Signetics

74121
Multivibrator

Monostable Multivibrator
Product Specification

Logic Products

FEATURES

- **Very good pulse width stability**
- **Virtually immune to temperature and voltage variations**
- **Schmitt trigger input for slow input transitions**
- **Internal timing resistor provided**

DESCRIPTION

These multivibrators feature dual active LOW going edge inputs and a single active HIGH going edge input which can be used as an active HIGH enable input. Complementary output pulses are provided.

Pulse triggering occurs at a particular voltage level and is not directly related to the transition time of the input pulse. Schmitt-trigger input circuitry (TTL hysteresis) for the B input allows jitter-free triggering from inputs with transition rates as slow as 1 volt/second, providing the circuit with an excellent noise immunity of typically 1.2 volts. A high immunity to V_{CC} noise of typically 1.5 volts is also provided by internal latching circuitry. Once fired, the outputs are independent of further transitions of the inputs and are a function only of the timing components. Input pulses may be of any duration relative to the output pulse. Output pulse length may be varied from 20 nanoseconds to 28 seconds by choosing appropriate timing components. With no external timing components (i.e., R_{int} connected to V_{CC}, C_{ext} and R_{ext}/C_{ext} open), an output pulse of typically 30 or 35 nanoseconds is achieved which may be used as a dc triggered reset signal. Output rise and fall times are TTL compatible and independent of pulse length.

Pulse width stability is achieved through internal compensation and is virtually independent of V_{CC} and temperature. In most applications, pulse stability will only be limited by the accuracy of external timing components.

Jitter-free operation is maintained over the full temperature and V_{CC} ranges for more than six decades of timing capacitance (10pF to 10μF) and more than one decade of timing resistance (2kΩ to 30kΩ for the 54121 and 2KΩ to 40kΩ for the 74121). Throughout these ranges, pulse width is defined by the relationship: (see Figure 1)

$$\frac{t_W(out) = C_{ext}\ R_{ext}\ \ln 2}{t_W(out) \cong 0.7\ C_{ext}\ R_{ext}}$$

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74121	43ns	18mA

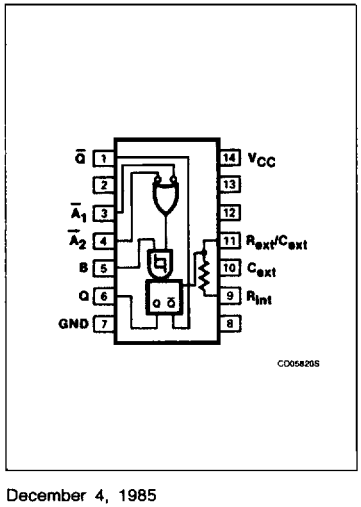
ORDERING CODE

PACKAGES	COMMERCIAL RANGE V_{CC} = 5V ±5%; T_A = 0°C to +70°C
Plastic DIP	N74121 N
Plastic SO	N74121 D

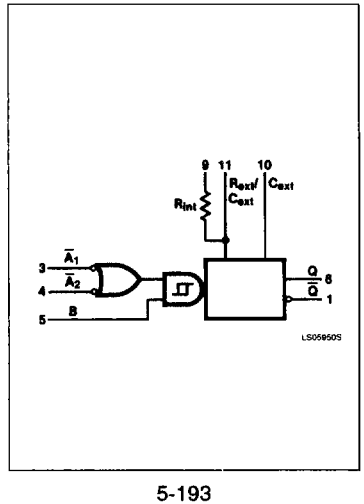
NOTE:
For information regarding devices processed to Military Specifications, see the Signetics Military Products Data Manual.

5

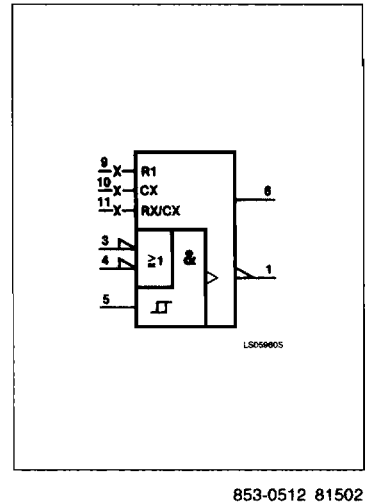
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

INPUTS			OUTPUTS	
$\overline{A}_1$	$\overline{A}_2$	B	Q	$\overline{Q}$
L	X	H	L	H
X	L	H	L	H
X	X	L	L	H
H	H	X	L	H
H	↓	H	⎍	⎎
↓	H	H	⎍	⎎
↓	↓	H	⎍	⎎
L	X	↑	⎍	⎎
X	L	↑	⎍	⎎

H = HIGH voltage level
L = LOW voltage level
X = Don't care
↑ = LOW-to-HIGH transition
↓ = HIGH-to-LOW transition

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74
$\overline{A}_1$, $\overline{A}_2$	Inputs	1ul
B	Input	2ul
Q, $\overline{Q}$	Outputs	10ul

NOTE:
A 74 unit load (ul) is understood to be 40μA I_{IH} and −1.6mA I_{IL}.

