California State University, Northridge

College of Engineering & Computer Science

Electrical and Computer Engineering Department

ECE 443L Digital Electronics Laboratory Report 5

CMOS based Monostable Multivibrators Circuit Design

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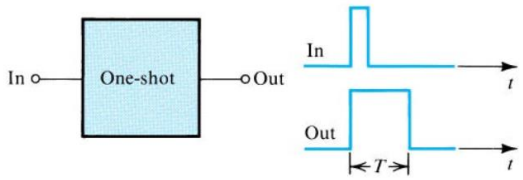
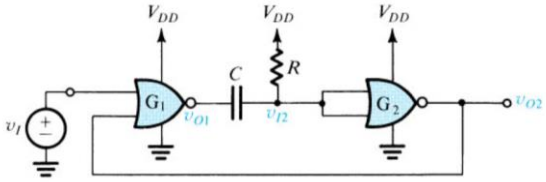
Abstract:

The flip flop has two stable states and is called a bistable multivibrator. The monostable multivibrator has one stable state in which it can remain indefinitely. The monostable multivibrator can be used as a pulse stretcher or a pulse standardizer. It is also referred to as a one shot.

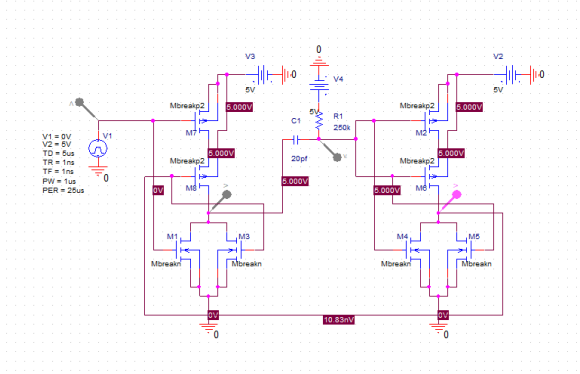


The CMOS monostable multivibrator is composed of two-input CMOS NOR gates, a capacitor, and a resistor. The input source Vi supplies the positive trigger pulses.

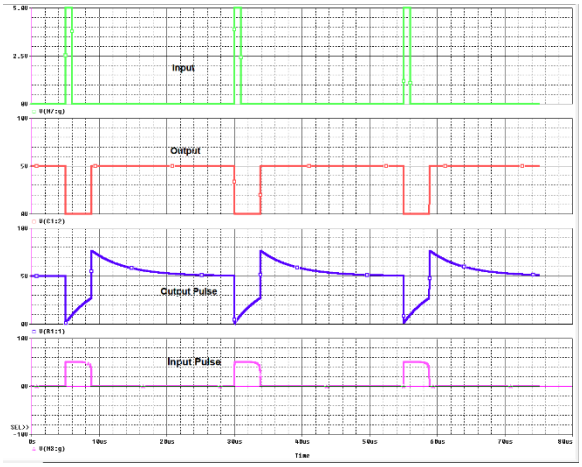


Author 1 Case 1 & 3:

Pspice & Experimental Assignment for Lab # 5 - CMOS based Monostable Multivibrators Circuit Design, Simulation and Experimental Test as well as Analysis.

