

## Dual Monostable Multivibrator

The MC14528B is a dual, retriggerable, resettable monostable multivibrator. It may be triggered from either edge of an input pulse, and produces an output pulse over a wide range of widths, the duration of which is determined by the external timing components,  $C_X$  and  $R_X$ .

- Separate Reset Available
- Diode Protection on All Inputs
- Triggerable from Leading or Trailing Edge Pulse
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range
- Pin-for-Pin Replacement with the MC14538B

### MAXIMUM RATINGS\* (Voltages Referenced to $V_{SS}$ )

| Symbol            | Parameter                                          | Value                   | Unit |
|-------------------|----------------------------------------------------|-------------------------|------|
| $V_{DD}$          | DC Supply Voltage                                  | - 0.5 to + 18.0         | V    |
| $V_{in}, V_{out}$ | Input or Output Voltage (DC or Transient)          | - 0.5 to $V_{DD} + 0.5$ | V    |
| $I_{in}, I_{out}$ | Input or Output Current (DC or Transient), per Pin | $\pm 10$                | mA   |
| $P_D$             | Power Dissipation, per Package†                    | 500                     | mW   |
| $T_{stg}$         | Storage Temperature                                | - 65 to + 150           | °C   |
| $T_L$             | Lead Temperature (8-Second Soldering)              | 260                     | °C   |

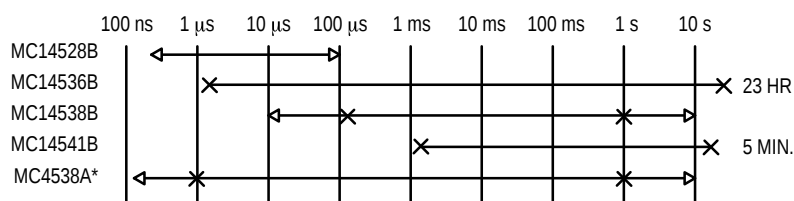
\* Maximum Ratings are those values beyond which damage to the device may occur.

† Temperature Derating:

Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C

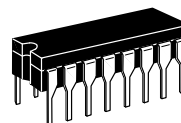
### ONE-SHOT SELECTION GUIDE



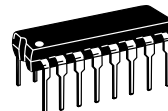
\*LIMITED OPERATING VOLTAGE (2-6 V)

TOTAL OUTPUT PULSE WIDTH RANGE ← →  
RECOMMENDED PULSE WIDTH RANGE × ×

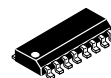
## MC14528B



**L SUFFIX**  
CERAMIC  
CASE 620



**P SUFFIX**  
PLASTIC  
CASE 648



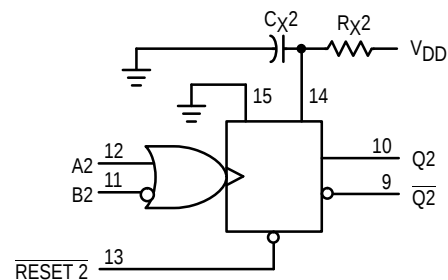
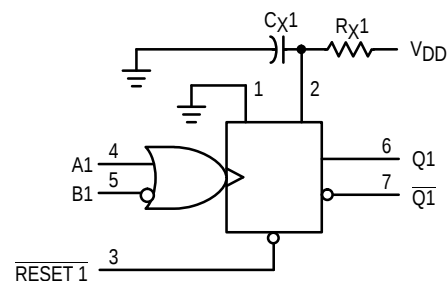
**D SUFFIX**  
SOIC  
CASE 751B

### ORDERING INFORMATION

MC14XXXBCP Plastic  
MC14XXXBCL Ceramic  
MC14XXXBD SOIC

$T_A = -55^\circ$  to  $125^\circ\text{C}$  for all packages.

