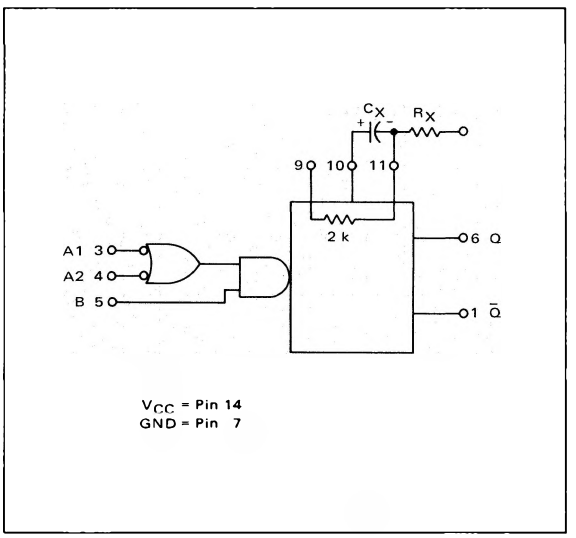
MONOSTABLE MULTIVIBRATOR

MC54121F,L*
MC74121F,L,P*

This monostable multivibrator produces accurate output pulses from either edge of an input pulse. The output pulse widths may be varied from 40 nanoseconds to 40 seconds by using appropriate external timing components. Internal compensation provides pulse width stability of better than 1.0% with variation of V_{CC} and ambient temperature. In most applications, overall stability will be determined by the accuracy of the external components. Inputs A1 and A2 trigger on the negative-going edge of the input pulse, and input B triggers on the positive-going edge.



Input Loading Factor = 1
Output Loading Factor = 10
Total Power Dissipation = 90 mW typ/pkg
(50% duty cycle)

TRUTH TABLE

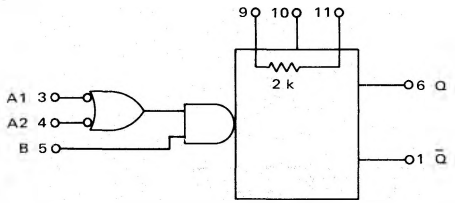
t_n INPUT			t_{n+1} INPUT			OUTPUT
A1	A2	B	A1	A2	B	
1	1	0	1	1	1	Inhibit
0	X	1	0	X	0	Inhibit
X	0	1	X	0	0	Inhibit
0	X	0	0	X	1	Triggering
X	0	0	X	0	1	Triggering
1	1	1	X	0	1	Triggering
1	1	1	0	X	1	Triggering
X	0	0	X	1	0	Inhibit
0	X	0	1	X	0	Inhibit
X	0	1	1	1	1	Inhibit
0	X	1	1	1	1	Inhibit
1	1	0	X	0	0	Inhibit
1	1	0	0	X	0	Inhibit

X = Don't care
t_n = Time period prior to input transition
t_{n+1} = Time period following input transition

*F suffix = TO-86 ceramic flat package (Case 607).
L suffix = TO-116 ceramic dual in-line package (Case 632).
P suffix = TO-116 plastic dual in-line package (Case 605).

ELECTRICAL CHARACTERISTICS

Test procedures are shown for only one A input. The other A input is tested in the same manner.

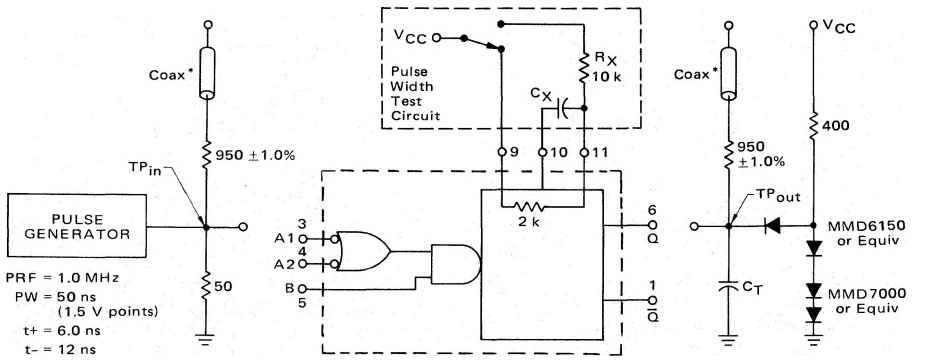


	TEST CURRENT/VOLTAGE VALUES (All Temperatures)										
	mA		Volts								
	I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_R	$V_{th\ 1}$	$V_{th\ 0}$	V_{CC}	V_{CCL}	V_{CCH}
MC54121	16	-0.4	0.4	2.4	5.5	4.5	2.0	0.8	5.0	4.5	5.5
MC74121	16	-0.4	0.4	2.4	5.5	4.5	2.0	0.8	5.0	4.75	5.25

