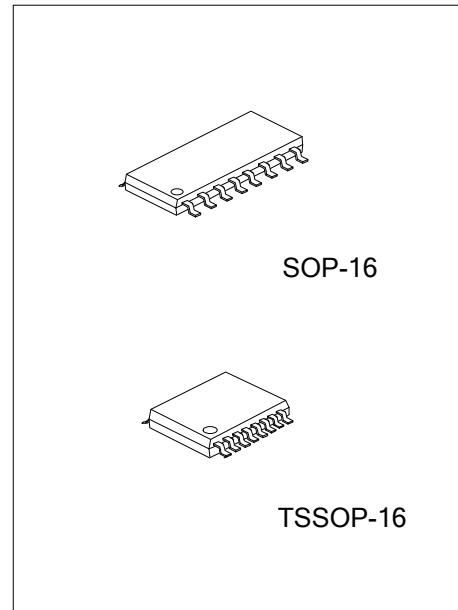




## U74HC123

CMOS IC

### DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH RESET



#### DESCRIPTION

The **U74HC123** is high-speed Si-gate CMOS device and is pin compatible with low power Schottky TTL (LSTTL).

The U74HC123 is a dual retriggerable monostable multivibrator with output pulse width control by three methods. The basic pulse time is programmed by selection of an external resistor ( $R_{EXT}$ ) and capacitor ( $C_{EXT}$ ).

Once triggered, the basic output pulse width may be extended by retriggering the gated active LOW-going edge input ( $n\bar{A}$ ) or the active HIGH-going edge input ( $nB$ ). By repeating this process, the output pulse period ( $nQ=HIGH$ ,  $n\bar{Q}=LOW$ ) can be made as long as desired. Alternatively an output delay can be terminated at any time by a LOW-going edge on input  $n\bar{R}_D$ , which also inhibits the triggering.

An internal connection from  $n\bar{R}_D$  to the input gates makes it possible to trigger the circuit by a positive-going signal at input  $n\bar{R}_D$  as shown in the function table. The basic output pulse width is essentially determined by the values of the external timing components  $R_{EXT}$  and  $C_{EXT}$ .

Schmitt-trigger action in the  $n\bar{A}$  and  $nB$  inputs, makes the circuit highly tolerant to slower input rise and fall times.

#### FEATURES

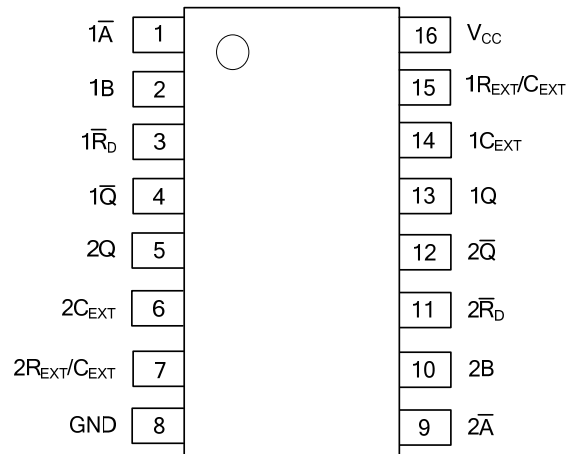
- \* DC triggered from active HIGH or active LOW inputs
- \* Retriggerable for very long pulses up to 100% duty factor
- \* Direct reset terminates output pulse
- \* Schmitt-trigger action on all inputs except for the reset input

#### ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
U74HC123L-S16-R	U74HC123G-S16-R	SOP-16	Tape Reel
U74HC123L-S16-T	U74HC123G-S16-T	SOP-16	Tube
U74HC123L-P16-R	U74HC123G-P16-R	TSSOP-16	Tape Reel
U74HC123L-P16-T	U74HC123G-P16-T	TSSOP-16	Tube

<p>U74HC123L-S16-R</p> <p>(1) Packing Type (2) Package Type (3) Lead Free</p>	<p>(1) R: Tape Reel, T: Tube</p> <p>(2) S16: SOP-16, P16: TSSOP-16</p> <p>(3) L: Lead Free, G: Halogen Free</p>
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## PIN CONFIGURATION



