National Semiconductor

February 1988

MM54C221/MM74C221 Dual Monostable Multivibrator

General Description

The MM54C221/MM74C221 dual monostable multivibrator is a monolithic complementary MOS integrated circuit. Each multivibrator features a negative-transition-triggered input and a positive-transition-triggered input, either of which can be used as an inhibit input, and a clear input.

Once fired, the output pulses are independent of further transitions of the A and B inputs and are a function of the external timing components C_{EXT} and R_{EXT}. The pulse width is stable over a wide range of temperature and V_{CC}.

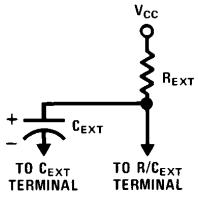
Pulse stability will be limited by the accuracy of external timing components. The pulse width is approximately defined by the relationship $t_{W(OUT)} \approx C_{EXT} R_{EXT}$. For further information and applications, see AN-138.

Features

■ Wide supply voltage range	4.5V to 15V
■ Guaranteed noise margin	1.0V
■ High noise immunity	0.45 V_{CC} (typ.)
■ Low power TTL compatibility	fan out of 2 driving 74L

Connection Diagrams

Timing Component



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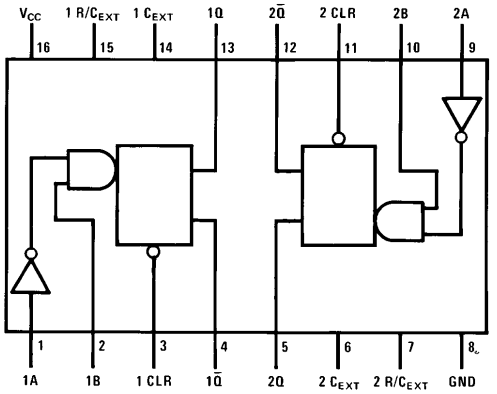
Dual-In-Line Package



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Top View

Order Number MM54C221 or MM74C221

Truth Table

Inputs			Outputs	
Clear	**A**	**B**	**Q**	**$\overline{Q}$**
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎

H = High level
L = Low level
↑ = Transition from low to high
↓ = Transition from high to low
⎍ = One high level pulse
⎎ = One low level pulse
X = Irrelevant

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Voltage at Any Pin	$-0.3V$ to $V_{CC} + 0.3V$
Operating Temperature Range	
MM54C221	$-55°C$ to $+125°C$
MM74C221	$-40°C$ to $+85°C$
Storage Temperature Range	$-65°C$ to $+150°C$
Power Dissipation	
Dual-In-Line	700 mW
Small Outline	500 mW
Operating V_{CC} Range	4.5V to 15V
Absolute Maximum V_{CC}	18V
$R_{EXT} \geq 80\ V_{CC}\ (\Omega)$	
Lead Temperature (Soldering, 10 seconds)	260°C

DC Electrical Characteristics Max/min limits apply across temperature range, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
CMOS to CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V, I_O = -10\ \mu A$ $V_{CC} = 10V, I_O = -10\ \mu A$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V, I_O = +10\ \mu A$ $V_{CC} = 10V, I_O = +10\ \mu A$			0.5 1	V V
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V, V_{IN} = 15V$		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		μA
I_{CC}	Supply Current (Standby)	$V_{CC} = 15V, R_{EXT} = \infty$, Q1, Q2 = Logic "0" (Note 3)		0.05	300	μA
I_{CC}	Supply Current (During Output Pulse)	$V_{CC} = 15V$, Q1 = Logic "1", Q2 = Logic "0" *(Figure 4)*		15		mA
		$V_{CC} = 5V$, Q1 = Logic "1", Q2 = Logic "0" *(Figure 4)*		2		mA
	Leakage Current at R/C_{EXT} Pin	$V_{CC} = 15V, V_{CEXT} = 5V$		0.01	3.0	μA
CMOS/LPTTL Interface						
$V_{IN(1)}$	Logical "1" Input Voltage	54C $V_{CC} = 4.5V$ 74C $V_{CC} = 4.75V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C $V_{CC} = 4.5V$ 74C $V_{CC} = 4.75V$			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C $V_{CC} = 4.5V, I_O = -360\ \mu A$ 74C $V_{CC} = 4.75V, I_O = -360\ \mu A$	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C $V_{CC} = 4.5V, I_O = 360\ \mu A$ 74C $V_{CC} = 4.75V, I_O = 360\ \mu A$			0.4 0.4	V V
Output Drive (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 5V$ $T_A = 25°C, V_{OUT} = 0V$	-1.75			mA
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 10V$ $T_A = 25°C, V_{OUT} = 0V$	-8			mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 5V$ $T_A = 25°C, V_{OUT} = V_{CC}$	1.75			mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 10V$ $T_A = 25°C, V_{OUT} = V_{CC}$	8			mA

