

54/74221  
54LS/74LS221

DESCRIPTION

The "221" is a Dual Monostable Multivibrator with Schmitt-trigger inputs (B) and an overriding direct Reset ( $\bar{R}_D$ ). The output pulse width is independent of the input pulse width and can be varied from 35 nanoseconds to over one minute for the 74LS221. The output pulse width is determined by the value of the external resistance and capacitance connected to the  $C_{ext}$  and  $R_{ext}/C_{ext}$  terminals.

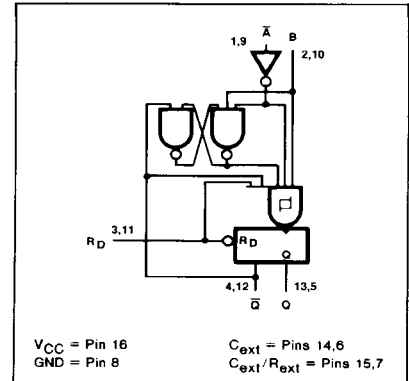
FEATURES

- Pulse-Width Variance is typically less than  $\pm 0.5\%$  for 98% of the units
- The "221" demonstrates electrical and switching characteristics that are virtually identical to the "121" one-shots
- Pin-Out is identical to the "123"
- Overriding Reset terminates output pulse
- B input has hysteresis for improved noise immunity
- Maximum pulse width:  
54221 21 seconds  
74221 28 seconds  
54LS221 49 seconds  
74LS221 70 seconds

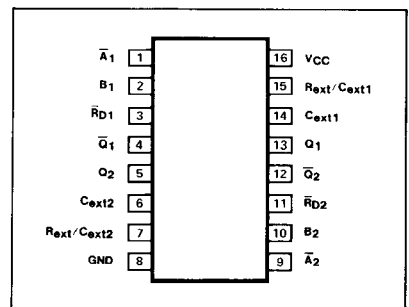
ORDERING CODE (See Section 9 for further Package and Ordering Information)

PACKAGES	COMMERCIAL RANGES $V_{CC}=5V \pm 5\%$ ; $T_A=0^\circ C$ to $+70^\circ C$		MILITARY RANGES $V_{CC}=5V \pm 10\%$ ; $T_A=-55^\circ C$ to $+125^\circ C$	
	Plastic DIP	N74221N	• N74LS221N	
Ceramic DIP	N74221F	• N74LS221F	S54221F	• S54LS221F
Flatpak			S54221W	• S54LS221W

LOGIC SYMBOL



PIN CONFIGURATION



INPUT AND OUTPUT LOADING AND FAN-OUT TABLE<sup>(a)</sup>

PINS	DESCRIPTION		54/74	54S/74S	54LS/74LS
$\bar{A}$	Trigger (active LOW) input	$I_{IH}$ ( $\mu A$ ) $I_{IL}$ (mA)	40 -1.6		20 -0.4
B	Trigger (active HIGH) input	$I_{IH}$ ( $\mu A$ ) $I_{IL}$ (mA)	80 -3.2		20 -0.8
$\bar{R}_D$	Direct Reset (active LOW) input	$I_{IH}$ ( $\mu A$ ) $I_{IL}$ (mA)	80 -3.2		20 -0.8
Q	Pulse (active HIGH) output	$I_{OH}$ ( $\mu A$ ) $I_{OL}$ (mA)	-800 16		-400 4/8(a)
$\bar{Q}$	Pulse (active LOW) output	$I_{OH}$ ( $\mu A$ ) $I_{OL}$ (mA)	-800 16		-400 4/8(a)

NOTE  
a. The slashed numbers indicate different parametric values for Military/Commercial temperature ranges respectively.

**FUNCTIONAL DESCRIPTION**

The "221" is a dual monostable multivibrator with performance characteristics virtually identical to those of the "121". Each multivibrator features an active LOW going edge input (A) and an active HIGH going edge input (B) either of which can be used as an enable input.