## FUNCTION TABLE

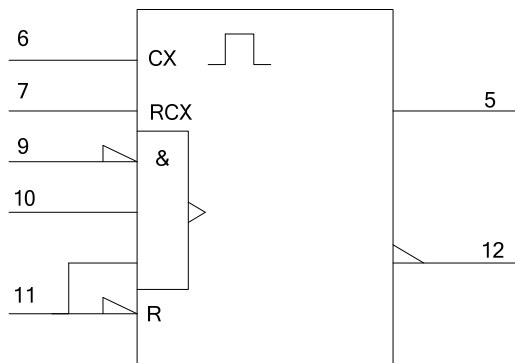
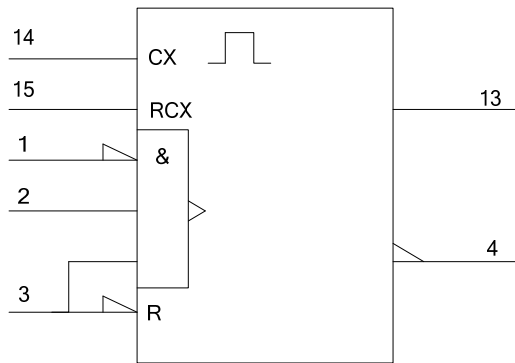
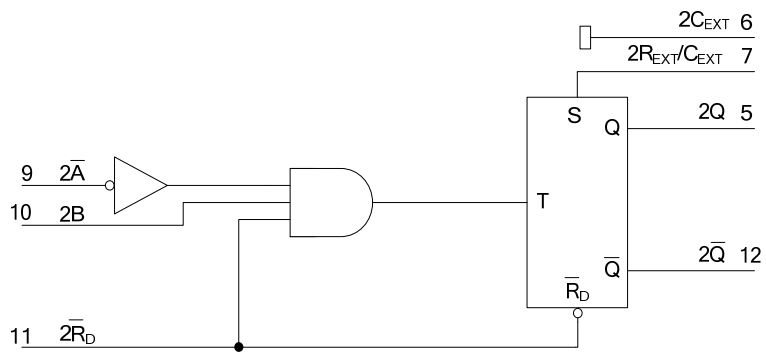
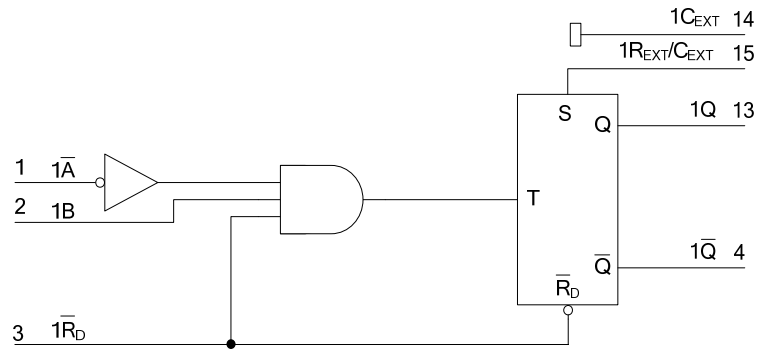
INPUTS			OUTPUTS	
$\overline{nR_D}$	$\overline{nA}$	nB	nQ	$\overline{nQ}$
L	X	X	L	H
X	H	X	L(2)	H(2)
X	X	L	L(2)	H(2)
H	L	↑	⌋	⌋
H	↓	H	⌋	⌋
↑	L	H	⌋	⌋

Note: 1. H: HIGH voltage level L: LOW voltage level X: don't care ↑: LOW-to-HIGH transition

↓: HIGH-to-LOW transition ⌋: one HIGH level output pulse ⌋: one LOW level output pulse