AC Electrical Characteristics* $T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Units
$t_{pd\ A,\ B}$	Propagation Delay from Trigger Input (A, B) to Output Q, $\overline{Q}$	$V_{CC} = 5V$ $V_{CC} = 10V$		250 120	500 250	ns ns
$t_{pd\ CL}$	Propagation Delay from Clear Input (CL) to Output Q, $\overline{Q}$	$V_{CC} = 5V$ $V_{CC} = 10V$		250 120	500 250	ns ns
t_S	Time Prior to Trigger Input (A, B) that Clear must be Set	$V_{CC} = 5V$ $V_{CC} = 10V$	150 60	50 20		ns ns
$t_{W(A,\ B)}$	Trigger Input (A, B) Pulse Width	$V_{CC} = 5V$ $V_{CC} = 10V$	150 70	50 30		ns ns
$t_{W(CL)}$	Clear Input (CL) Pulse Width	$V_{CC} = 5V$ $V_{CC} = 10V$	150 70	50 30		ns ns
$t_{W(OUT)}$	Q or $\overline{Q}$ Output Pulse Width	$V_{CC} = 5V$, $R_{EXT} = 10k$, $C_{EXT} = 0$ pF		900		ns
		$V_{CC} = 10V$, $R_{EXT} = 10k$, $C_{EXT} = 0$ pF		350		ns
		$V_{CC} = 15V$, $R_{EXT} = 10k$, $C_{EXT} = 0$ pF		320		ns
		$V_{CC} = 5V$, $R_{EXT} = 10k$, $C_{EXT} = 1000$ pF *(Figure 1)*	9.0	10.6	12.2	μs
		$V_{CC} = 10V$, $R_{EXT} = 10k$, $C_{EXT} = 1000$ pF *(Figure 1)*	9.0	10	11	μs
		$V_{CC} = 15V$, $R_{EXT} = 10k$, $C_{EXT} = 1000$ pF *(Figure 1)*	8.9	9.8	10.8	μs
		$V_{CC} = 5V$, $R_{EXT} = 10k$, $C_{EXT} = 0.1\ \mu$F *(Figure 2)*	900	1020	1200	μs
		$V_{CC} = 10V$, $R_{EXT} = 10k$, $C_{EXT} = 0.1\ \mu$F *(Figure 2)*	900	1000	1100	μs
		$V_{CC} = 15V$, $R_{EXT} = 10k$, $C_{EXT} = 0.1\ \mu$F *(Figure 2)*	900	990	1100	μs
R_{ON}	ON Resistance of Transistor between R/C_{EXT} to C_{EXT}	$V_{CC} = 5V$ (Note 4) $V_{CC} = 10V$ (Note 4) $V_{CC} = 15V$ (Note 4)		50 25 16.7	150 65 45	Ω Ω Ω
	Output Duty Cycle	$R = 10k$, $C = 1000$ pF $R = 10k$, $C = 0.1\ \mu$F (Note 5)			90 90	% %
C_{IN}	Input Capacitance	R/C_{EXT} Input (Note 2) Any Other Input (Note 2)		15 5	25	pF pF

*AC Parameters are guaranteed by DC correlated testing.

