

## 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  $V_{CC}$ .

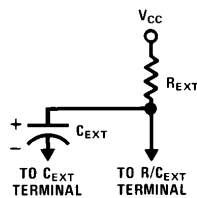
Pulse stability will be limited by the accuracy of external timing components. The pulse width is approximately defined by the relationship  $t_{W(OUT)} \approx C_{EXT} R_{EXT}$ . For further information and applications, see AN-138.

### 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

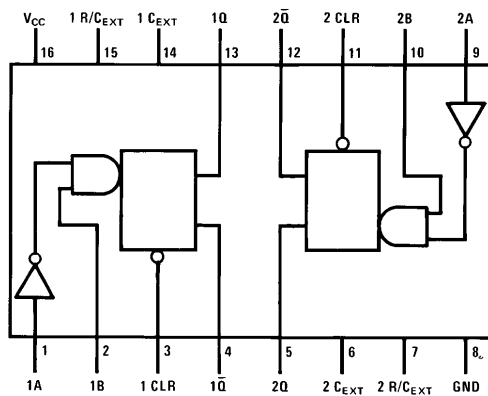
### Connection Diagrams

Timing Component



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Dual-In-Line Package









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Top View

Order Number MM54C221 or MM74C221

### Truth Table

Clear	Inputs		Outputs	
	A	B	Q	Q̄
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	-55°C to +125°C
MM54C221	-40°C to +85°C
MM74C221	-65°C to +150°C

Power Dissipation	700 mW
Dual-In-Line	500 mW
Small Outline	
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
<b>CMOS to CMOS</b>						
$V_{IN(1)}$	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	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V, V_{IN} = 0V$	-1.0	-0.005		$\mu A$
$I_{CC}$	Supply Current (Standby)	$V_{CC} = 15V, R_{EXT} = \infty$ , Q1, Q2 = Logic "0" (Note 3)		0.05	300	$\mu A$
$I_{CC}$	Supply Current (During Output Pulse)	$V_{CC} = 15V, Q1 = \text{Logic "1"}$ , $Q2 = \text{Logic "0"}$ (Figure 4)		15		mA
		$V_{CC} = 5V, Q1 = \text{Logic "1"}$ , $Q2 = \text{Logic "0"}$ (Figure 4)		2		mA
	Leakage Current at R/ $C_{EXT}$ Pin	$V_{CC} = 15V, V_{C_{EXT}} = 5V$		0.01	3.0	$\mu A$
<b>CMOS/LPTTL Interface</b>						
$V_{IN(1)}$	Logical "1" Input Voltage	54C $V_{CC} = 4.5V$	$V_{CC} - 1.5$			V
		74C $V_{CC} = 4.75V$	$V_{CC} - 1.5$			V
$V_{IN(0)}$	Logical "0" Input Voltage	54C $V_{CC} = 4.5V$			0.8	V
		74C $V_{CC} = 4.75V$			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C $V_{CC} = 4.5V, I_O = -360 \mu A$	2.4			V
		74C $V_{CC} = 4.75V, I_O = -360 \mu A$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C $V_{CC} = 4.5V, I_O = 360 \mu A$			0.4	V
		74C $V_{CC} = 4.75V, I_O = 360 \mu A$			0.4	V
<b>Output Drive (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)</b>						
$I_{SOURCE}$	Output Source Current (P-Channel)	$V_{CC} = 5V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-1.75			mA
$I_{SOURCE}$	Output Source Current (P-Channel)	$V_{CC} = 10V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-8			mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 5V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	1.75			mA
$I_{SINK}$	Output Sink Current (N-Channel)	$V_{CC} = 10V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	8			mA

## AC Electrical Characteristics\* $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , unless otherwise noted

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

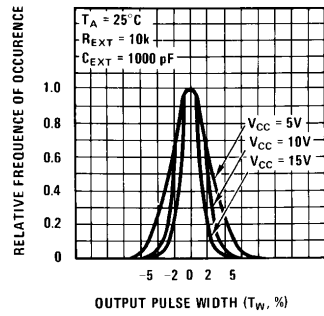
**Note 2:** Capacitance is guaranteed by periodic testing.