### BLOCK DIAGRAM



$V_{DD}$  = PIN 16

$V_{SS}$  = PIN 1, PIN 8, PIN 15

$R_X$  AND  $C_X$  ARE EXTERNAL COMPONENTS

# ELECTRICAL CHARACTERISTICS (Voltages Referenced to V<sub>SS</sub>)

| Characteristic                                                                                                                                                                                                                                     | Symbol                                 | V <sub>DD</sub><br>Vdc | - 55°C                                                                                                                                                                                                                                                                  |       | 25°C   |           |       | 125°C  |       | Unit             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------|-----------|-------|--------|-------|------------------|
|                                                                                                                                                                                                                                                    |                                        |                        | Min                                                                                                                                                                                                                                                                     | Max   | Min    | Typ #     | Max   | Min    | Max   |                  |
| Output Voltage<br>V <sub>in</sub> = V <sub>DD</sub> or 0<br><br>V <sub>in</sub> = 0 or V <sub>DD</sub>                                                                                                                                             | V <sub>OL</sub>                        | 5.0                    | —                                                                                                                                                                                                                                                                       | 0.05  | —      | 0         | 0.05  | —      | 0.05  | Vdc              |
|                                                                                                                                                                                                                                                    |                                        | 10                     | —                                                                                                                                                                                                                                                                       | 0.05  | —      | 0         | 0.05  | —      | 0.05  |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | —                                                                                                                                                                                                                                                                       | 0.05  | —      | 0         | 0.05  | —      | 0.05  |                  |
|                                                                                                                                                                                                                                                    | V <sub>OH</sub>                        | 5.0                    | 4.95                                                                                                                                                                                                                                                                    | —     | 4.95   | 5.0       | —     | 4.95   | —     | Vdc              |
|                                                                                                                                                                                                                                                    |                                        | 10                     | 9.95                                                                                                                                                                                                                                                                    | —     | 9.95   | 10        | —     | 9.95   | —     |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | 14.95                                                                                                                                                                                                                                                                   | —     | 14.95  | 15        | —     | 14.95  | —     |                  |
| Input Voltage<br>(V <sub>O</sub> = 4.5 or 0.5 Vdc)<br>(V <sub>O</sub> = 9.0 or 1.0 Vdc)<br>(V <sub>O</sub> = 13.5 or 1.5 Vdc)<br><br>(V <sub>O</sub> = 0.5 or 4.5 Vdc)<br>(V <sub>O</sub> = 1.0 or 9.0 Vdc)<br>(V <sub>O</sub> = 1.5 or 13.5 Vdc)  | V <sub>IL</sub>                        | 5.0                    | —                                                                                                                                                                                                                                                                       | 1.5   | —      | 2.25      | 1.5   | —      | 1.5   | Vdc              |
|                                                                                                                                                                                                                                                    |                                        | 10                     | —                                                                                                                                                                                                                                                                       | 3.0   | —      | 4.50      | 3.0   | —      | 3.0   |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | —                                                                                                                                                                                                                                                                       | 4.0   | —      | 6.75      | 4.0   | —      | 4.0   |                  |
|                                                                                                                                                                                                                                                    | V <sub>IH</sub>                        | 5.0                    | 3.5                                                                                                                                                                                                                                                                     | —     | 3.5    | 2.75      | —     | 3.5    | —     | Vdc              |
|                                                                                                                                                                                                                                                    |                                        | 10                     | 7.0                                                                                                                                                                                                                                                                     | —     | 7.0    | 5.50      | —     | 7.0    | —     |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | 11                                                                                                                                                                                                                                                                      | —     | 11     | 8.25      | —     | 11     | —     |                  |