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 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 A and B inputs and

are a function of the timing components. The output pulses can be terminated by the overriding active LOW Reset ( $\bar{R}_D$ ). Input pulses may be of any duration relative to the output pulse. Output pulse length may be varied from 35 nanoseconds to the maximums shown in the FEATURES by choosing appropriate timing components. With  $R_{ext} = 2k\Omega$  and  $C_{ext} = 0$ , an output pulse of typically 30 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

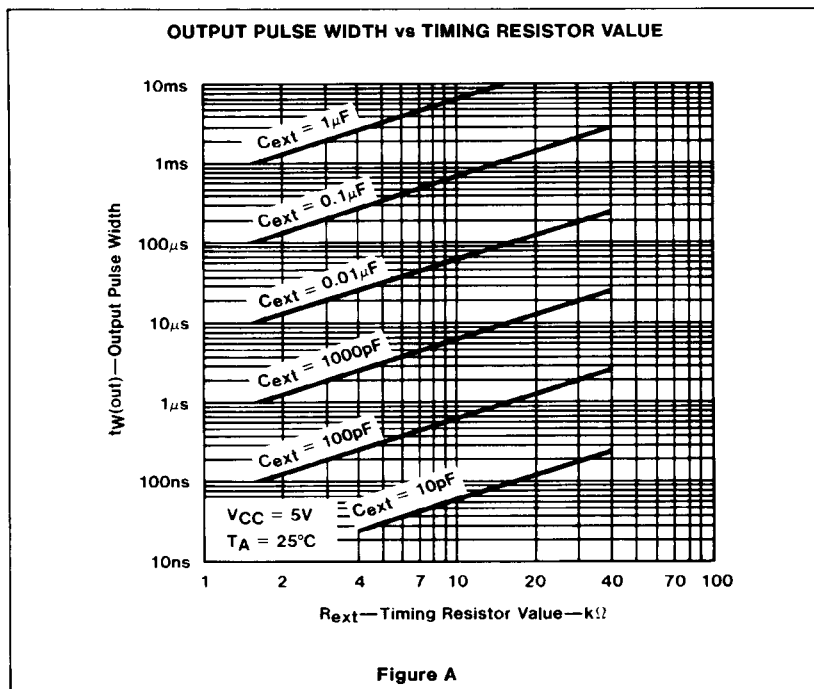
than six decades of timing capacitance (10pF to 10 $\mu$ F) and more than one decade of timing resistance (2k $\Omega$  to 30k $\Omega$  for the 54221, 2k $\Omega$  to 40k $\Omega$  for the 74221, 2k $\Omega$  to 70k $\Omega$  for the 54LS221, and 2k $\Omega$  to 100k $\Omega$  for the 74LS221). Throughout these ranges, pulse width is defined by the following relationship: (See Figure A)

$$t_{W(out)} = C_{ext}R_{ext} \ln 2$$

$$t_{W(out)} \approx 0.7 C_{ext}R_{ext}$$

In circuits where pulse cutoff is not critical, timing capacitance up to 1000 $\mu$ F and timing resistance as low as 1.4k $\Omega$  may be used.

Pin assignments for these devices are identical to those of the "123" so that the "221" can be substituted for those products in systems not using the retrigger by merely changing the value of  $R_{ext}$  and/or  $C_{ext}$ .



DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE<sup>(b)</sup>

PARAMETER		TEST CONDITIONS	54/74		54S/74S		54LS/74LS		UNIT
			Min	Max	Min	Max	Min	Max	
I <sub>CC</sub>	Supply current	V <sub>CC</sub> = Max	Quiescent	50				11	mA
			Triggered	80				27	mA

AC CHARACTERISTICS: T<sub>A</sub> = 25°C (See Section 4 for Test Circuits and Conditions)

PARAMETER		TEST CONDITIONS	54/74		54S/74S		54LS/74LS		UNIT
			C <sub>L</sub> = 15pF R <sub>L</sub> = 400Ω				C <sub>L</sub> = 15pF R <sub>L</sub> = 2kΩ		
			Min	Max	Min	Max	Min	Max	
t <sub>PLH</sub>	Propagation delay $\bar{A}$ input to Q & $\bar{Q}$ output	Figure 1 C <sub>ext</sub> = 80pF, R <sub>ext</sub> = 2kΩ		70				70	ns
t <sub>PHL</sub>				80				80	ns
t <sub>PLH</sub>	Propagation delay B input to Q & $\bar{Q}$ output	Figure 2 C <sub>ext</sub> = 80pF, R <sub>ext</sub> = 2kΩ		55				55	ns
t <sub>PHL</sub>				65				65	ns
t <sub>PLH</sub>	Propagation delay $\bar{R}_D$ input to $\bar{Q}$ & Q output	Figure 3 C <sub>ext</sub> = 80pF, R <sub>ext</sub> = 2kΩ		40				40	ns
t <sub>PHL</sub>				27				27	ns
t <sub>w</sub>	Minimum output pulse width	C <sub>ext</sub> = 0pF, R <sub>ext</sub> = 2kΩ	20	50			20	70	ns
t <sub>w</sub>	Output pulse width	C <sub>ext</sub> = 80pF, R <sub>ext</sub> = 2kΩ	70	150			70	150	ns
		C <sub>ext</sub> = 100pF, R <sub>ext</sub> = 10kΩ	650	750			600	750	ns
		C <sub>ext</sub> = 1μF, R <sub>ext</sub> = 10kΩ	6.5	7.5			6.0	7.5	ns