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

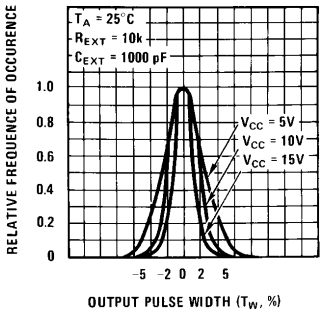
Note 2: Capacitance is guaranteed by periodic testing.

Note 3: In Standby (Q = Logic "0") the power dissipated equals the leakage current plus V_{CC}/R_{EXT}.

Note 4: See AN-138 for detailed explanation R_{ON}.

Note 5: Maximum output duty cycle = $R_{EXT}/R_{EXT} + 1000$.

Typical Performance Characteristics



0% Point pulse width:

At V_{CC} = 5V, T_W = 10.6 μs
At V_{CC} = 10V, T_W = 10 μs
At V_{CC} = 15V, T_W = 9.8 μs

Percentage of units within ±4%:

At V_{CC} = 5V, 90% of units
At V_{CC} = 10V, 95% of units
At V_{CC} = 15V, 98% of units

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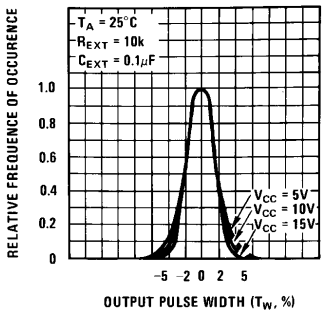
FIGURE 1. Typical Distribution of Units for Output Pulse Width



0% Point pulse width:

At V_{CC} = 5V, T_W = 1020 μs
At V_{CC} = 10V, T_W = 1000 μs
At V_{CC} = 15V, T_W = 982 μs

Percentage of units within ±4%:

At V_{CC} = 5V, 95% of units
At V_{CC} = 10V, 97% of units
At V_{CC} = 15V, 98% of units

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FIGURE 2. Typical Distribution of Units for Output Pulse Width

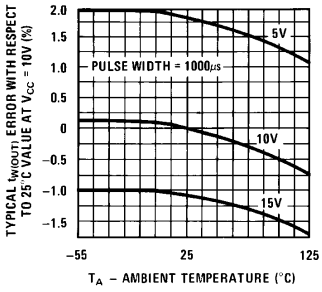

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FIGURE 3. Typical Variation in Output Pulse Width vs Temperature

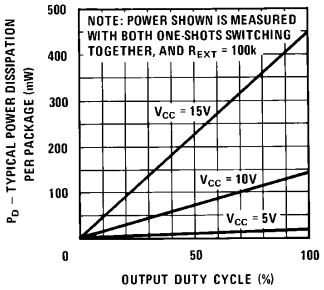

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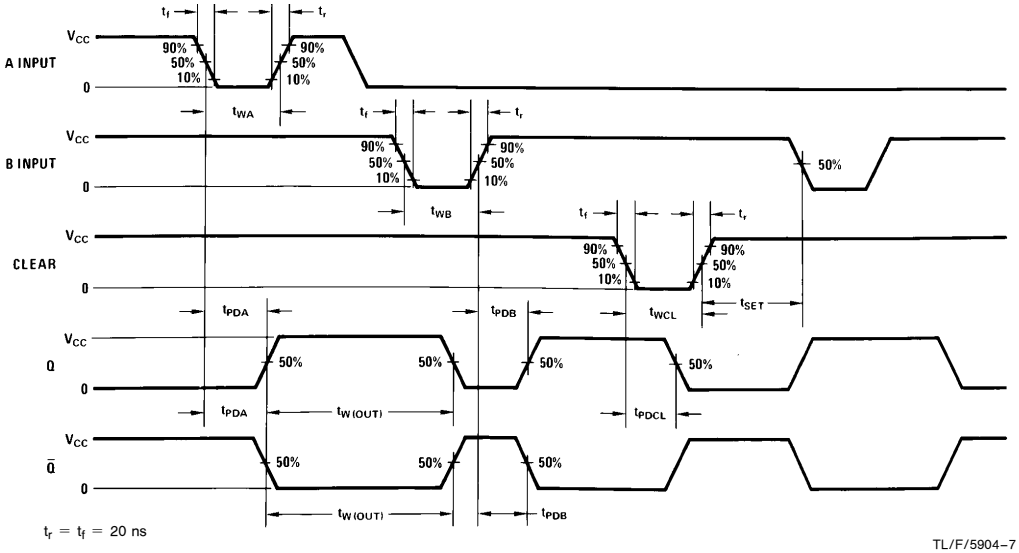
FIGURE 4. Typical Power Dissipation per Package