| Output Drive Current<br>(V <sub>OH</sub> = 2.5 Vdc)<br>(V <sub>OH</sub> = 4.6 Vdc)<br>(V <sub>OH</sub> = 9.5 Vdc)<br>(V <sub>OH</sub> = 13.5 Vdc)<br><br>(V <sub>OL</sub> = 0.4 Vdc)<br>(V <sub>OL</sub> = 0.5 Vdc)<br>(V <sub>OL</sub> = 1.5 Vdc) | Source<br><br><br><br><br><br><br>Sink | 5.0                    | - 1.2                                                                                                                                                                                                                                                                   | —     | - 1.0  | - 1.7     | —     | - 0.7  | —     | mA <sub>dc</sub> |
|                                                                                                                                                                                                                                                    |                                        | 5.0                    | - 0.64                                                                                                                                                                                                                                                                  | —     | - 0.51 | - 0.88    | —     | - 0.36 | —     |                  |
|                                                                                                                                                                                                                                                    |                                        | 10                     | - 1.6                                                                                                                                                                                                                                                                   | —     | - 1.3  | - 2.25    | —     | - 0.9  | —     |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | - 4.2                                                                                                                                                                                                                                                                   | —     | - 3.4  | - 8.8     | —     | - 2.4  | —     |                  |
|                                                                                                                                                                                                                                                    | I <sub>OL</sub>                        | 5.0                    | 0.64                                                                                                                                                                                                                                                                    | —     | 0.51   | 0.88      | —     | 0.36   | —     | mA <sub>dc</sub> |
|                                                                                                                                                                                                                                                    |                                        | 10                     | 1.6                                                                                                                                                                                                                                                                     | —     | 1.3    | 2.25      | —     | 0.9    | —     |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | 4.2                                                                                                                                                                                                                                                                     | —     | 3.4    | 8.8       | —     | 2.4    | —     |                  |
| Input Current                                                                                                                                                                                                                                      | I <sub>in</sub>                        | 15                     | —                                                                                                                                                                                                                                                                       | ± 0.1 | —      | ± 0.00001 | ± 0.1 | —      | ± 1.0 | μA <sub>dc</sub> |
| Input Capacitance<br>(V <sub>in</sub> = 0)                                                                                                                                                                                                         | C <sub>in</sub>                        | —                      | —                                                                                                                                                                                                                                                                       | —     | —      | 5.0       | 7.5   | —      | —     | pF               |
| Quiescent Current<br>(Per Package)                                                                                                                                                                                                                 | I <sub>DD</sub>                        | 5.0                    | —                                                                                                                                                                                                                                                                       | 5.0   | —      | 0.005     | 5.0   | —      | 150   | μA <sub>dc</sub> |
|                                                                                                                                                                                                                                                    |                                        | 10                     | —                                                                                                                                                                                                                                                                       | 10    | —      | 0.010     | 10    | —      | 300   |                  |
|                                                                                                                                                                                                                                                    |                                        | 15                     | —                                                                                                                                                                                                                                                                       | 20    | —      | 0.015     | 20    | —      | 600   |                  |
| **Total Supply Current at an external load Capacitance (C <sub>L</sub> ) and at external timing capacitance (C <sub>X</sub> ), use the formula —                                                                                                   | I <sub>T</sub>                         | —                      | $I_T(C_L, C_X) = [(C_L + 0.36C_X)V_{DD}f + 2 \times 10^{-8} R_X C_X (V_{DD} - 2)^2] \times 10^{-3}$ where: I <sub>T</sub> in μA (per circuit), C <sub>L</sub> and C <sub>X</sub> in pF, R <sub>X</sub> in megohms, V <sub>DD</sub> in Vdc, f in kHz is input frequency. |       |        |           |       |        |       | μA <sub>dc</sub> |

