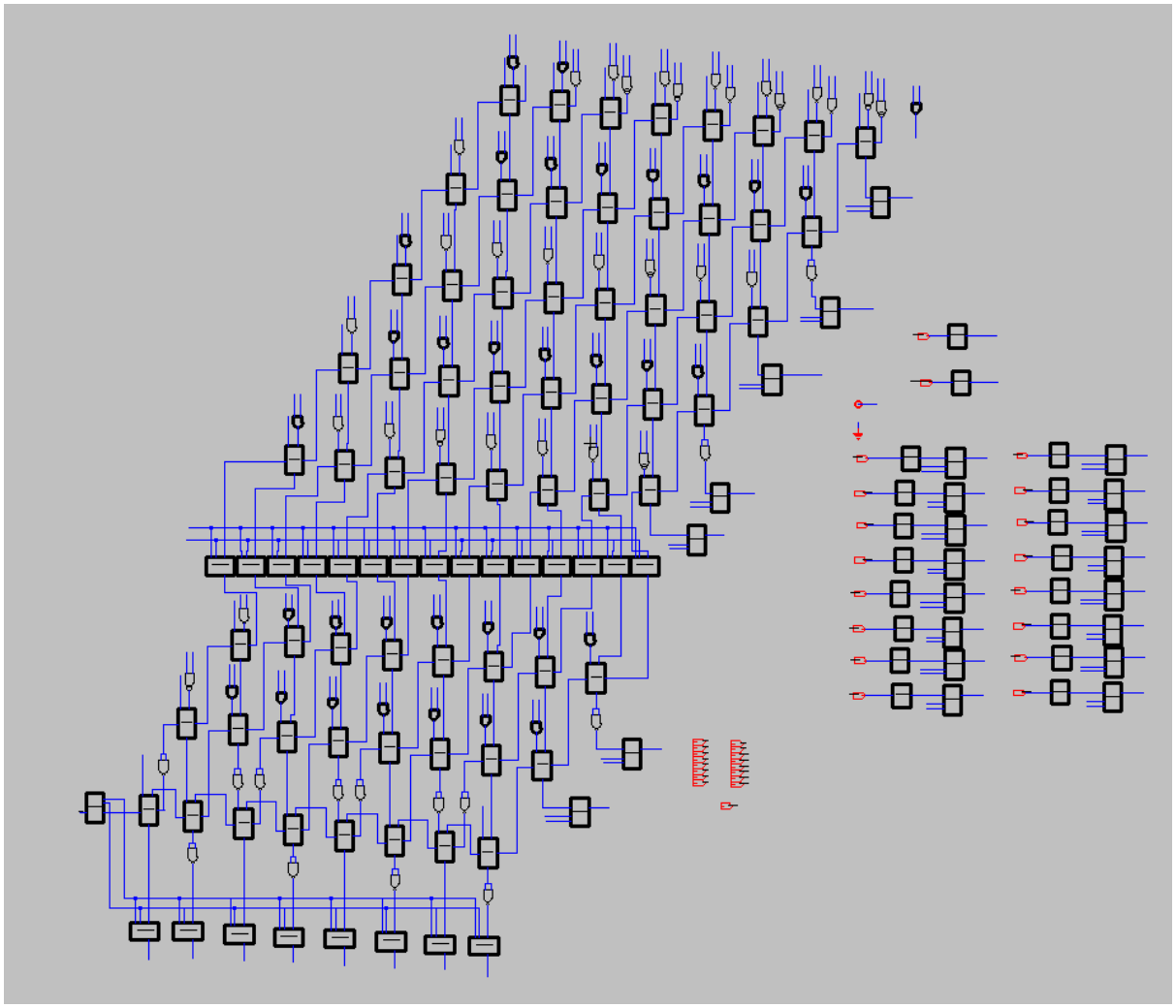


Maximum Operating Frequency of CSM

	Maximum clock frequency (Units:Hz)
Unpipelined CSM (schematic)	2.76E+09
Unpipelined CSM (layout)	1.56E+09