In circuits where pulse cutoff is not critical, timing capacitance up to 1000μF and timing resistance as low as 1.4kΩ may be used.

ABSOLUTE MAXIMUM RATINGS (Over operating free-air temperature range unless otherwise noted.)

PARAMETER		74	UNIT
V_{CC}	Supply voltage	7.0	V
V_{IN}	Input voltage	−0.5 to +5.5	V
I_{IN}	Input current	−30 to +5	mA
V_{OUT}	Voltage applied to output in HIGH output state	−0.5 to +V_{CC}	V
T_A	Operating free-air temperature range	0 to 70	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER			74			UNIT
			Min	Nom	Max	
V_{CC}	Supply voltage		4.75	5.0	5.25	V
I_{IK}	Input clamp current				−12	mA
I_{OH}	HIGH-level output current				−400	μA
I_{OL}	LOW-level output current				16	mA
dv/dt	Rate of rise or fall of input pulse	B input	1			V/s
		$\overline{A}_1$, $\overline{A}_2$ inputs	1			V/μs
T_A	Operating free-air temperature		0		70	°C

DC ELECTRICAL CHARACTERISTICS (Over recommended operating free-air temperature range unless otherwise noted.)

PARAMETER		TEST CONDITIONS[1]		74121			UNIT
				Min	Typ[2]	Max	
V_{T+}	Positive-going threshold at $\overline{A}$ and B	V_{CC} = MIN				2.0	V
V_{T-}	Negative-going threshold at $\overline{A}$ and B	V_{CC} = MIN		0.8			V
V_{OH}	HIGH-level output voltage	V_{CC} = MIN, V_{IH} = MIN, V_{IL} = MAX, I_{OH} = MAX		2.4	3.4		V
V_{OL}	LOW-level output voltage	V_{CC} = MIN, V_{IH} = MIN, V_{IL} = MAX, I_{OL} = MAX			0.2	0.4	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = I_{IK}				−1.5	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5V				1.0	mA
I_{IH}	HIGH-level input current	V_{CC} = MAX, V_I = 2.4V	$\overline{A}_1$, $\overline{A}_2$ inputs			40	μA
			B input			80	μA
I_{IL}	LOW-level input current	V_{CC} = MAX, V_I = 0.4V	$\overline{A}_1$, $\overline{A}_2$ inputs			−1.6	mA
			B input			−3.2	mA
I_{OS}	Short-circuit output current[3]	V_{CC} = MAX		−18		−55	mA
I_{CC}	Supply current (total)	V_{CC} = MAX	Quiescent		13	25	mA
			Triggered		23	40	mA

NOTES:
1. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
2. All typical values are at V_{CC} = 5V, T_A = 25°C.
3. I_{OS} is tested with V_{OUT} = +0.5V and V_{CC} = V_{CC} MAX + 0.5V. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.

AC ELECTRICAL CHARACTERISTICS T_A = 25°C, V_{CC} = 5.0V

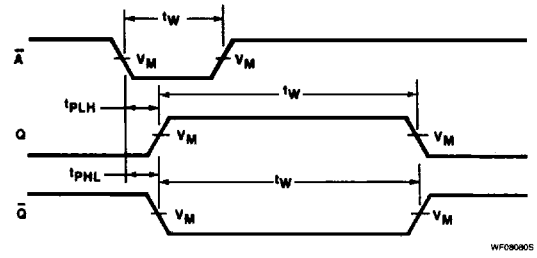
PARAMETER		TEST CONDITIONS	74		UNIT
			C_L = 15pF, R_L = 400Ω		
			Min	Max	
t_{PLH} t_{PHL}	Propagation delay $\overline{A}$ input to Q & $\overline{Q}$ output	Waveform 1 C_{ext} = 80pF, R_{int} to V_{CC}		70 80	ns
t_{PLH} t_{PHL}	Propagation delay B input to Q & $\overline{Q}$ output	Waveform 2 C_{ext} = 80pF, R_{int} to V_{CC}		55 65	ns
t_W	Minimum output pulse width	C_{ext} = 0pF, R_{int} to V_{CC}	20	50	ns
t_W	Output pulse width	C_{ext} = 80pF, R_{int} to V_{CC}	70	150	ns
		C_{ext} = 100pF, R_{ext} = 10kΩ	600	800	ns
		C_{ext} = 1μF, R_{ext} = 10kΩ	6.0	8.0	ms