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

\*\* The formulas given are for the typical characteristics only at 25°C.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>in</sub> and V<sub>out</sub> should be constrained to the range V<sub>SS</sub> ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>DD</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V<sub>SS</sub> or V<sub>DD</sub>). Unused outputs must be left open.

## PIN ASSIGNMENT

|                                  |   |   |    |                                  |
|----------------------------------|---|---|----|----------------------------------|
| V <sub>SS</sub>                  | 1 | ● | 16 | V <sub>DD</sub>                  |
| C <sub>X1</sub> /R <sub>X1</sub> | 2 |   | 15 | V <sub>SS</sub>                  |
| RESET 1                          | 3 |   | 14 | C <sub>X2</sub> /R <sub>X2</sub> |
| A1                               | 4 |   | 13 | RESET 2                          |
| B1                               | 5 |   | 12 | A2                               |
| Q1                               | 6 |   | 11 | B2                               |
| Q1                               | 7 |   | 10 | Q2                               |
| V <sub>SS</sub>                  | 8 |   | 9  | Q2                               |

**SWITCHING CHARACTERISTICS\*\*** ( $C_L = 50 \text{ pF}$ ,  $T_A = 25^\circ\text{C}$ )

| Characteristic                                                                                                                                                                                                                                              | Symbol             | $C_X$<br>pF | $R_X$<br>k $\Omega$ | $V_{DD}$<br>Vdc | Min             | Typ #              | Max               | Unit          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------|---------------------|-----------------|-----------------|--------------------|-------------------|---------------|
| Output Rise and Fall Time<br>$t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br>$t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$<br>$t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$                              | $t_{TLH}, t_{THL}$ | —           | —                   | 5.0<br>10<br>15 | —<br>—<br>—     | 100<br>50<br>40    | 200<br>100<br>80  | ns            |
| Turn-Off, Turn-On Delay Time — A or B to Q or $\bar{Q}$<br>$t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 240 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 87 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$   | $t_{PLH}, t_{PHL}$ | 15          | 5.0                 | 5.0<br>10<br>15 | —<br>—<br>—     | 325<br>120<br>90   | 650<br>240<br>180 | ns            |
| Turn-Off, Turn-On Delay Time — A or B to Q or $\bar{Q}$<br>$t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 620 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 257 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 185 \text{ ns}$ | $t_{PLH}, t_{PHL}$ | 1000        | 10                  | 5.0<br>10<br>15 | —<br>—<br>—     | 705<br>290<br>210  | —<br>—<br>—       | ns            |
| Input Pulse Width — A or B                                                                                                                                                                                                                                  | $t_{WH}$           | 15          | 5.0                 | 5.0<br>10<br>15 | 150<br>75<br>55 | 70<br>30<br>30     | —<br>—<br>—       | ns            |
|                                                                                                                                                                                                                                                             | $t_{WL}$           | 1000        | 10                  | 5.0<br>10<br>15 | —<br>—<br>—     | 70<br>30<br>30     | —<br>—<br>—       | ns            |
| Output Pulse Width — Q or $\bar{Q}$<br>(For $C_X < 0.01 \mu\text{F}$ use graph for appropriate $V_{DD}$ level.)                                                                                                                                             | $t_W$              | 15          | 5.0                 | 5.0<br>10<br>15 | —<br>—<br>—     | 550<br>350<br>300  | —<br>—<br>—       | ns            |
| Output Pulse Width — Q or $\bar{Q}$<br>(For $C_X > 0.01 \mu\text{F}$ use formula:<br>$t_W = 0.2 R_X C_X \ln [V_{DD} - V_{SS}])^\dagger$                                                                                                                     | $t_W$              | 10,000      | 10                  | 5.0<br>10<br>15 | 15<br>10<br>15  | 30<br>50<br>55     | 45<br>90<br>95    | $\mu\text{s}$ |
| Pulse Width Match between Circuits in the same package                                                                                                                                                                                                      | $t_1 - t_2$        | 10,000      | 10                  | 5.0<br>10<br>15 | —<br>—<br>—     | 6.0<br>8.0<br>8.0  | 25<br>35<br>35    | %             |
| Reset Propagation Delay — $\overline{\text{Reset}}$ to Q or $\bar{Q}$                                                                                                                                                                                       | $t_{PLH}, t_{PHL}$ | 15          | 5.0                 | 5.0<br>10<br>15 | —<br>—<br>—     | 325<br>90<br>60    | 600<br>225<br>170 | ns            |
|                                                                                                                                                                                                                                                             |                    | 1000        | 10                  | 5.0<br>10<br>15 | —<br>—<br>—     | 1000<br>300<br>250 | —<br>—<br>—       | ns            |
| Retrigger Time                                                                                                                                                                                                                                              | $t_{rr}$           | 15          | 5.0                 | 5.0<br>10<br>15 | 0<br>0<br>0     | —<br>—<br>—        | —<br>—<br>—       | ns            |
|                                                                                                                                                                                                                                                             |                    | 1000        | 10                  | 5.0<br>10<br>15 | 0<br>0<br>0     | —<br>—<br>—        | —<br>—<br>—       | ns            |
| External Timing Resistance                                                                                                                                                                                                                                  | $R_X$              | —           | —                   | —               | 5.0             | —                  | 1000              | k $\Omega$    |
| External Timing Capacitance                                                                                                                                                                                                                                 | $C_X$              | —           | —                   | —               | No Limits*      |                    |                   | $\mu\text{F}$ |

$^\dagger R_X$  is in Ohms,  $C_X$  is in farads,  $V_{DD}$  and  $V_{SS}$  in volts,  $PW_{out}$  in seconds.

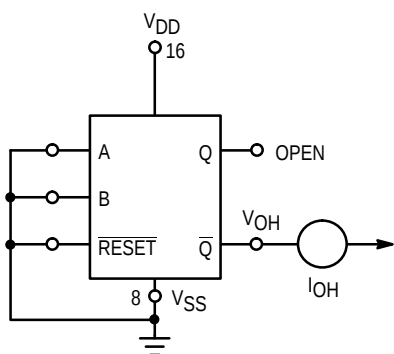
\* If  $C_X > 15 \mu\text{F}$ , Use Discharge Protection Diode  $D_X$ , per Fig. 9.