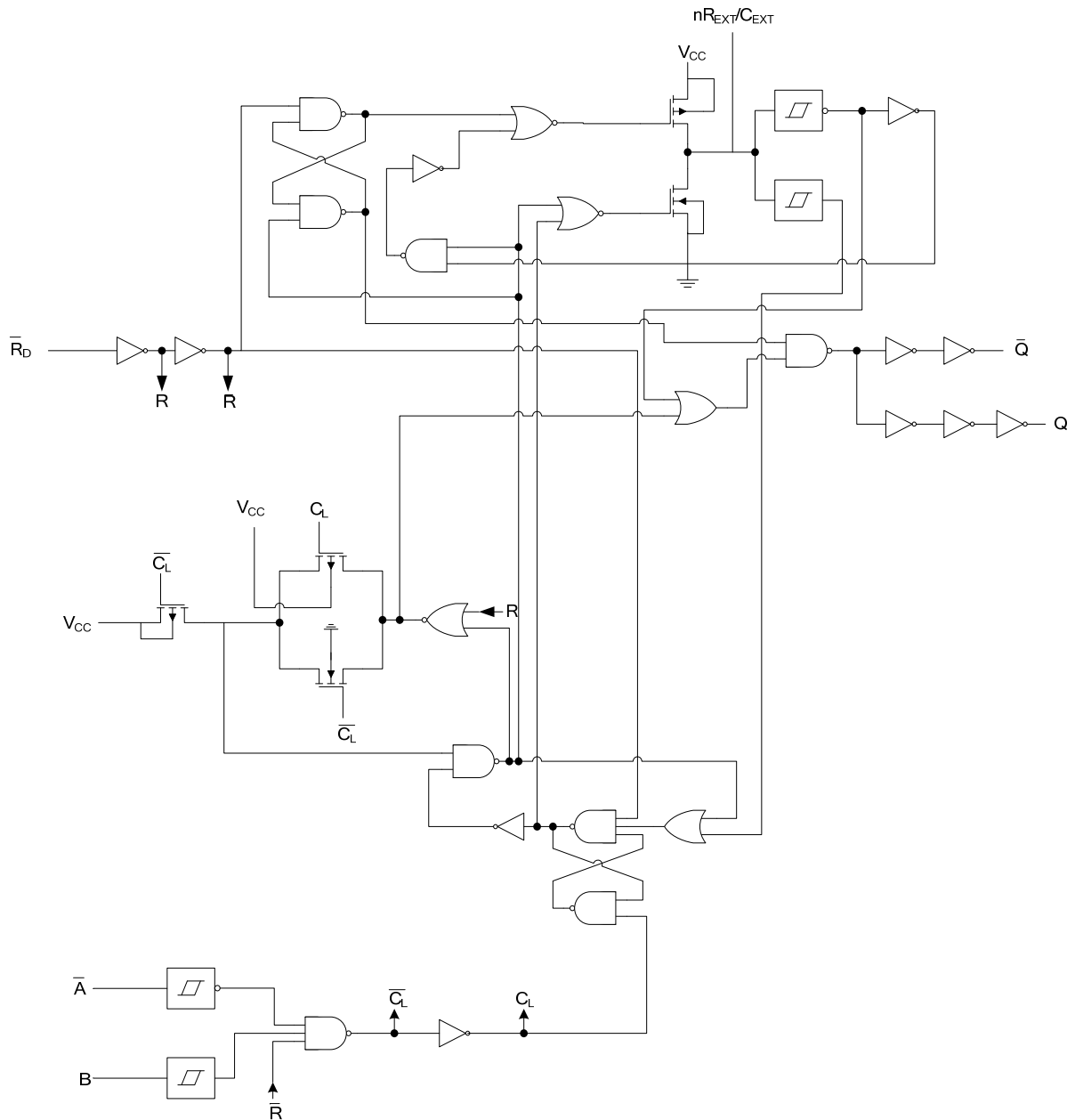
2. If the monostable was triggered before this condition was established, the pulse will continue as programmed.

■ LOGIC SYMBOL



IEC logic symbol

■ LOGIC DIAGRAM



### ■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	$V_{CC}$	-0.5 ~ 7	V
$V_{CC}$ or GND Current	$I_{CC}$	±50	mA
Output Current	$I_{OUT}$	±25	mA
Input Clamp Current	$I_{IK}$	±20	mA
Output Clamp Current	$I_{OK}$	±20	mA
Storage Temperature	$T_{STG}$	-65 ~ + 150	°C

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
 Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Supply Voltage	$V_{CC}$		2	5	6	V
High-level Input Voltage	$V_{IH}$	$V_{CC}=2V$	1.5	1.2		V
		$V_{CC}=4.5V$	3.15	2.4		
		$V_{CC}=6V$	4.2	3.2		
Low-level Input Voltage	$V_{IL}$	$V_{CC}=2V$		0.8	0.5	V
		$V_{CC}=4.5V$		2.1	1.35	
		$V_{CC}=6V$		2.8	1.8	
Input Voltage	$V_{IN}$		0		$V_{CC}$	V
Output Voltage	$V_{OUT}$		0		$V_{CC}$	V
Input Transition Rise and Fall Rate $nR_D$ Input	$\Delta t/\Delta V$	$V_{CC}=2V$			1000	ns
		$V_{CC}=4.5V$			500	
		$V_{CC}=6V$			400	
Ambient Temperature	$T_{amb}$		-40	+25	+125	°C