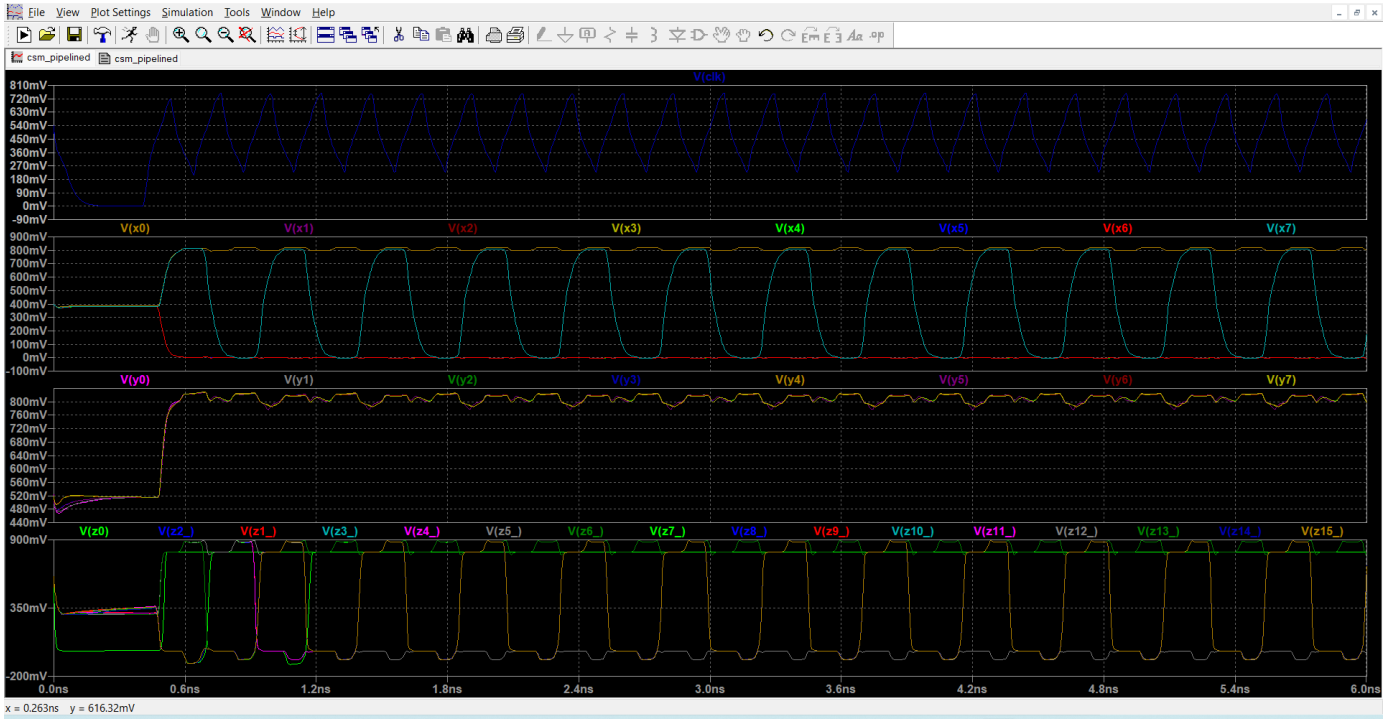


Pipelined CSM Schematic



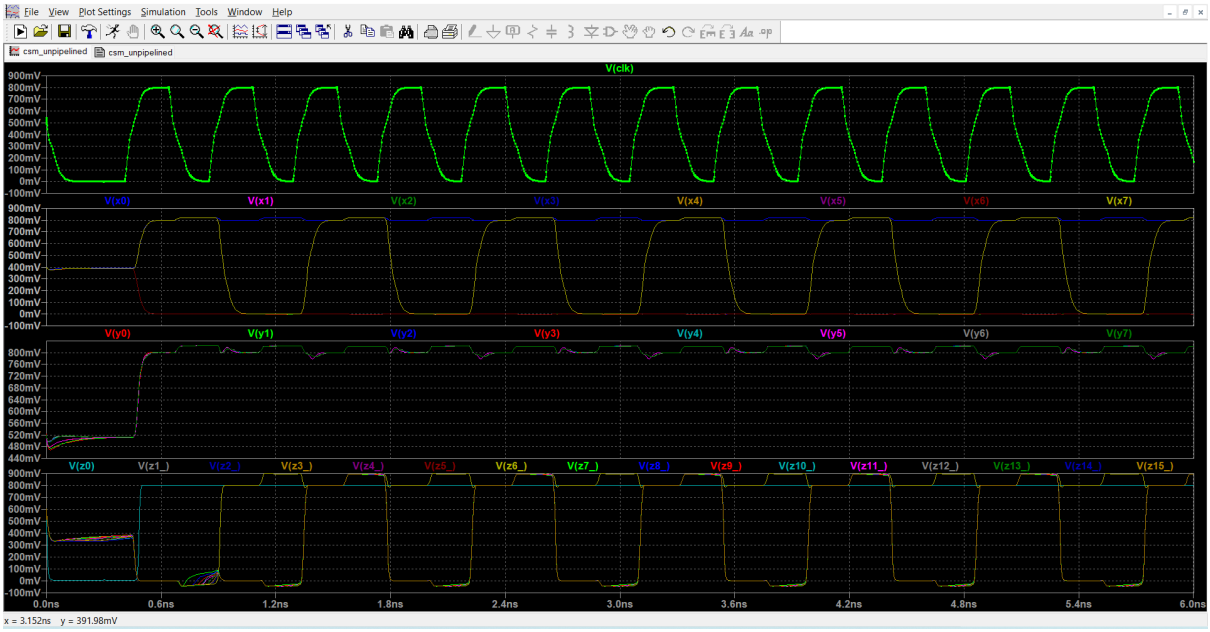
Maximum Clock Frequency with Pipeline (RC-extracted layout)