**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  $V_{CC} = 5V$ ,  $T_W = 10.6\ \mu\text{s}$

At  $V_{CC} = 10V$ ,  $T_W = 10\ \mu\text{s}$

At  $V_{CC} = 15V$ ,  $T_W = 9.8\ \mu\text{s}$

Percentage of units within +4%:

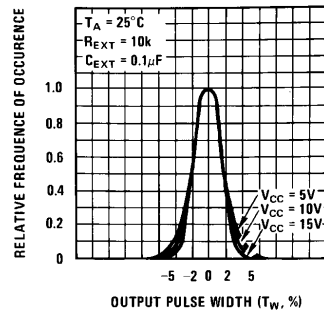
At  $V_{CC} = 5V$ , 90% of units

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  $V_{CC} = 5V$ ,  $T_W = 1020\ \mu\text{s}$

At  $V_{CC} = 10V$ ,  $T_W = 1000\ \mu\text{s}$

At  $V_{CC} = 15V$ ,  $T_W = 982\ \mu\text{s}$

Percentage of units within +4%:

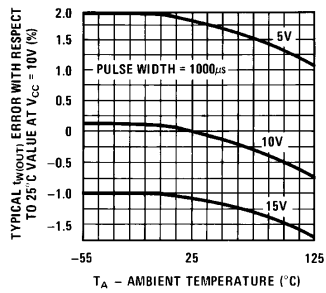
At  $V_{CC} = 5V$ , 95% of units

At  $V_{CC} = 10V$ , 97% of units

At  $V_{CC} = 15V$ , 98% of units

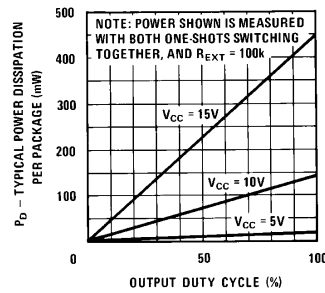
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FIGURE 2. Typical Distribution of Units for Output Pulse Width



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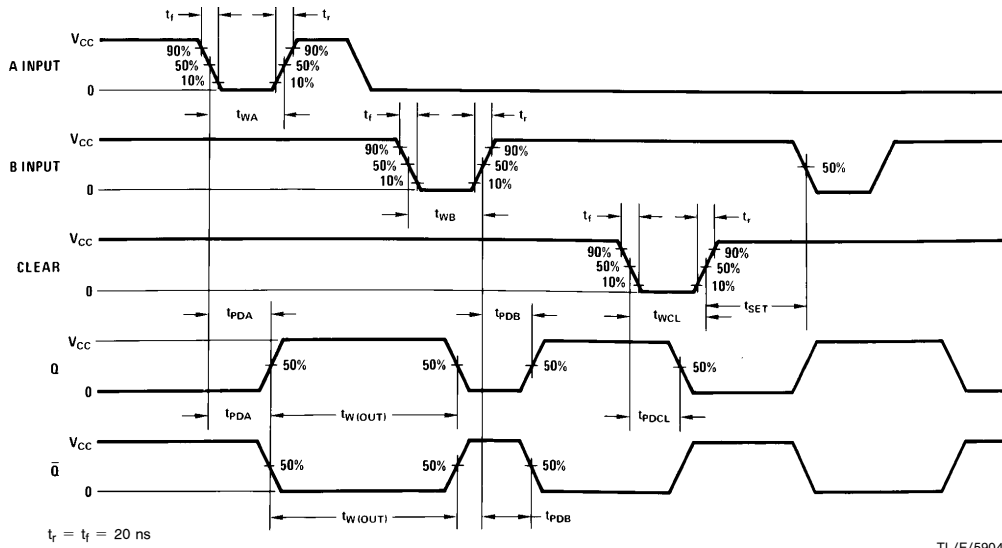
FIGURE 3. Typical Variation in Output Pulse Width vs Temperature