\*\* The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

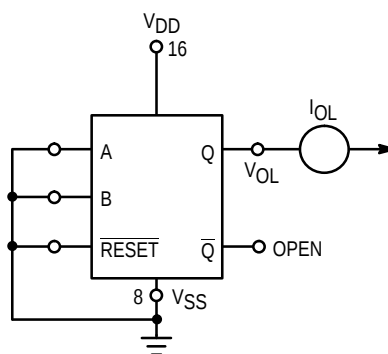
#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

**FUNCTION TABLE**

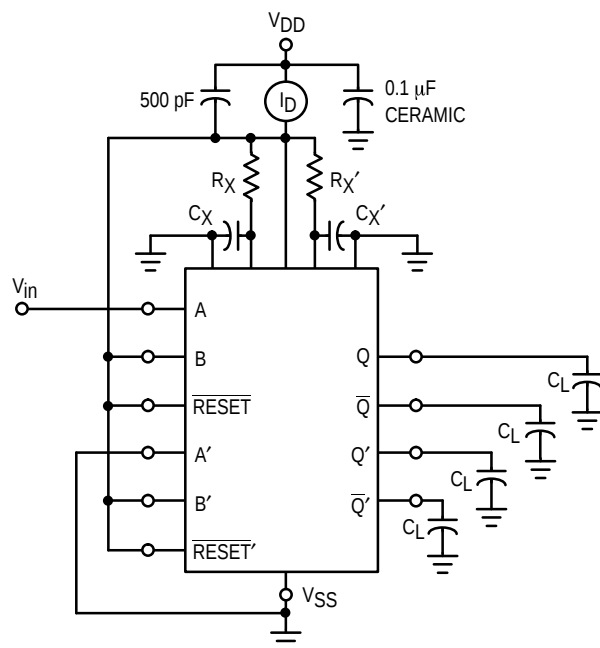
| Inputs                                                                                   |                                                                                                |                                                                                                | Outputs                                                                                                                                                                    |                                                                                                                                                                                |
|------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reset                                                                                    | A                                                                                              | B                                                                                              | Q                                                                                                                                                                          | $\bar{Q}$                                                                                                                                                                      |
| H<br>H                                                                                   | <br>L       | H<br>       | <br> | <br> |
| H<br>H                                                                                   | <br>H       | L<br>       | Not Triggered<br>Not Triggered                                                                                                                                             |                                                                                                                                                                                |
| H<br>H                                                                                   | L, H, <br>L | H<br>L, H,  | Not Triggered<br>Not Triggered                                                                                                                                             |                                                                                                                                                                                |
| L<br> | X<br>X                                                                                         | X<br>X                                                                                         | L<br>Not Triggered                                                                                                                                                         | H                                                                                                                                                                              |



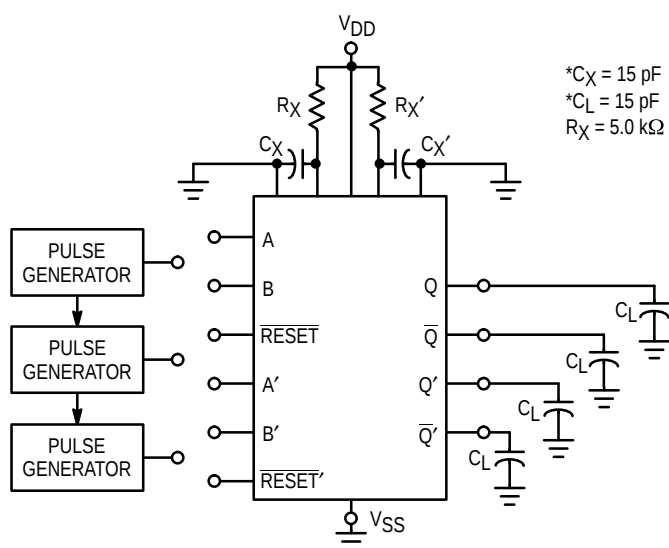
**Figure 1. Output Source Current Test Circuit**



**Figure 2. Output Sink Current Test Circuit**



### Figure 3. Power Dissipation Test Circuit and Waveforms



**Figure 4. AC Test Circuit**

## INPUT CONNECTIONS

| Characteristics                                                                             | Reset           | A               | B               |
|---------------------------------------------------------------------------------------------|-----------------|-----------------|-----------------|
| t <sub>PLH</sub> , t <sub>PHL</sub> , t <sub>TLH</sub> , t <sub>THL</sub><br>t <sub>W</sub> | V <sub>DD</sub> | PG1             | V <sub>DD</sub> |
| t <sub>PLH</sub> , t <sub>PHL</sub> , t <sub>TLH</sub> , t <sub>THL</sub><br>t <sub>W</sub> | V <sub>DD</sub> | V <sub>SS</sub> | PG2             |
| t <sub>PLH(R)</sub> , t <sub>PHL(R)</sub> , t <sub>W</sub>                                  | PG3             | PG1             | PG2             |

\* Includes capacitance of probes, wiring, and fixture parasitic.