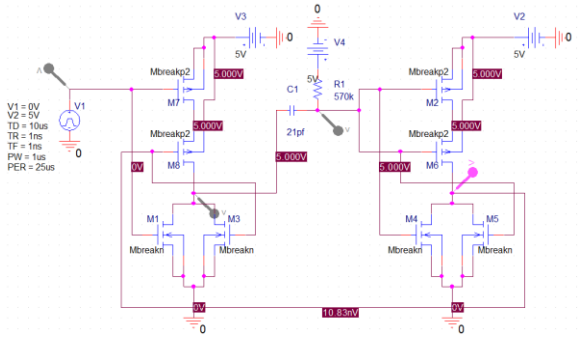


Case 1 Tau stretching by 4x using 20pf capacitor and 250k ohm resistor

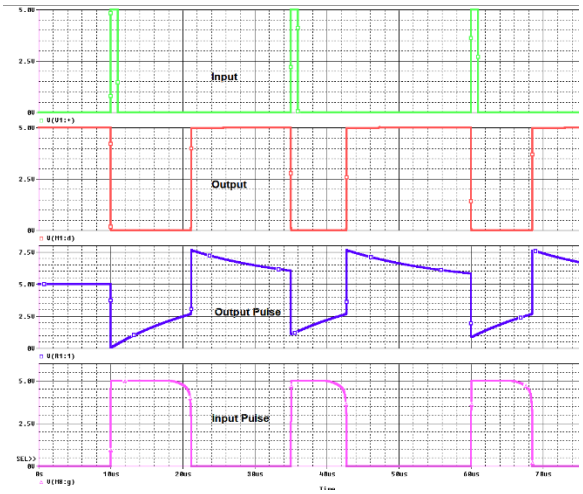


Trace Color	Trace Name	X1	X2	Y1 - Y2	Y1(Cursor1) - Y2(Cursor2)		0.000		
	X Values	0.000	0.000	0.000	Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
CURSOR 1,2	V(M7:g)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	V(C1:2)	5.0000	5.0000	0.000	5.0000	5.0000	5.0000	5.0000	5.0000
	V(R1:1)	5.0000	5.0000	0.000	5.0000	5.0000	5.0000	5.0000	5.0000
	V(M3:g)	10.831n	10.831n	0.000	10.831n	10.831n	10.831n	10.831n	10.831n

Simulation results of case 1 showing stretching and pulse of tau and 4tau



Case 3 Tau stretching by 9x using a 21pf capacitor and 570k resistor



Trace Color	Trace Name	Y1	Y2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2)	0.000		
	X Values	0.000	0.000	0.000	Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
CURSOR 1,2	V(M8:g)	10.831n	10.831n	0.000	0.000	0.000	10.831n	10.831n	10.831n
	V(R1:1)	5.0000	5.0000	0.000	5.0000	5.0000	5.0000	5.0000	5.0000
	V(M1:d)	5.0000	5.0000	0.000	5.0000	5.0000	5.0000	5.0000	5.0000
	V(V1:+)	0.000	0.000	0.000	-10.831n	-10.831n	0.000	0.000	0.000

Simulation result of above circuit

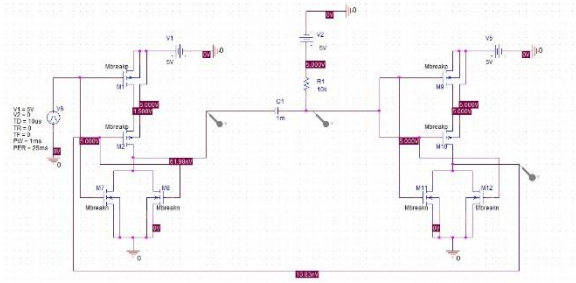
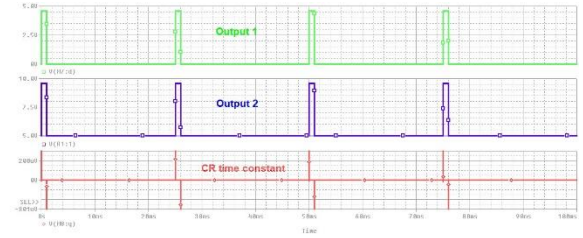


Figure 5.1 Monostable with 2 NOR gates @ 25ms period, 1ms pulse width & T=6*tau



Trace Color	Trace Name	Y1	Y2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2)	-6.7217n		
	X Values	50.541m	0.000	50.541m	Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
CURSOR 1,2	V(M8:g)	4.1091n	10.831n	-6.7217n	0.000	0.000	10.831n	4.1091n	7.4700n
	V(R1:1)	9.581	5.0000	4.5806	9.581	5.0000	9.581	5.0000	7.2903
	V(M7:d)	4.5817	-27.072n	4.5817	4.5817	-37.903n	4.5817	-27.072n	2.2909

Figure 5.2 Monostable vibrator with 2 NOR Gates @ T= 6*tau waveforms

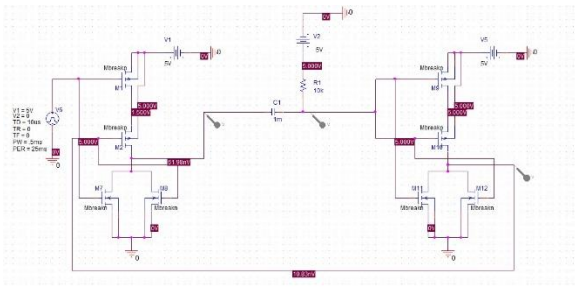
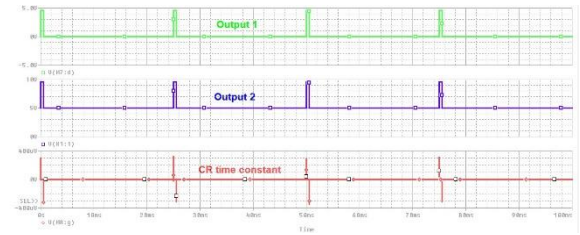