Max Clock Frequency = 5.03E+09 Hz

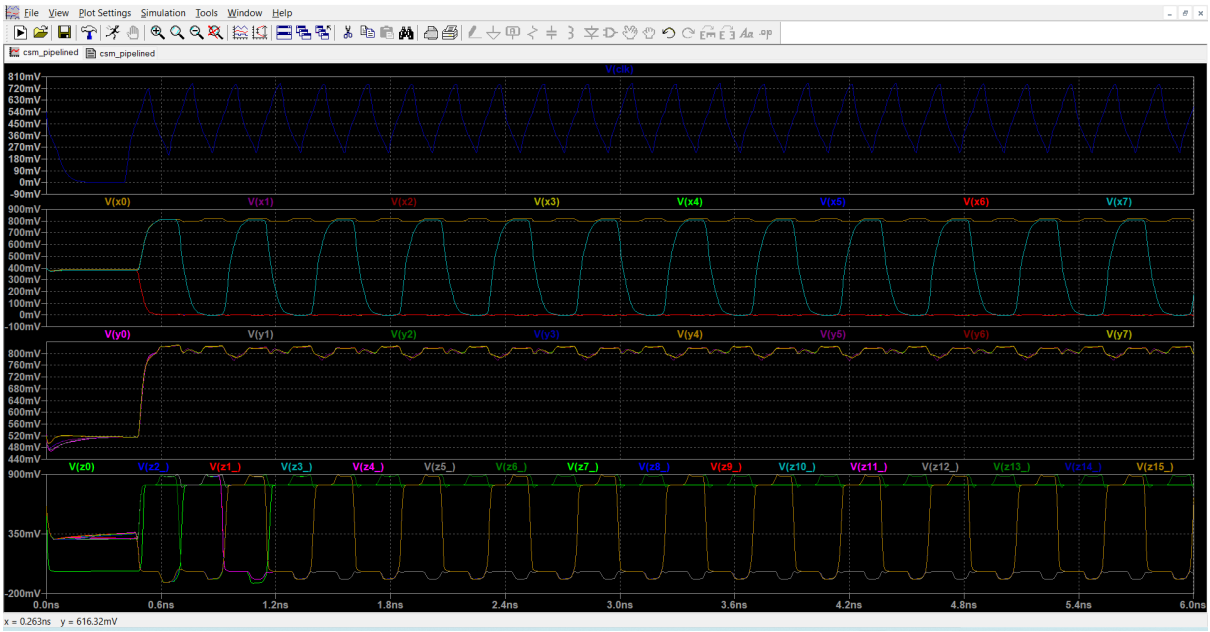


Comparison between Clock Frequency Spice Simulations of Unpipelined CSM and Pipelined CSM