### ■ ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ C$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage High-Level	$V_{OH}$	$V_{CC}=2V, I_{OH}=-20\mu A$	1.9	2		V
		$V_{CC}=4.5V, I_{OH}=-20\mu A$	4.4	4.5		
		$V_{CC}=6V, I_{OH}=-20\mu A$	5.9	6		
		$V_{CC}=4.5V, I_{OH}=-4mA$	3.98	4.32		
		$V_{CC}=6V, I_{OH}=-5.2mA$	5.48	5.81		
Output Voltage Low-Level	$V_{OL}$	$V_{CC}=2V, I_{OL}=20\mu A$		0	0.1	V
		$V_{CC}=4.5V, I_{OL}=20\mu A$		0	0.1	
		$V_{CC}=6V, I_{OL}=20\mu A$		0	0.1	
		$V_{CC}=4.5V, I_{OL}=4mA$		0.15	0.26	
		$V_{CC}=6V, I_{OL}=5.2mA$		0.16	0.26	
Input Leakage Current	$I_{(LEAK)}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND			±0.1	μA
Quiescent Supply Current	$I_{CC}$	$V_{CC}=6V, V_{IN}=V_{CC}$ or GND, $I_{OUT}=0$			8	μA
Input Capacitance	$C_I$			3.5		pF

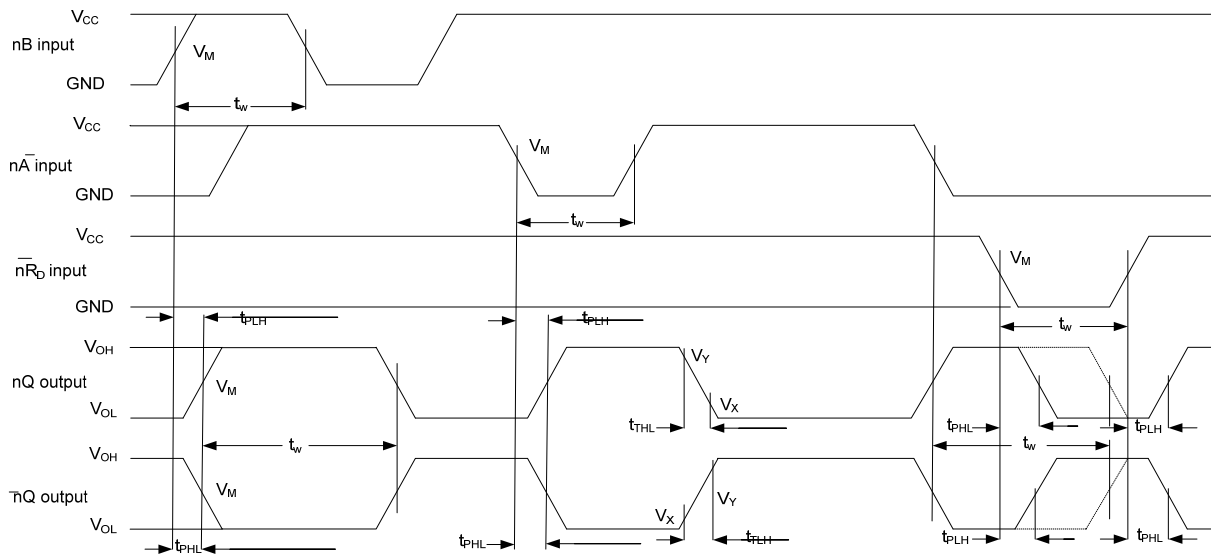
■ SWITCHING CHARACTERISTICS ( $t_r = t_f = 6\text{ns}$ ,  $C_L = 50\text{pF}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Propagation Delay Time From $n\bar{A}$ , $nB$ to $nQ$ or $n\bar{Q}$	$t_{PLH}/t_{PHL}$	$V_{CC}=2V$		83	255	ns	
		$V_{CC}=4.5V$		30	51		
		$V_{CC}=5V, C_L=15p$	$C_{EXT}=0pF$ $R_{EXT}=5k$		26		
		$V_{CC}=6V$		24	43		
Propagation Delay Time From $n\bar{R}_D$ to $nQ$ or $n\bar{Q}$	$t_{PLH}/t_{PHL}$	$V_{CC}=2V$		66	215	ns	
		$V_{CC}=4.5V$		24	43		
		$V_{CC}=5V, C_L=15p$	$C_{EXT}=0pF$ $R_{EXT}=5k$		20		
		$V_{CC}=6V$		19	37		
Output transition time	$t_t$	$V_{CC}=2V$		19	75	ns	
		$V_{CC}=4.5V$		7	15		
		$V_{CC}=6V$		6	13		
Trigger pulse width $n\bar{A} = \text{LOW}$	$t_w$	$V_{CC}=2V$	100	8		ns	
		$V_{CC}=4.5V$	20	3			
		$V_{CC}=6V$	17	2			
Trigger pulse width $nB = \text{HIGH}$	$t_w$	$V_{CC}=2V$	100	17		ns	
		$V_{CC}=4.5V$	20	6			
		$V_{CC}=6V$	17	5			
Reset pulse width $n\bar{R}_D = \text{LOW}$	$t_w$	$V_{CC}=2V$	100	14		ns	
		$V_{CC}=4.5V$	20	5			
		$V_{CC}=6V$	17	4			
Output pulse width $nQ = \text{HIGH}, n\bar{Q} = \text{LOW}$	$t_w$	$V_{CC}=5V, C_{EXT}=100nF, R_{EXT}=10k$		450		$\mu s$	
Output pulse width $nQ = \text{HIGH}, n\bar{Q} = \text{LOW}$	$t_w$	$V_{CC}=5V, C_{EXT}=0pF, R_{EXT}=5k$		75		ns	
Retrigger time $n\bar{A}, nB$	$t_{rt}$	$V_{CC}=5V, C_{EXT}=0pF, R_{EXT}=5k$		110		ns	
External timing resistor	$R_{EXT}$	$V_{CC}=2V$	10		1000	$k\Omega$	
		$V_{CC}=5V$	2		1000		
External timing capacitor	$C_{EXT}$	$V_{CC}=5V$	2		10000	$pF$	