5

AC SET-UP REQUIREMENTS $T_A = 25°C$, $V_{CC} = 5.0V$

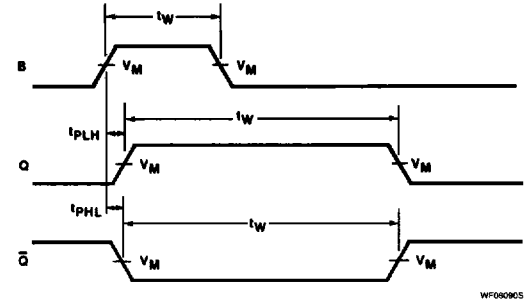
PARAMETER		TEST CONDITIONS	74		UNIT
			Min	Max	
t_W	Minimum input pulse width to trigger	Waveforms 1 & 2	50		ns
R_{ext}	External timing resistor range		1.4	40	kΩ
C_{ext}	External timing capacitance range		0	1000	μF
	Output duty cycle	$R_{ext} = 2k\Omega$		67	%
		$R_{ext} = R_{ext}(Max)$		90	%

AC WAVEFORMS



V_M = 1.5V for 74 and 74S; V_M = 1.3V for 74LS

Waveform 1. Propagation Delay $\bar{A}$ Input To Q And $\bar{Q}$ Outputs, Input And Output Pulse Widths



V_M = 1.5V for 74 and 74S; V_M = 1.3V for 74LS

Waveform 2. Propagation Delay B Input To Q And $\bar{Q}$ Output, Input And Output Pulse Widths

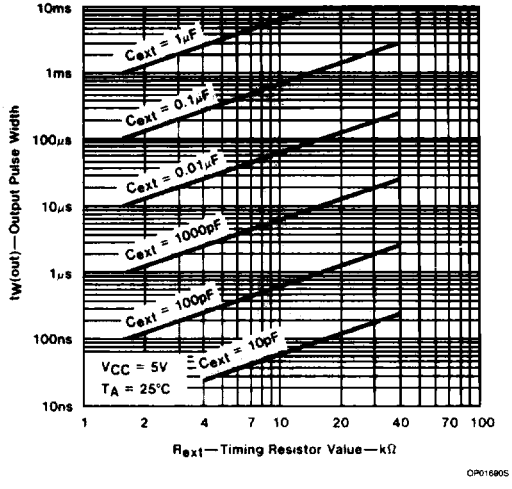
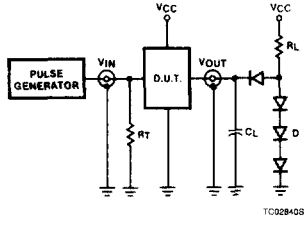
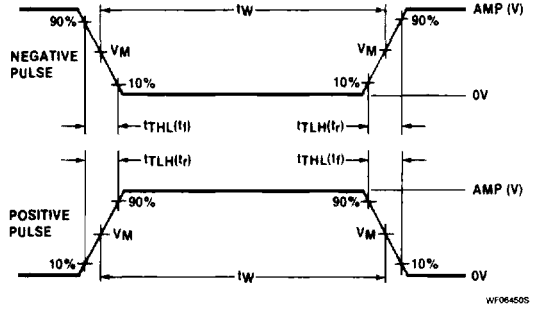


Figure 1. Output Pulse Width vs. Timing Resistor Value

TEST CIRCUITS AND WAVEFORMS





V_M = 1.3V for 74LS; V_M = 1.5V for all other TTL families.

Test Circuit For 74 Totem-Pole Outputs

Input Pulse Definition

DEFINITIONS

R_L = Load resistor to V_{CC}; see AC CHARACTERISTICS for value.

C_L = Load capacitance includes jig and probe capacitance; see AC CHARACTERISTICS for value.

R_T = Termination resistance should be equal to Z_{OUT} of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

t_{TLH}, t_{THL} Values should be less than or equal to the table entries.

FAMILY	INPUT PULSE REQUIREMENTS				
	Amplitude	Rep. Rate	Pulse Width	t_{TLH}	t_{THL}
74	3.0V	1MHz	500ns	7ns	7ns
74LS	3.0V	1MHz	500ns	15ns	6ns
74S	3.0V	1MHz	500ns	2.5ns	2.5ns

5