Characteristic	Symbol	Pin Under Test	MC54121 Test Limits -55 to +125°C Min	Max	Unit	MC74121 Test Limits 0 to +70°C Min	Max	Unit	TEST CURRENT/VOLTAGE APPLIED TO PINS LISTED BELOW: I_{OL}	I_{OH}	V_{IL}	V_{IH}	V_{IHH}	V_R	$V_{th\ 1}$	$V_{th\ 0}$	V_{CC}	V_{CCL}	V_{CCH}	Gnd
Input																				
Forward Current	I_F	3	–	-1.6	mAdc	–	-1.6	mAdc	–	–	3	–	–	4	–	–	–	–	14	5,7
		5	–	-3.2	mAdc	–	-3.2	mAdc	–	–	5	–	–	3,4	–	–	–	–	14	6*,7
Leakage Current	I_{R1}	3	–	40	µAdc	–	40	µAdc	–	–	–	3	–	–	–	–	–	–	14	4,5,7
		5	–	80	µAdc	–	80	µAdc	–	–	–	5	–	3,4	–	–	–	–	14	7
	I_{R2}	3	–	1.0	mAdc	–	1.0	mAdc	–	–	–	–	3	–	–	–	–	–	14	4,5,7
		5	–	1.0	mAdc	–	1.0	mAdc	–	–	–	–	5	3,4	–	–	–	–	14	7
Output																				
Output Voltage	V_{OL}	6	–	0.4	Vdc	–	0.4	Vdc	6	–	–	–	–	–	–	3,4,5	–	14	–	7
	V_{OH}	6	2.4	–	Vdc	2.4	–	Vdc	–	6	–	–	–	–	–	3,4,5	–	14	–	7,11
Short-Circuit Current	I_{SC}	1	-20	-55	mAdc	-18	-55	mAdc	–	–	–	–	–	–	–	–	–	–	9,14	1,3,4,5,7
		6	-20	-55	mAdc	-18	-55	mAdc	–	–	–	–	–	–	–	–	–	–	14	3,4,5,6,7,10,11**
Power Requirements																				
Power Supply Drain	I_{PD}	14	–	25	mAdc	–	25	mAdc	–	–	–	–	–	–	–	5	–	–	9,14	3,4,7
		14	–	40	mAdc	–	40	mAdc	–	–	–	–	–	–	5	–	–	–	9,14	3,4,7
Switching Parameters (C_X = 80 pF unless otherwise noted.)									Pulse In	Pulse Out										
Turn-Off Delay – A to Q	t_{pd+}	6	–	70#	ns	–	70#	ns	3	6	–	4,5	–	–	–	–	9,14	–	–	7
B to Q		6	–	55#	ns	–	55#	ns	5	6	3,4	–	–	–	–	–	9,14	–	–	7
Turn-On Delay – A to Q̄	t_{pd-}	1	–	80#	ns	–	80#	ns	3	1	–	4,5	–	–	–	–	9,14	–	–	7
B to Q̄		1	–	65#	ns	–	65#	ns	5	1	3,4	–	–	–	–	–	9,14	–	–	7
Output Pulse Witdth	PW																			
With Internal Timing Resistor		5,1	70#	150#	ns	70#	150#	ns	5	1	–	–	–	–	–	–	9,14	–	–	3,4,7
With C_X = 0		↓	20#	50#	↓	20#	50#	↓	↓	↓	–	–	–	–	–	–	9,14	–	–	↓
With R_X = 10 kΩ, C_X = 100 pF			600#	800#		600#	800#				–	–	–	–	–	–	14	–	–	
R_X = 10 kΩ, C_X = 1.0 µF			6.0#	8.0#	ms	6.0#	8.0#	ms			–	–	–	–	–	–	14	–	–	
Minimum Duration of Trigger Pulse	t_{Hold}	5,1	–	50#	ns	–	50#	ns	5	1	–	–	–	–	–	–	9,14	–	–	3,4,7

*Momentarily ground this pin before taking measurement.
**Pin 10 should be grounded after pin 11.
#Tested only at 25°C.

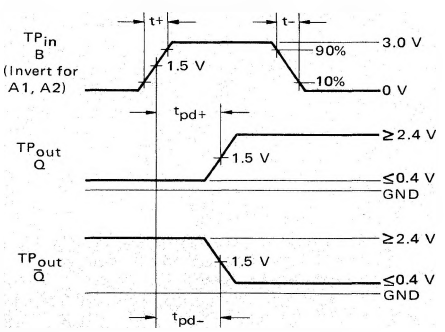
TEST CIRCUIT AND VOLTAGE WAVEFORMS



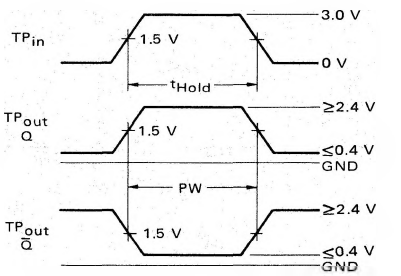
* The coax delays from input to scope and output to scope must be matched. The scope must be terminated in 50-ohm impedance. The 950-ohm resistor and the scope termination impedance constitute a 20:1 attenuator probe. Coax shall be CT-070-50 or equivalent.