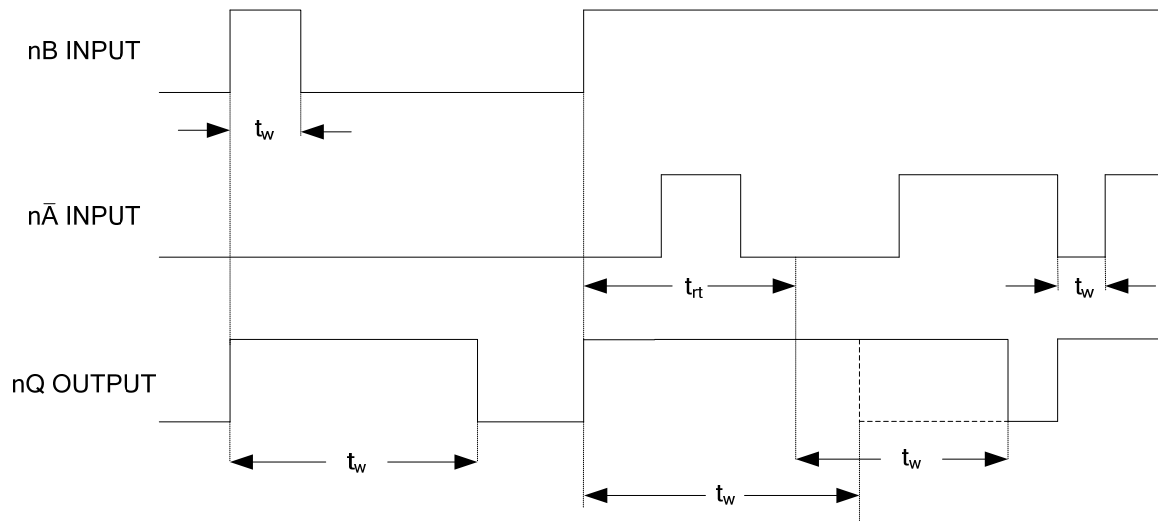
■ OPERATING CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Power Dissipation Capacitance Per monostable	$C_{PD}$			54		$pF$