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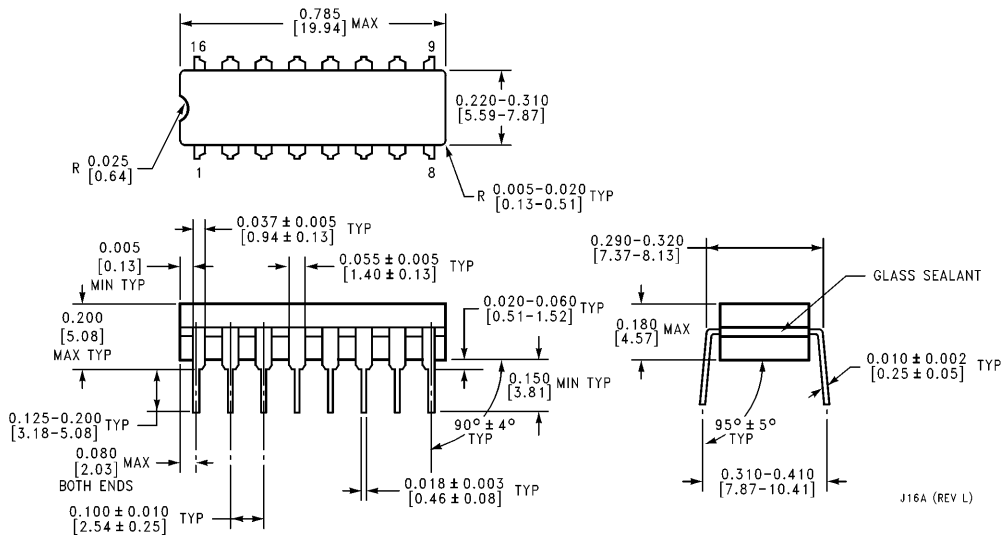
FIGURE 4. Typical Power Dissipation per Package

## Switching Time Waveforms



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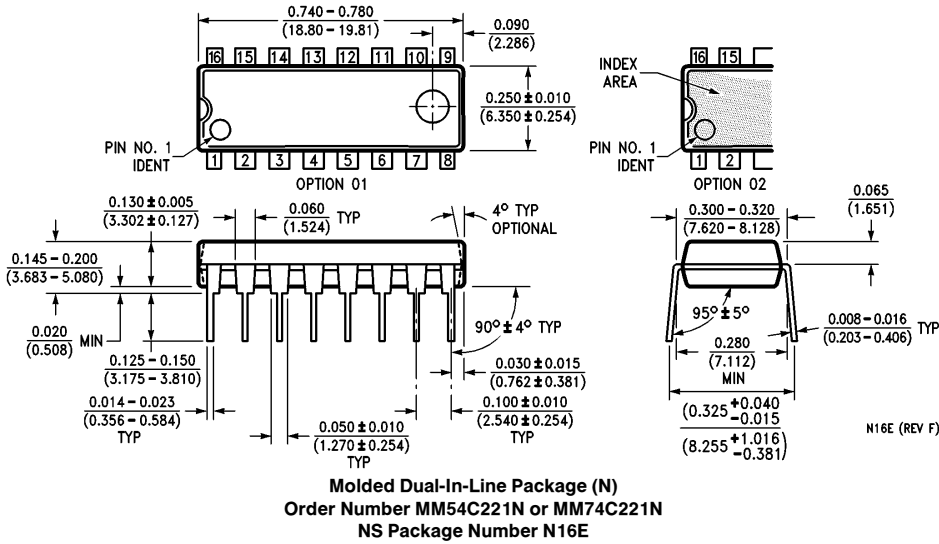
## Physical Dimensions inches (millimeters)



J16A (REV L)

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

**Physical Dimensions** inches (millimeters) (Continued)



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