C_T = 15 pF = total parasitic capacitance, which includes probe, wiring, and load capacitances.

SWITCHING TIMES



OUTPUT PULSE WIDTH



APPLICATIONS INFORMATION

Inputs A1 and A2 are negative-edge-triggered and will trigger the monostable multivibrator into the active state when either or both go low while B is high. The B input will trigger the one-shot when B goes high while either A or B is low. Triggering occurs at a particular voltage level and is independent of the input pulse transition time. The Schmitt-trigger capability of the B input can be used to obtain level detection and to process relatively slow leading edges. Jitter-free triggering is obtained with transition times as slow as 1.0 volt/second, providing the circuit with a typical noise immunity of 1.2 volts. Internal latching circuitry provides for a typical noise immunity of 1.5 volts on the V_{CC} line.

During the active state, the outputs are independent of further transitions on the inputs and depend only on the external timing components. With no external timing components and pin 9 connected to V_{CC} (pins 10 and 11 left open), an output pulse of approximately 30 nanoseconds is obtained. An external timing capacitor connected between pins 10 and 11 will extend the pulse width. Accurate repeatable pulse width may be obtained by leaving pin 9 open and connecting an external resistor between pin 11 and V_{CC}. This resistor should be at least 1.4 kilohms and may be as large as 40 kilohms for the MC74121 and 30 kilohms for the MC54121. The timing capacitor may be as large as 1000 μF. Within these limits, the output pulse width is given by:

$$PW = C_X R_X \log_e 2.$$

FIGURE 1 – SCHMITT TRIGGER THRESHOLD VOLTAGE versus TEMPERATURE

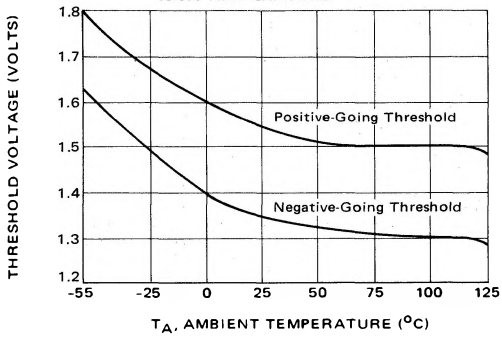


FIGURE 2 – INTERNAL TIMING RESISTOR VARIATION versus TEMPERATURE

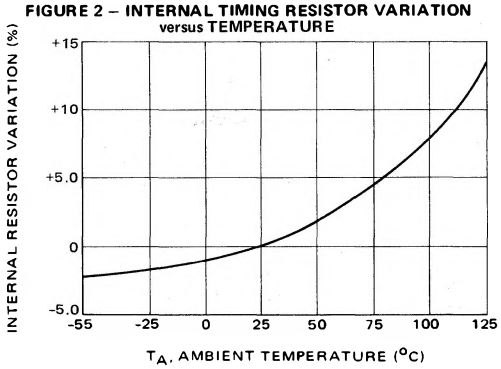


FIGURE 3 – OUTPUT PULSE WIDTH VARIATION versus TEMPERATURE

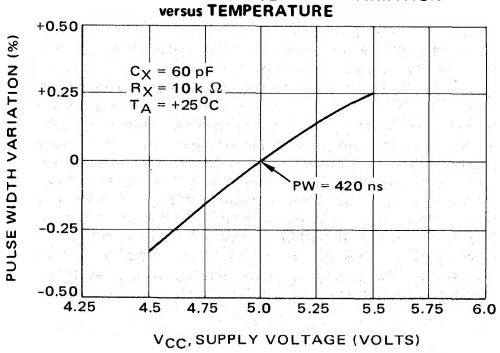


FIGURE 4 – OUTPUT PULSE WIDTH versus EXTERNAL TIMING RESISTOR VALUE

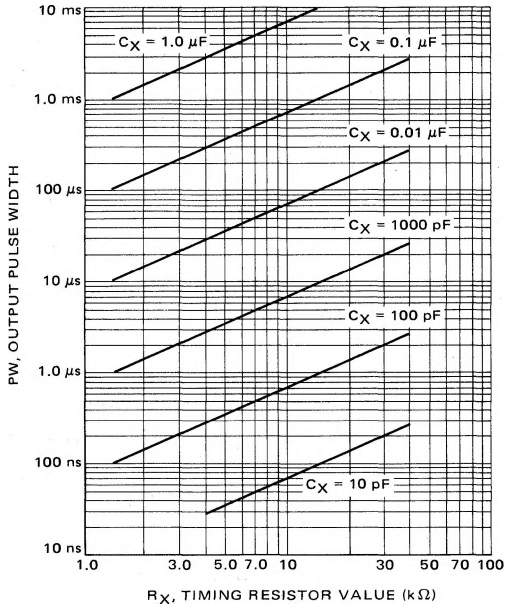


FIGURE 5 – OUTPUT PULSE WIDTH versus EXTERNAL CAPACITANCE