Switching Time Waveforms



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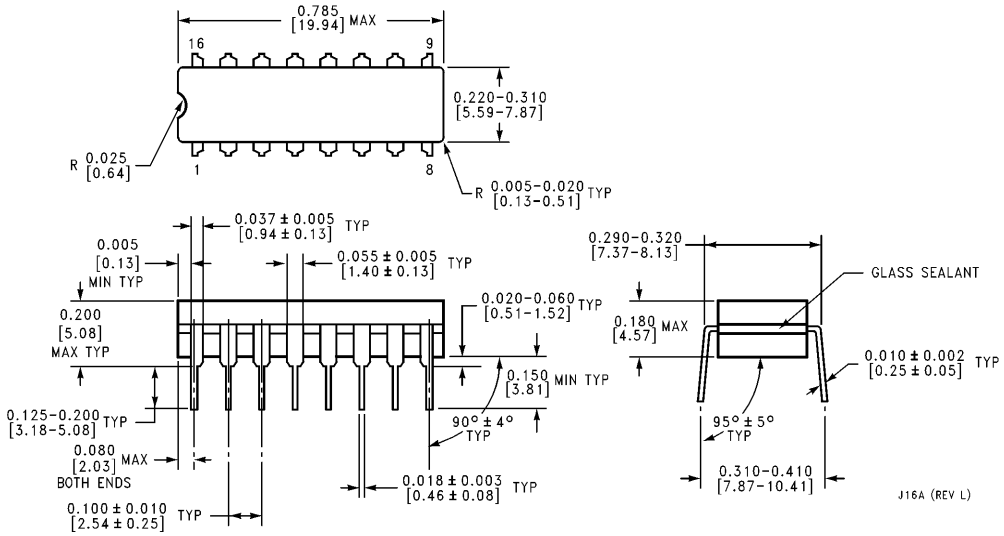
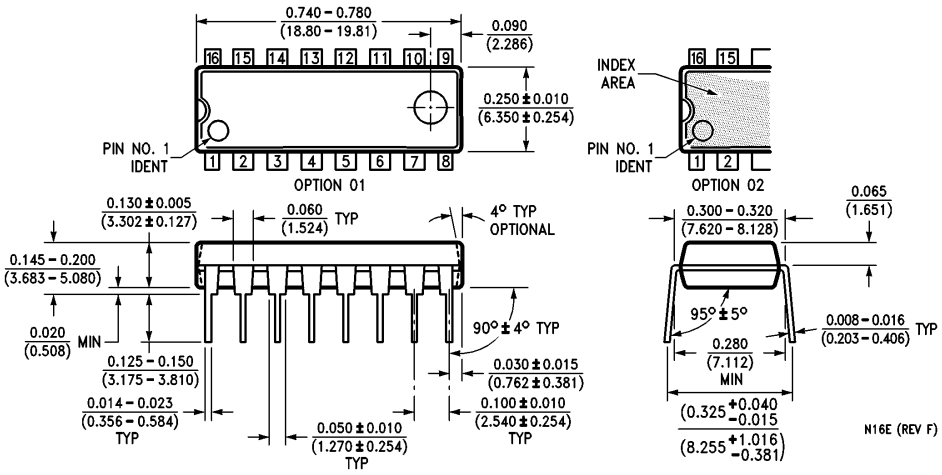
Physical Dimensions inches (millimeters)



Ceramic Dual-In-Line Package (J)
Order Number MM54C221J or MM74C221C
NS Package Number J16A

Physical Dimensions inches (millimeters) (Continued)



Molded Dual-In-Line Package (N)
Order Number MM54C221N or MM74C221N
NS Package Number N16E

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