NOTE: AC test waveforms for PG1, PG2, and PG3 on next page.

PG1 = 

PG2 = 

PG3 = 

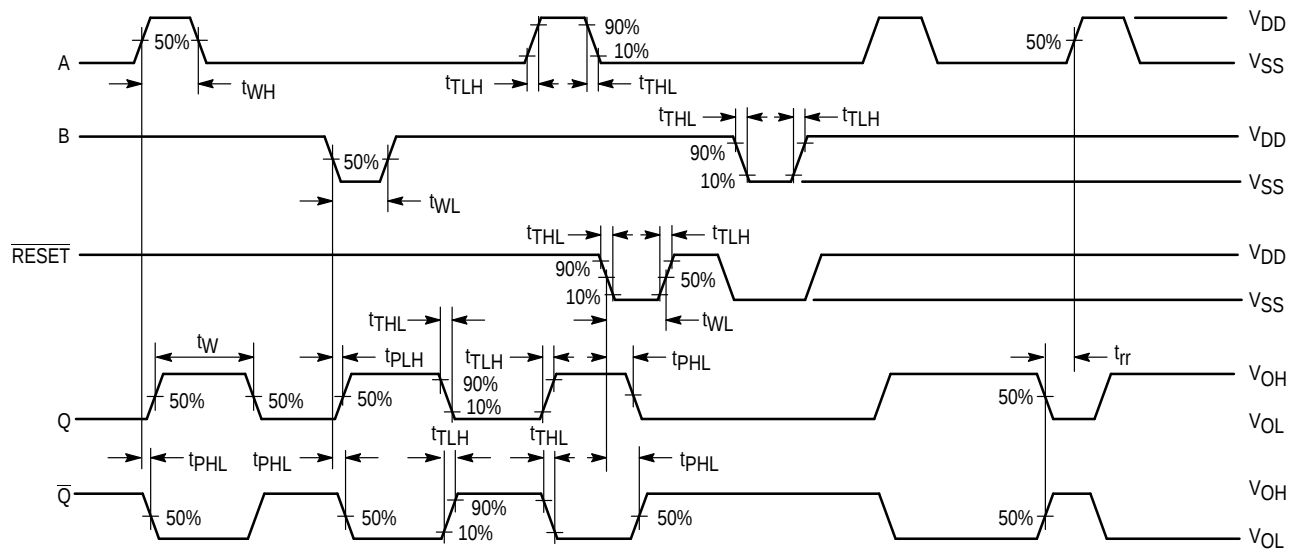


Figure 5. AC Test Waveforms

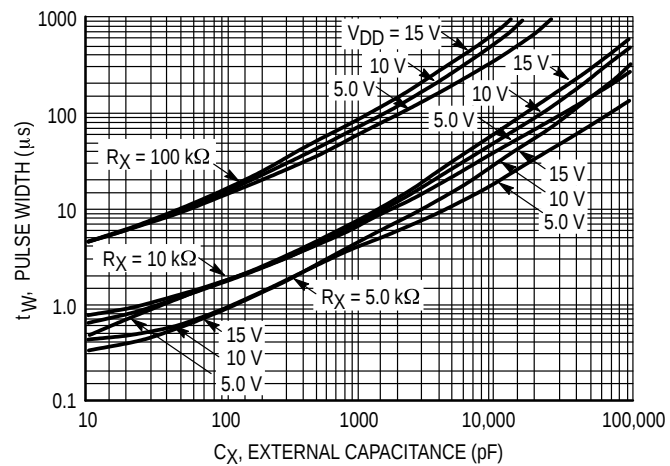
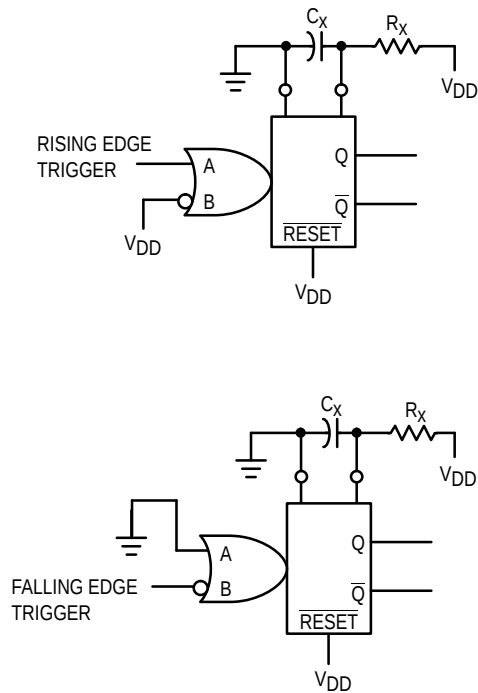
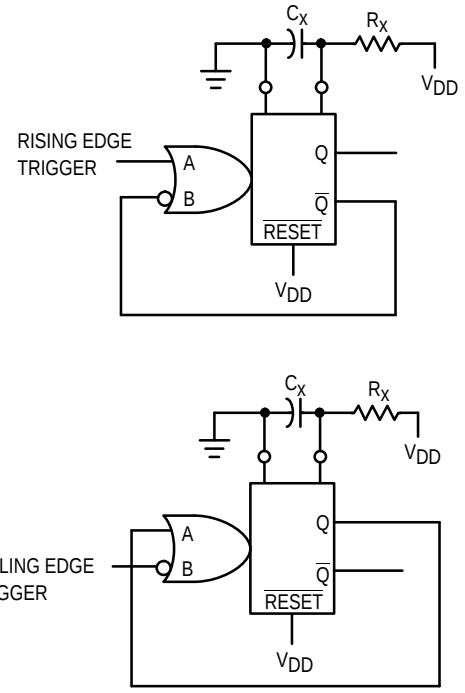


Figure 6. Pulse Width versus  $C_X$