## ■ TEST CIRCUIT AND WAVEFORMS

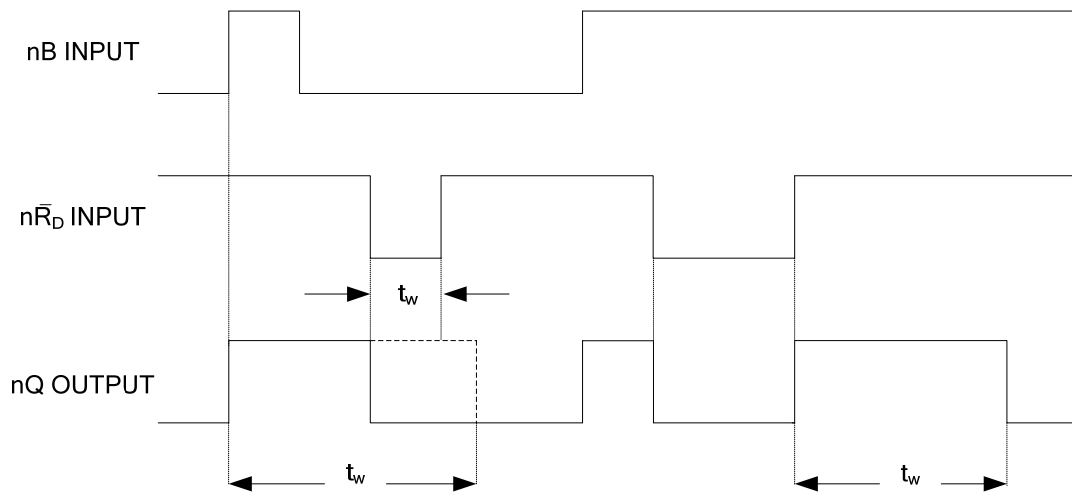


Propagation delays from inputs (nA, nB, nRD) to outputs (nQ, nQ-bar) and output transition times

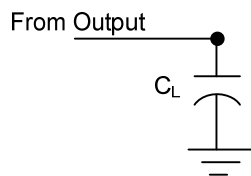


Output pulse control using retrigger pulse; nRD=HIGH

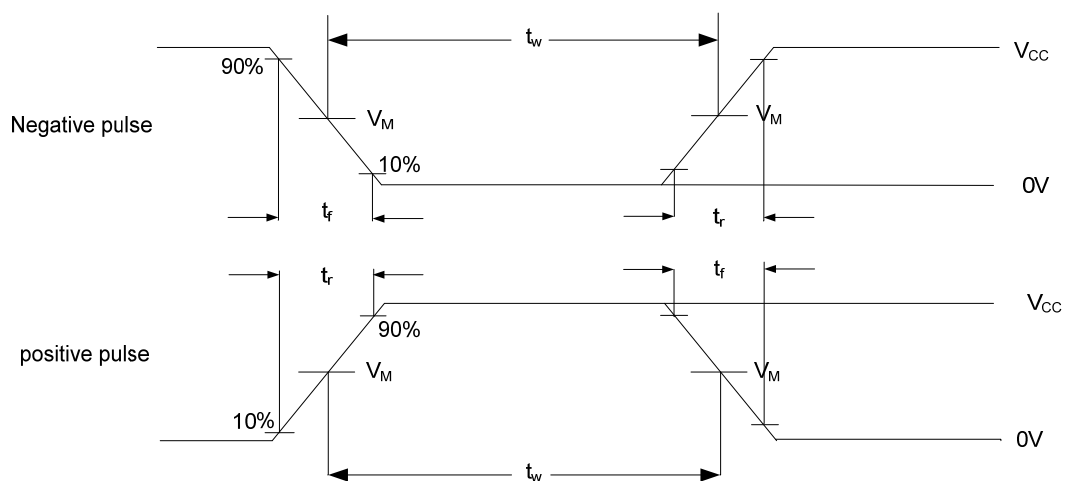
## ■ TEST CIRCUIT AND WAVEFORMS(Cont.)