(Without Pipeline)

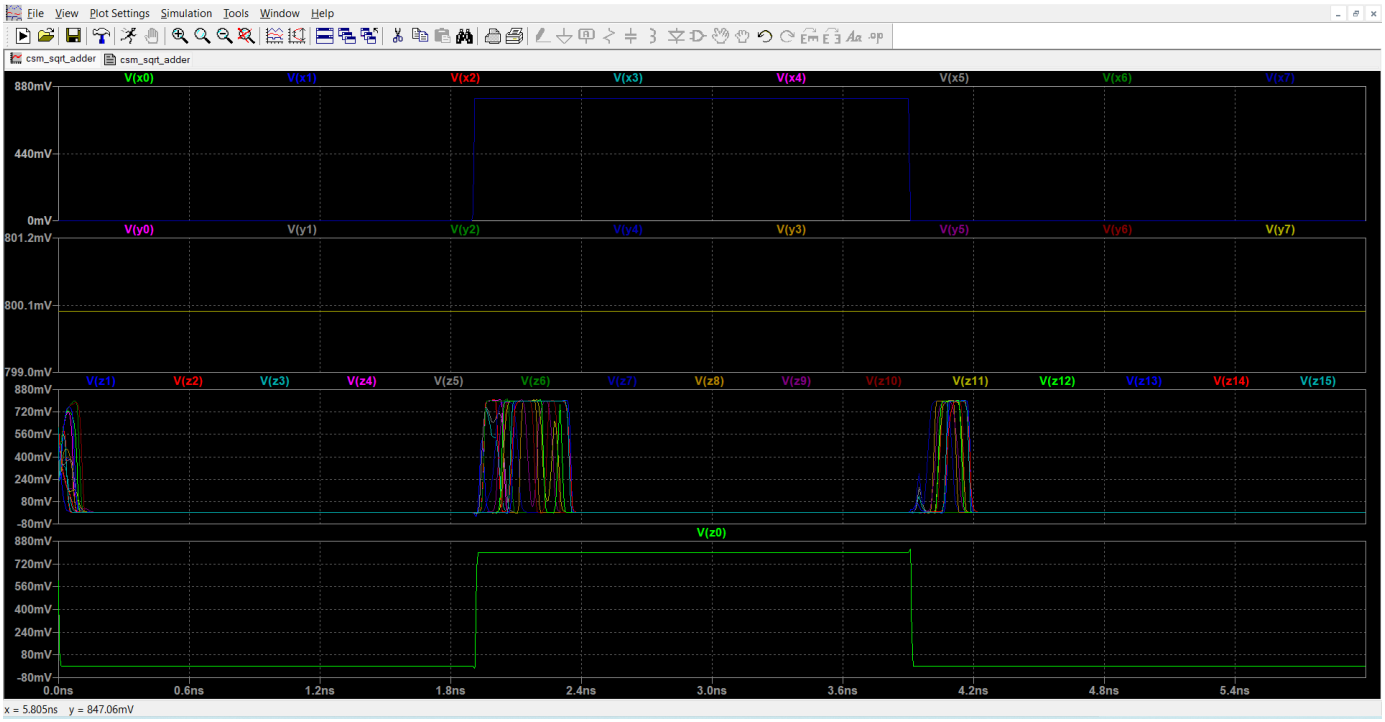


(With Pipeline)