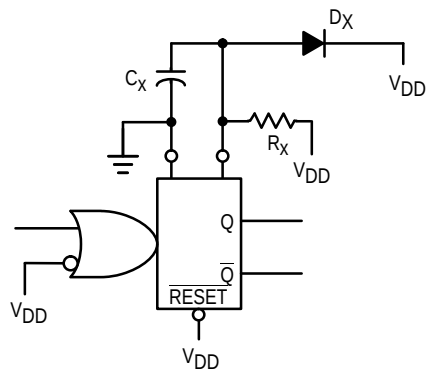
## TYPICAL APPLICATIONS



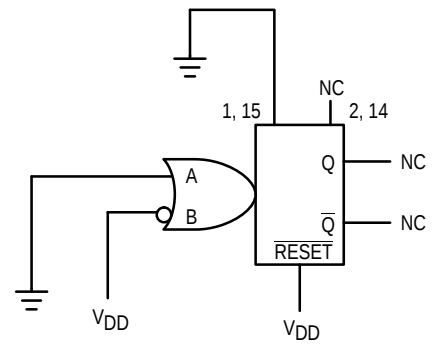
**Figure 7. Retriggerable Monostables Circuitry**



**Figure 8. Non-Retriggerable Monostables Circuitry**



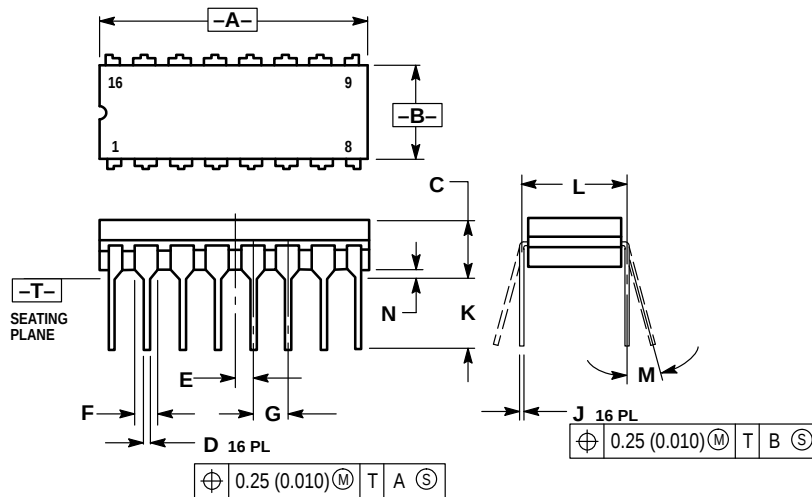
**Figure 9. Use of a Diode to Limit Power Down Current Surge**



