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SEMICONDUCTOR

May 2007

74VHC123A
Dual Retriggerable Monostable Multivibrator

Features

- High Speed: t_{PD} = 8.1ns (Typ.) at T_A = 25°C
- Low Power Dissipation: I_{CC} = 4µA (Max) at T_A = 25°C
- Active State: I_{CC} = 600µA (Max.) at T_A = 25°C
- High Noise Immunity: $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Power down protection is provided on all inputs
- Pin and function compatible with 74HC123A

General Description

The VHC123A is an advanced high speed CMOS Monostable Multivibrator fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. Each multivibrator features both a negative, A, and a positive, B, transition triggered input, either of which can be used as an inhibit input. Also included is a clear input that when taken low resets the one-shot. The VHC123A can be triggered on the positive transition of the clear while A is held low and B is held high. The output pulse width is determined by the equation: PW = $(R_x)(C_x)$; where PW is in seconds, R is in ohms, and C is in farads.

Limits for R_x and C_x are:

External capacitor, C_x: No limit

External resistors, R_x: V_{CC} = 2.0V, 5 kΩ min
V_{CC} >

Connection Diagram

Logic Symbol

IEEE/IEC

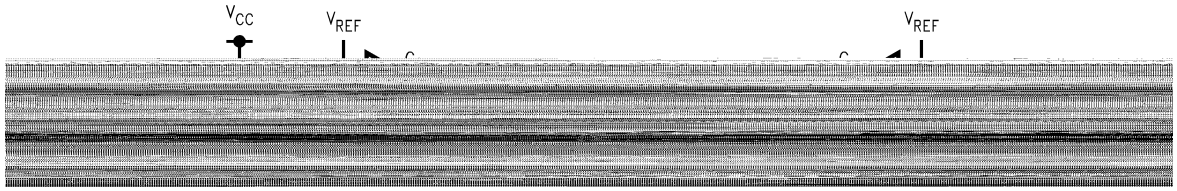
Pin Description

Pin Names	Description
A	Trigger Inputs (Negative Edge)
B	Trigger Inputs (Positive Edge)
CLR	Reset Inputs
C_x	

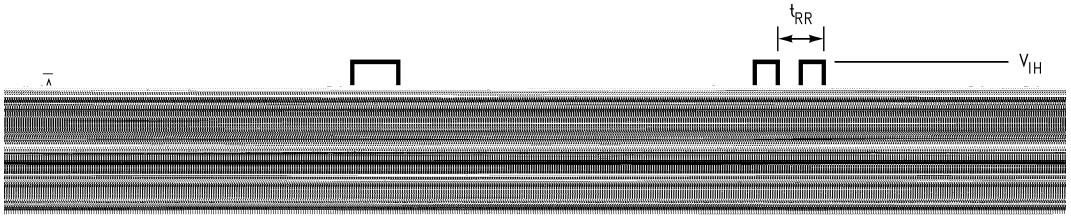
Truth Table

H = HIGH Voltage Level
L = LOW Voltage Level
= HIGH-to-LOW Transition
= LOW-to-HIGH Transition
X = Don't Care

System Diagram



Timing Chart



Functional Description

1. Stand-by State

   The external capacitor (C_x) is fully charged to V_{CC} in the Stand-by State. That means, before triggering, the Q_P and Q_N transistors which are connected to the R_x/C_x node are in the off state. Two comparators that relate to the timing of the output pulse, and two reference voltage supplies turn off. The total supply current is only leakage current.

2. Trigger Operation

   Trigger operation is effective in any of the following three cases. First, the condition where the $\overline{A}$ input is LOW, and B input has a rising signal; second, where the B input is HIGH, and the A input has a falling signal; and third, where the $\overline{A}$ input is LOW and the B input is HIGH, and the $\overline{CLR}$ input has a rising signal.

   After a trigger becomes effective, comparators C_1 and C_2 start operati 7.rT2 (nal;)Tj 0.5114 0 TD 0.2334 Tw (start R 1.2)-26163.Tw ( ) (nal;)Tj 0.548 -1.55a1.n201.7 1 leaka

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Recommended Operating Conditions

DC Electrical Characteristics

Symbol	Parameter	V_{CC} (V)	Conditions		T_A = 25°C			T_A = –40° to 85°C		Units
					Min.	Typ.	Max.	Min.	Max.	
V_{IH}	HIGH Level Input Voltage	2.0			1.50			1.50		V
		3.0–5.5			0.7 x V_{CC}			0.7 x V_{CC}		
V_{IL}	LOW Level Input Voltage	2.0					0.50		0.50	V
		3.0–5.5					0.3 x V_{CC}		0.3 x V_{CC}	
V_{OH}	HIGH Level Output Voltage	2.0	V_{IN} = V_{IH} or V_{IL}	I_{OH} = –50µA	1.9	2.0		1.9		V
		3.0			2.9	3.0		2.9		
		4.5			4.4	4.5		4.4		
		3.0		I_{OH} = –4mA	2.58			2.48		
		4.5		I_{OH} = –8mA	3.94			3.80		
V_{OL}	LOW Level Output Voltage	2.0	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50µA		0.0	0.1		0.1	V
		3.0				0.0	0.1		0.1	
		4.5				0.0	0.1		0.1	
		3.0		I_{OL} = 4mA			0.36		0.44	
		4.5		I_{OL} = 8mA			0.36		0.44	
I_{IN}	Input Leakage Current	0–5.5	V_{IN} = 5.5V or GND				±0.1		±1.0	µA
I_{IN}	R_x/C_x Terminal Off-State Current	5.5	V_{IN} = V_{CC} or GND				±0.25		±2.50	µA
I_{CC}	Quiescent Supply Current	5.5	V_{IN} = V_{CC} or GND				4.0		40.0	µA
I_{CC}	Active—State[3] Supply Current	3.0	V_{IN} = V_{CC} or GND, R_x/C_x = 0.5 V_{CC}			160	250		280	µA
		4.5				380	500		650	
		5.5				560	750		975	