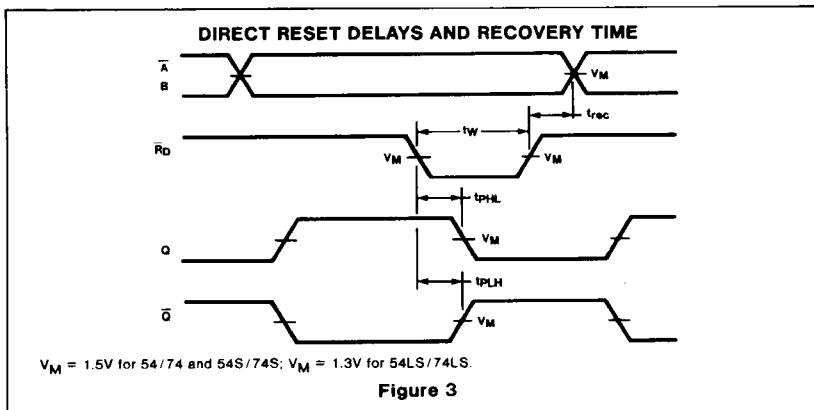
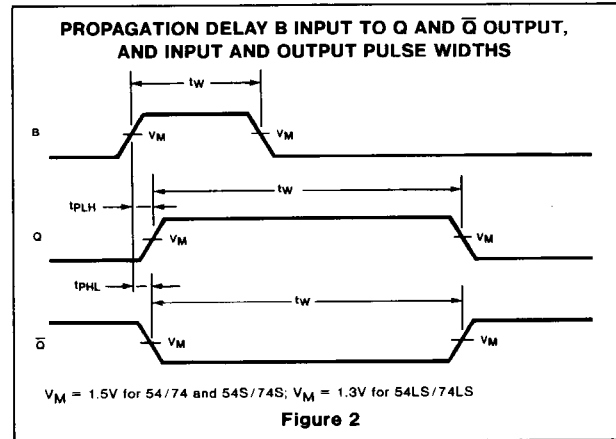
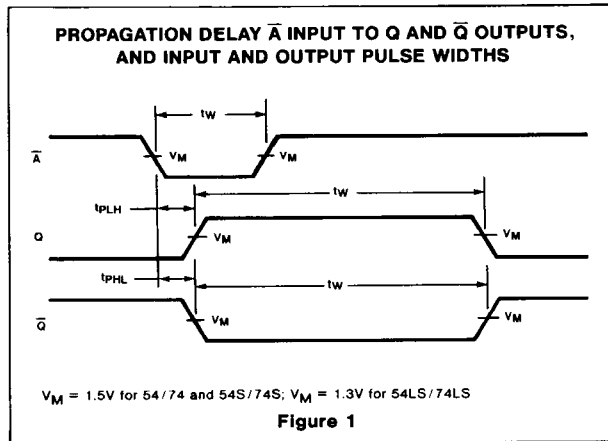
AC SETUP REQUIREMENTS: T<sub>A</sub> = 25°C (See Section 4 for Test Circuits and Conditions)

PARAMETER		TEST CONDITIONS	54/74		54S/74S		54LS/74LS		UNIT
			Min	Max	Min	Max	Min	Max	
t <sub>w</sub>	Minimum input pulse width to trigger	Figures 1 & 2	50				50		ns
t <sub>w</sub>	Minimum Reset pulse width	Figure 3	20				40		ns
t <sub>rec</sub>	Recovery time from Reset to trigger input	Figure 3	15				15		ns
R <sub>ext</sub>	External timing resistor range	Mil	1.4	30			1.4	70	kΩ
		Com	1.4	40			1.4	100	kΩ
C <sub>ext</sub>	External timing capacitance range		0	1000			0	1000	μF
	Output duty cycle	R <sub>ext</sub> = 2kΩ		67				67	%
		R <sub>ext</sub> = R <sub>ext</sub> (Max)		90				90	%

NOTE

b. For family dc characteristics, see inside front cover for 54/74 and 54H/74H, and see inside back cover for 54S/74S and 54LS/74LS specifications.

AC WAVEFORMS



3