Signetics

74123
Multivibrator

Dual Retriggerable Monostable Multivibrator
Product Specification

Logic Products

FEATURES

- **DC triggered from active HIGH or active LOW inputs**
- **Retriggerable for very long pulses — up to 100% duty cycle**
- **Direct reset terminates output pulse**
- **Compensated for V_{CC} and temperature variations**

TYPE	TYPICAL PROPAGATION DELAY	TYPICAL SUPPLY CURRENT (TOTAL)
74123	24ns	46mA

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

ORDERING CODE

PACKAGES	COMMERCIAL RANGE V_{CC} = 5V ±5%; T_A = 0°C to +70°C
Plastic DIP	N74123N
Plastic SO	N74123D

DESCRIPTION

The '123 is a dual retriggerable monostable multivibrator with output pulse width control by three methods. The basic pulse time is programmed by selection of external resistance (R_{ext}) and capacitance (C_{ext}) values. Once triggered, the basic pulse width may be extended by retriggering the gated active LOW going edge input ($\overline{A}$) or the active HIGH going edge input (B), or be reduced by use of the overriding active LOW reset.

The basic output pulse width is essentially determined by the values of external capacitance and timing resistance.

For pulse widths when $C_{ext} \leqslant 1000pF$, see Figure A.

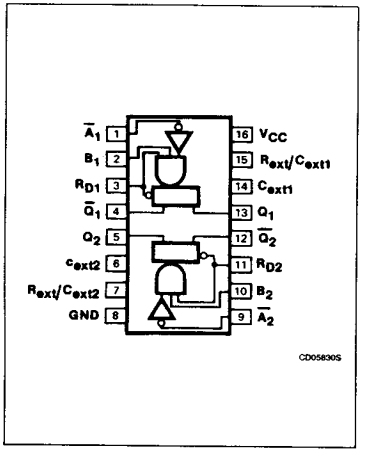
When $C_{ext} > 1000pF$, the output pulse width is defined as:

$$t_W = 0.28\ R_{ext} \cdot C_{ext}\ (1 + \tfrac{0.7}{R_{ext}})$$

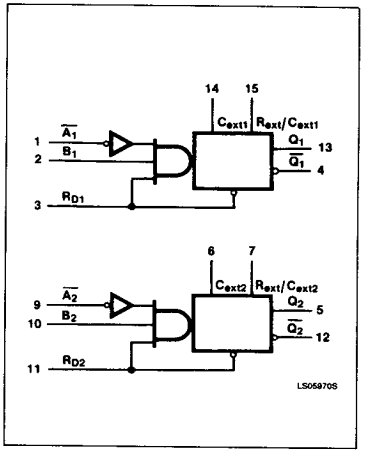
The external resistance and capacitance are normally connected as shown in Figure B. If an electrolytic capacitor is to be used with an inverse voltage rating of less than 1V then Figure C should be used. (Inverse voltage rating of an electrolytic is normally specified at 5% of the forward voltage rating.) If the inverse voltage rating is 1V or more (this includes a 100% safety margin) then Figure B can be used. Note that if Figure C is used the timing equations change as follows:

$$t_W \cong 0.25\ R_{ext} \cdot C_{ext}\ (1 + \tfrac{0.7}{R_{ext}})$$

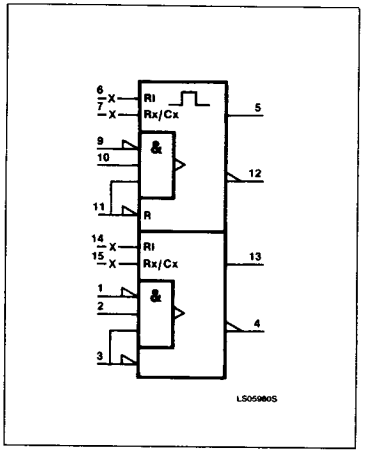
PIN CONFIGURATION



LOGIC SYMBOL



LOGIC SYMBOL (IEEE/IEC)



FUNCTION TABLE

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

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

INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	74
$\overline{A}$, B	Inputs	1ul
R_D	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}.

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

5

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			−800	μA
I_{OL}	LOW-level output current			16	mA
T_A	Operating free-air temperature	0		70	°C
V_{IH}	HIGH-level input voltage	2.0			V
V_{IL}	LOW-level input voltage			+0.8	V

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

PARAMETER		TEST CONDITIONS[1]		74123			UNIT
				Min	Typ[2]	Max	
V_{OH}	HIGH-level output voltage[5]	V_{CC} = MIN, I_{OH} = MAX		2.4	3.4		V
V_{OL}	LOW-level output voltage[5]	V_{CC} = MIN, 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	$\overline{A}$, B inputs			40	μA
			R_D input			80	μA
I_{IL}	LOW-level input current	V_{CC} = MAX, V_I = 0.4V	$\overline{A}$, B inputs			-1.6	mA
			R_D input			-3.2	mA
I_{OS}	Short-circuit output current[3, 5]	V_{CC} = MAX		-10		-40	mA
I_{CC}	Supply current[4] (total)	V_{CC} = MAX	Quiescent		46	66	mA
			Triggered		46	66	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.
4. Quiescent I_{CC} is measured (after being reset) with 2.4V applied to both R_D and $\overline{A}$ inputs, B inputs grounded and all outputs open. Triggered I_{CC} is measured with 2.4V applied to all R_D and B inputs, $\overline{A}$ inputs grounded and all outputs open. For both measurements, C_{ext} = 0.02μF and R_{ext} = 25kΩ.
5. Ground C_{ext} to measure V_{OH} at Q, V_{OL} at $\overline{Q}$, or I_{OS} at Q. C_{ext} is open to measure V_{OH} at $\overline{Q}$, V_{OL} at Q, or I_{OS} at $\overline{Q}$.