Note:

3. Per circuit.

AC Electrical Characteristics[4]

Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C Min.	Typ.	Max.	T_A = –40°C to +85°C Min.	Max.	Units
t_{PLH}, t_{PHL}	Propagation Delay Time (A, B–Q, $\overline{Q}$)	3.3 ± 0.3	C_L = 15 pF		13.4	20.6	1.0	24.0	ns
			C_L = 50 pF		15.9	24.1	1.0	27.5	
		5.0 ± 0.5	C_L = 15 pF		8.1	12.0	1.0	14.0	ns
			C_L = 50 pF		9.6	14.0	1.0	16.0	
t_{PLH}, t_{PHL}	Propagation Delay Time ($\overline{CLR}$ Trigger—Q, $\overline{Q}$)	3.3 ± 0.3	C_L = 15 pF		14.5	22.4	1.0	26.0	ns
			C_L = 50 pF		17.0	25.9	1.0	29.5	
		5.0 ± 0.5	C_L = 15 pF		8.7	12.9	1.0	15.0	ns
			C_L = 50 pF		10.2	14.9	1.0	17.0	
t_{PLH}, t_{PHL}	Propagation Delay Time ($\overline{CLR}$—Q, $\overline{Q}$)	3.3 ± 0.3	C_L = 15 pF		10.3	15.8	1.0	18.5	ns
			C_L = 50 pF		12.8	19.3	1.0	22.0	
		5.0 ± 0.5	C_L = 15 pF		6.3	9.4	1.0	11.0	ns
			C_L = 50 pF		7.8	11.4	1.0	13.0	
t_{WOUT}	Output Pulse Width	3.3 ± 0.3	C_L = 50pF, C_x = 28pF,		160	240		300	ns
		5.0 ± 0.5	R_x = 2kΩ		133	200		240	
		3.3 ± 0.3	C_L = 50pF, C_x = 0.01µF,	90	100	110	90	110	µs
		5.0 ± 0.5	R_x = 10kΩ	90	100	110	90	110	
		3.3 ± 0.3	C_L = 50pF, C_x = 0.1µF, R_x						

Notes:

4. Refer to Timing Chart.

5. C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

   I_{CC} (opr.) = C_{PD} • V_{CC} • f_{IN+} $I_{CC}{}^1$ • Duty / 100 + I_{CC} / 2 (per Circuit)

   $I_{CC}{}^1$: Active Supply Current

   Duty: %

AC Operating Requirement[6]

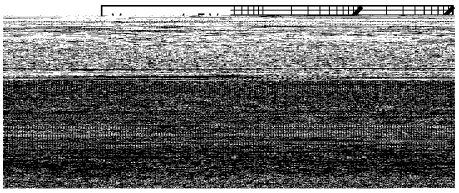
Symbol	Parameter	V_{CC} (V)	Conditions	T_A = 25°C Min.	Typ.	Max.	T_A = –40°C to +85°C Min.	Max.	Units
$t_W(L)$, $t_W(H)$	Minimum Trigger Pulse Width	3.3	RR	5.0			5.0		ns
		5.0		5.0			5.0		
$t_W(L)$	Minimum Clear Pulse Width	3.3		5.0			5.0		ns
		5.0		5.0			5.0		
t_{RR}	Minimum Retrigger Time	3.3 ± 0.3	R_x						

Note:

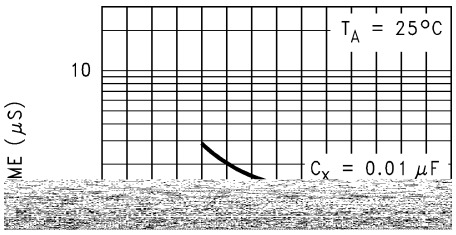
6. Refer to Timing Chart.

Device Characteristics

t_{wout}*C_x Characteristics (Typ.)

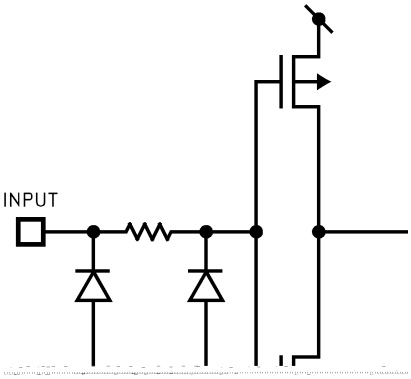


t_{RR}*V_{CC} Characteristics (Typ.)



Output Pulse Width Constant K-Supply Voltage (Typ.)

Input Equivalent Circuit



Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

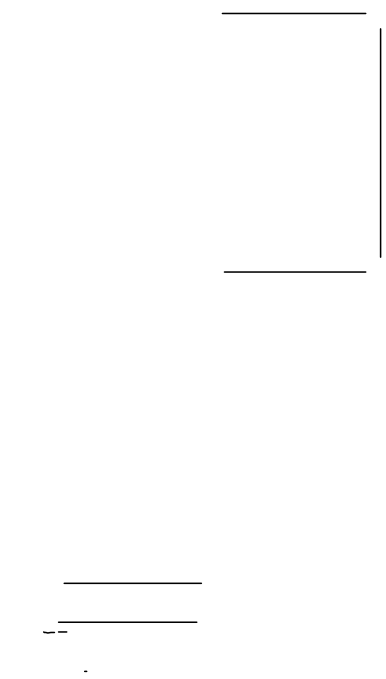


Figure 2. 16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.

Figure 3. 16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16