Output pulse control using input in nR<sub>D</sub>; nA=LOW



TEST CIRCUIT

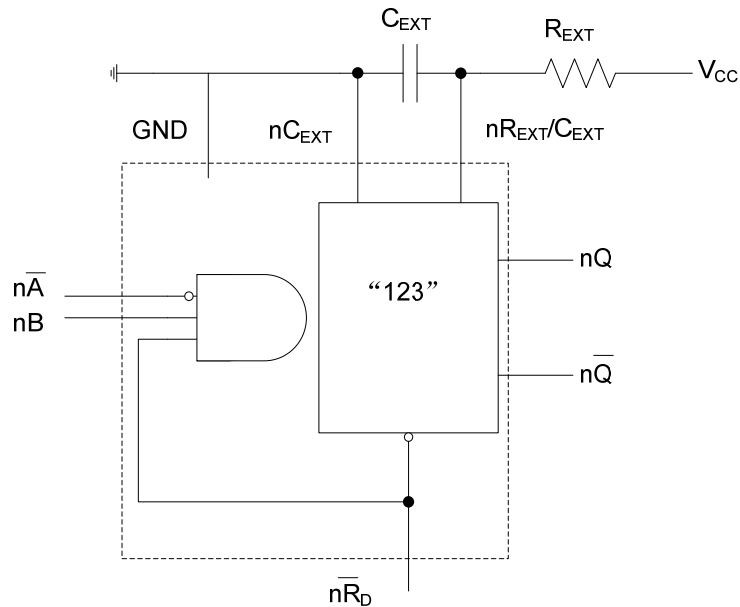




## APPLICATION INFORMATION

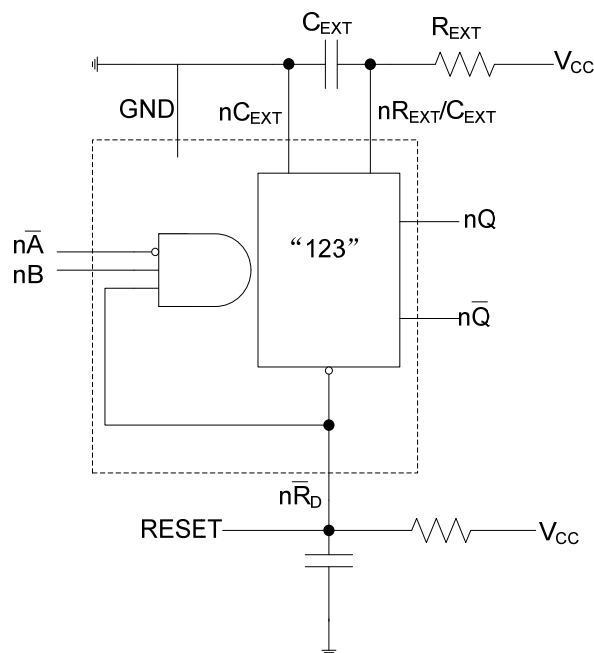
### Timing component connections

The basic output pulse width is essentially determined by the values of the external timing components  $R_{EXT}$  and  $C_{EXT}$ .



### Power-up considerations

When the monostable is powered-up it may produce an output pulse, with a pulse width defined by the values of  $R_{EXT}$  and  $C_{EXT}$ , this output can be eliminated using the circuit below.

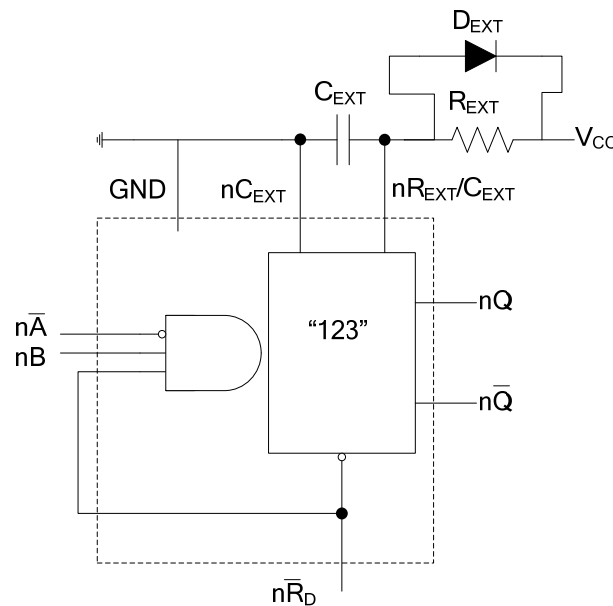


Power-up output pulse elimination circuit

■ APPLICATION INFORMATION(Cont.)

**Power-down considerations**

A large capacitor ( $C_{EXT}$ ) may cause problems when powering-down the monostable due to the energy stored in this capacitor. When a system containing this device is powered-down or a rapid decrease of  $V_{CC}$  to zero occurs, the monostable may sustain damage, due to the capacitor discharging through the input protection diodes. To avoid this possibility, use a damping diode ( $D_{EXT}$ ) preferably a germanium or Schottky type diode able to withstand large current surges and connect as shown below.



Power-down protection circuit

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