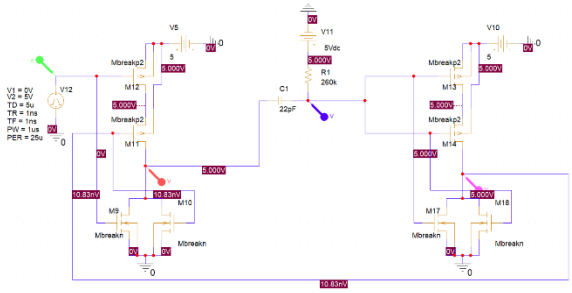
Figure 5.4 Monostable Multivibrator with 2 NOR gates @ 25ms Period, .5ms Pulse width & T= 12*tau



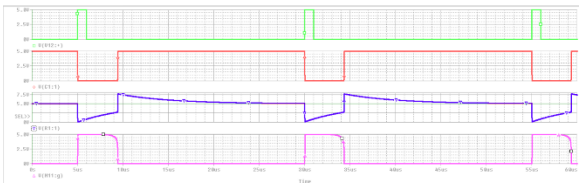
Trace Color	Trace Name	Y1	Y2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2)	-6.8411n		
	X Values	50.268m	0.000	50.268m	Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
CURSOR 1,2	V(M8:g)	3.9897n	10.831n	-6.8411n	0.000	0.000	10.831n	3.9897n	7.4103n
	V(R1:1)	9.581	5.0000	4.5811	9.581	5.0000	9.581	5.0000	7.2905
	V(M7:d)	4.5817	-27.072n	4.5817	4.5817	-37.903n	4.5817	-27.072n	2.2908

Monostable Multivibrator with 2 NOR gates @ T=12*tau waveforms.

Author 1 alternate case 1 and 3:

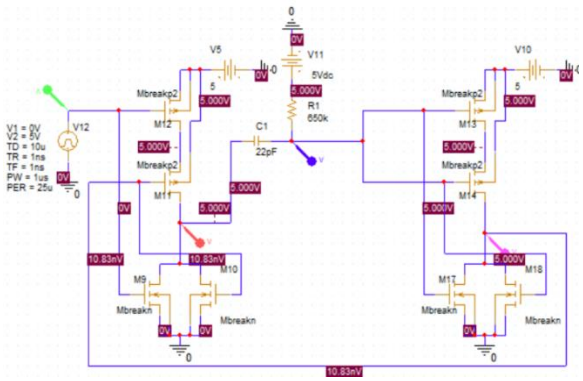


5.1 CMOS Monostable Multivibrator Circuit

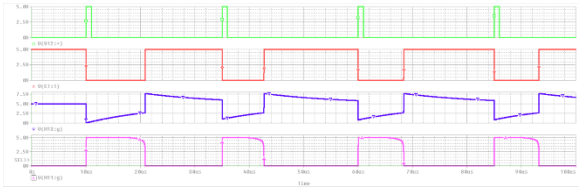


Trace Color	Trace Name	X1	X2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2)		0.000		
	X Values	0.000	0.000	0.000		Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
	V(M11:g)	10.831n	10.831n	0.000		-5.0000	-5.0000	10.831n	10.831n	10.831n
CURSOR 1,2	V(R1:1)	5.0000	5.0000	0.000		0.000	0.000	5.0000	5.0000	5.0000
	V(C1:1)	5.0000	5.0000	0.000		-37.472n	-37.472n	5.0000	5.0000	5.0000
	V(V12:+)	0.000	0.000	0.000		-5.0000	-5.0000	0.000	0.000	0.000

5.2 CMOS Monostable Multivibrator Simulation Result Tau = 4.



5.3 CMOS Monostable Multivibrator Circuit



Trace Color	Trace Name	X1	X2	Y1 - Y2		Y1(Cursor1) - Y2(Cursor2)		0.000		
	X Values	0.000	0.000	0.000		Y1 - Y1(Cursor1)	Y2 - Y2(Cursor2)	Max Y	Min Y	Avg Y
CURSOR 1,2	V(M11:g)	10.831n	10.831n	0.000		0.000	0.000	10.831n	10.831n	10.831n
	V(M13:g)	5.0000	5.0000	0.000		5.0000	5.0000	5.0000	5.0000	5.0000
	V(C1:1)	5.0000	5.0000	0.000		5.0000	5.0000	5.0000	5.0000	5.0000
	V(V12:+)	0.000	0.000	0.000		-10.831n	-10.831n	0.000	0.000	0.000

5.3 CMOS Monostable Multivibrator Simulation Result Tau = 10.

Conclusion:

In this lab we demonstrated the use and effect of the monostable vibrator. It is widely used in the modern world for temperature sensitive alarms or climate control in a car or home.