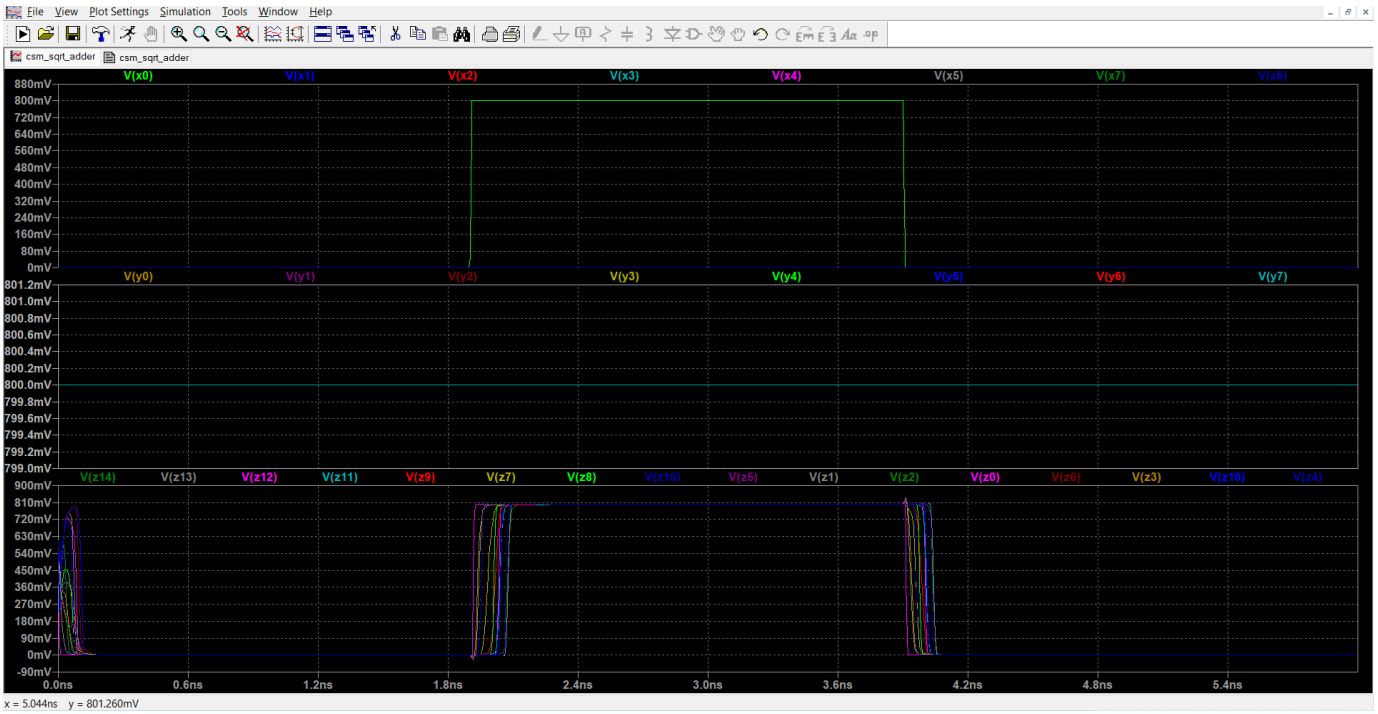


Spice Stimulations Vector Merge Sqrt and Ripple Adders

Case-1: A = -1, B = -1



Case-2: A = -1, B = 1



A (dec)	A (binary)	B (dec)	B (binary)	S (dec)	S (binary)	Sqrt Carry Delay	Ripple Carry Delay
1	00000001	-1	11111111	-1	1111111111111111	1.64E-10	2.07E-10
1	00000001	-128	10000000	-128	1111111110000000	1.67E-10	2.09E-10
17	00010001	28	00011100	476	0000000111011100	2.12E-10	4.67E-11
21	00010101	53	00110101	1113	0000010001011001	2.09E-10	2.14E-10
-11	11110101	-11	11110101	121	0000000001111001	2.36E-10	2.40E-10
127	01111111	-128	10000000	-16256	1100000010000000	1.65E-10	1.48E-10
-128	10000000	-1	11111111	128	0000000010000000	2.22E-10	2.24E-10
-1	11111111	-1	11111111	1	0000000000000001	9.69E-12	9.71E-12