**Figure 10. Connection of Unused Sections**

## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 620-10 ISSUE V

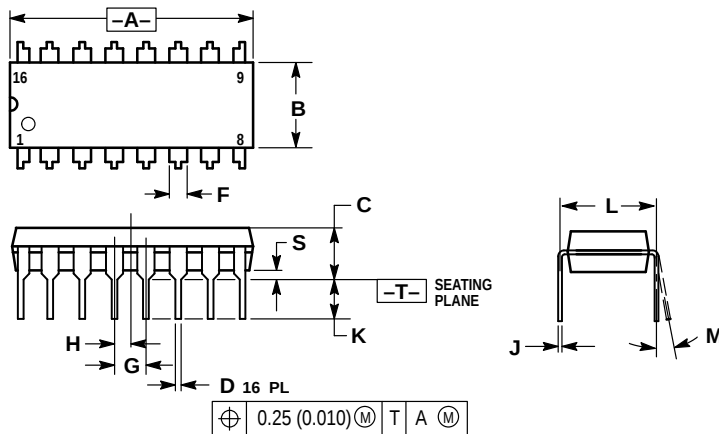


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.750  | 0.785 | 19.05       | 19.93 |
| B   | 0.240  | 0.295 | 6.10        | 7.49  |
| C   | —      | 0.200 | —           | 5.08  |
| D   | 0.015  | 0.020 | 0.39        | 0.50  |
| E   | 0.050  | BSC   | 1.27        | BSC   |
| F   | 0.055  | 0.065 | 1.40        | 1.65  |
| G   | 0.100  | BSC   | 2.54        | BSC   |
| H   | 0.008  | 0.015 | 0.21        | 0.38  |
| K   | 0.125  | 0.170 | 3.18        | 4.31  |
| L   | 0.300  | BSC   | 7.62        | BSC   |
| M   | 0°     | 15°   | 0°          | 15°   |
| N   | 0.020  | 0.040 | 0.51        | 1.01  |

### P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R



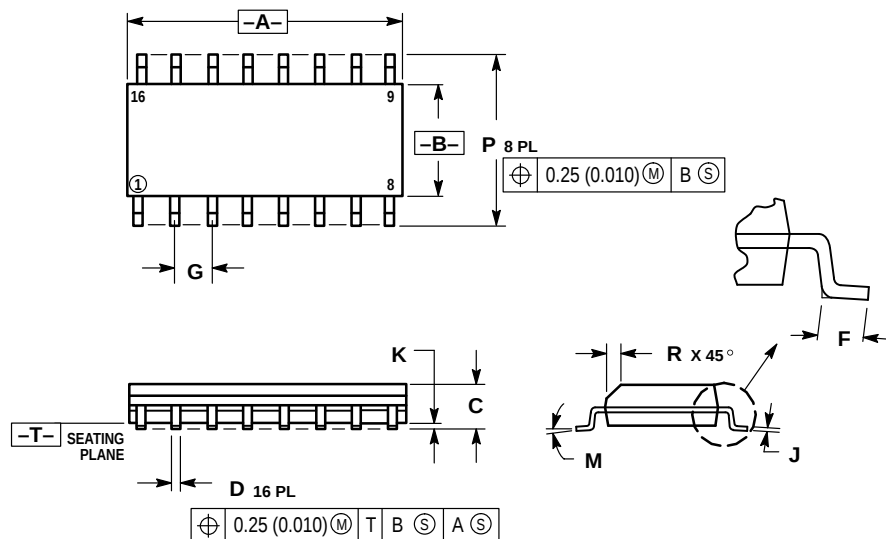
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.740  | 0.770 | 18.80       | 19.55 |
| B   | 0.250  | 0.270 | 6.35        | 6.85  |
| C   | 0.145  | 0.175 | 3.69        | 4.44  |
| D   | 0.015  | 0.021 | 0.39        | 0.53  |
| F   | 0.040  | 0.70  | 1.02        | 1.77  |
| G   | 0.100  | BSC   | 2.54        | BSC   |
| H   | 0.050  | BSC   | 1.27        | BSC   |
| J   | 0.008  | 0.015 | 0.21        | 0.38  |
| K   | 0.110  | 0.130 | 2.80        | 3.30  |
| L   | 0.295  | 0.305 | 7.50        | 7.74  |
| M   | 0°     | 10°   | 0°          | 10°   |
| S   | 0.020  | 0.040 | 0.51        | 1.01  |

## OUTLINE DIMENSIONS

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



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