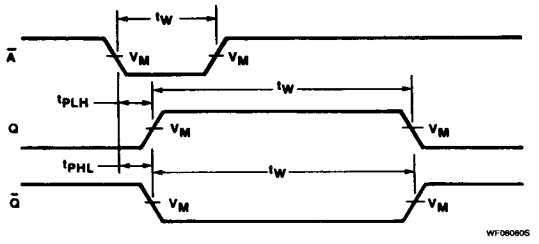
AC ELECTRICAL CHARACTERISTICS T_A = 25°C, V_{CC} = 5.0V

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} = 0pF, R_{ext} = 5kΩ		33 40	ns
t_{PLH} t_{PHL}	Propagation delay B input to Q & $\overline{Q}$ output	Waveform 2 C_{ext} = 0pF, R_{ext} = 5kΩ		28 36	ns
t_{PLH} t_{PHL}	Propagation delay $\overline{R}_D$ input to Q & $\overline{Q}$ output	Waveform 3 C_{ext} = 0pF, R_{ext} = 5kΩ		40 27	ns
t_WQ	Minimum Q pulse width	Waveforms 1 & 2 C_{ext} = 0pF, R_{ext} = 5kΩ		65	ns
t_WQ	Output pulse width	Waveforms 1 & 2 C_{ext} = 1000pF, R_{ext} = 10kΩ	2.76	3.37	μs

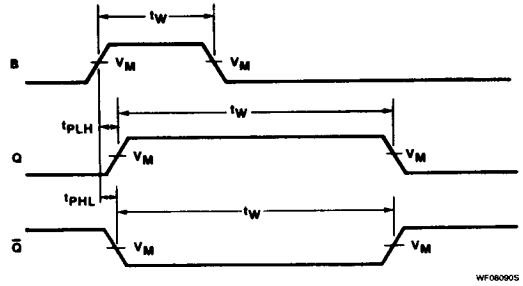
AC SET-UP REQUIREMENTS T_A = 25°C, V_{CC} = 5.0V

PARAMETER		TEST CONDITIONS	74		UNIT
			Min	Max	
t_W	Minimum input pulse width	Waveforms 1, 2 & 3	40		ns
R_{ext}	External timing resistor range		5.0	50	kΩ
C_{ext}	External timing capacitance range		No restriction		pF
$C_{Rx/Cx}$	Stray capacitance to GND at R_{ext}/C_{ext} terminal			50	pF

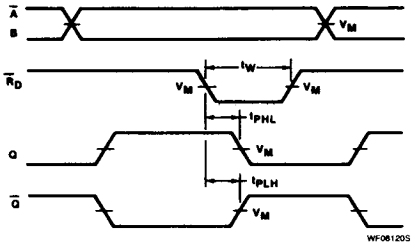
AC WAVEFORMS



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



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

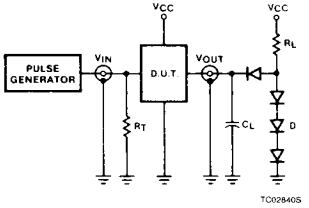


For all waveforms, V_M = 1.5V for 74 and 74S; V_M = 1.3V for 74LS

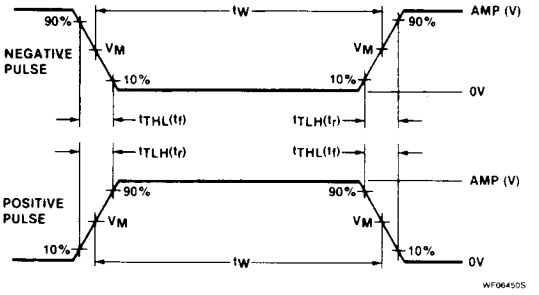
Waveform 3. Direct Reset Delays

5

TEST CIRCUITS AND WAVEFORMS



Test Circuit For 74 Totem-Pole Outputs



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

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

TYPICAL PERFORMANCE CHARACTERISTICS

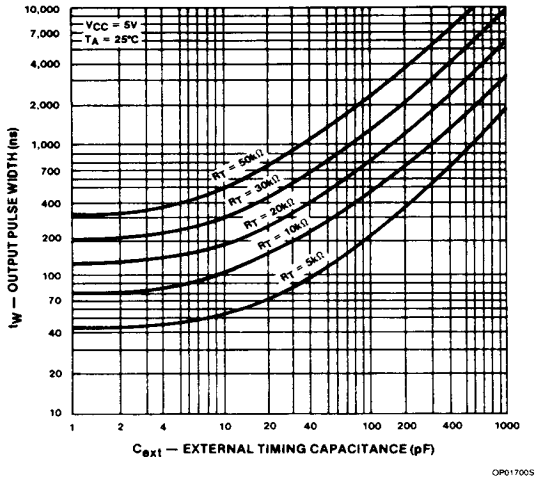


Figure A

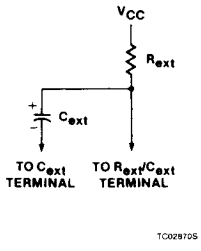


Figure B

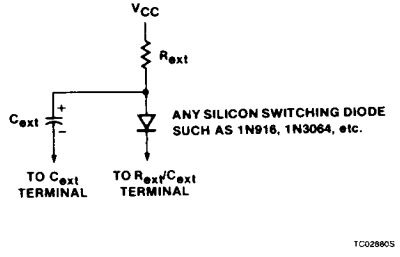


Figure C