

# MC14528B

## 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  $R_X$ .

### Features

- 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
- This part should only be used in new designs where the pulse width is  $< 10 \mu s$   
Note: For designs requiring a pulse width  $> 10 \mu s$ , please see MC14538, which is pin-for-pin compatible
- These Devices are Pb-Free and are RoHS Compliant
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable

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

| Rating                                            | Symbol            | Value                  | Unit |
|---------------------------------------------------|-------------------|------------------------|------|
| DC Supply Voltage Range                           | $V_{DD}$          | -0.5 to +18.0          | V    |
| Input or Output Voltage Range (DC or Transient)   | $V_{in}, V_{out}$ | -0.5 to $V_{DD} + 0.5$ | V    |
| Input or Output Current (DC or Transient) per Pin | $I_{in}, I_{out}$ | $\pm 10$               | mA   |
| Power Dissipation, per Package (Note 1)           | $P_D$             | 500                    | mW   |
| Ambient Temperature Range                         | $T_A$             | -55 to +125            | °C   |
| Storage Temperature Range                         | $T_{stg}$         | -65 to +150            | °C   |
| Lead Temperature (8-Second Soldering)             | $T_L$             | 260                    | °C   |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

#### 1. Temperature Derating:

Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°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,  $V_{in}$  and  $V_{out}$  should be constrained to the range  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .

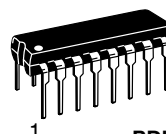
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either  $V_{SS}$  or  $V_{DD}$ ). Unused outputs must be left open.



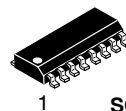
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<http://onsemi.com>

### MARKING DIAGRAMS



PDIP-16  
P SUFFIX  
CASE 648



SOIC-16  
D SUFFIX  
CASE 751B



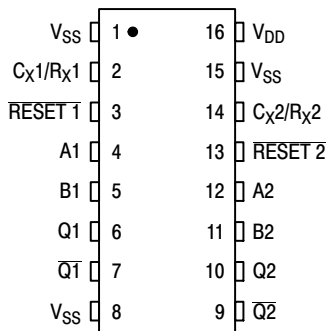
A = Assembly Location  
WL = Wafer Lot  
YY, Y = Year  
WW, W = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

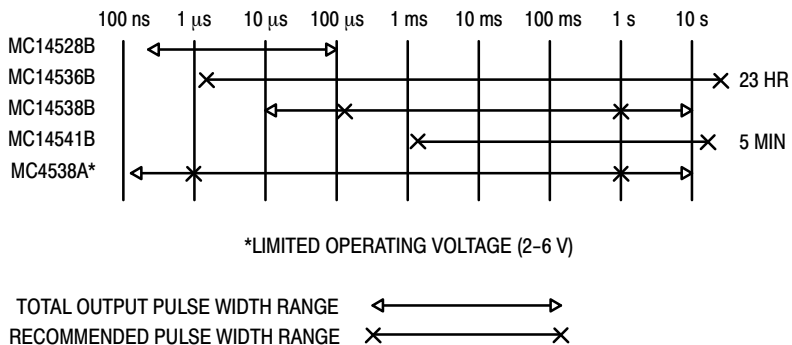
See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

## MC14528B

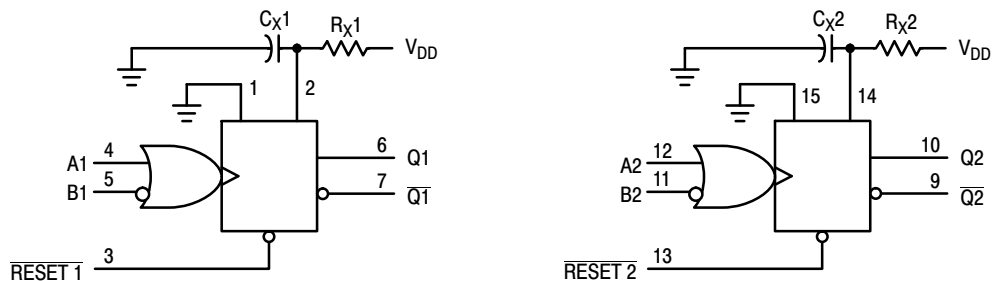
## PIN ASSIGNMENT



## ONE-SHOT SELECTION GUIDE



### BLOCK DIAGRAM



$V_{DD}$  = PIN 16  
 $V_{SS}$  = PIN 1, PIN 8, PIN 15  
 $R_X$  AND  $C_X$  ARE EXTERNAL COMPONENTS

## 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 H<br>Not Triggered                                                                                                                                                       |                                                                                                                                                                              |

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## 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<br>(Note 2)                | Max                  | Min                           | Max                  |      |
| Output Voltage “0” Level<br>V <sub>in</sub> = V <sub>DD</sub> or 0                                                                                     | V <sub>OL</sub> | 5.0<br>10<br>15        | –<br>–<br>–                                                                                                                                                                                                                                                                   | 0.05<br>0.05<br>0.05 | –<br>–<br>–                   | 0<br>0<br>0                    | 0.05<br>0.05<br>0.05 | –<br>–<br>–                   | 0.05<br>0.05<br>0.05 | Vdc  |
| “1” Level<br>V <sub>in</sub> = 0 or V <sub>DD</sub>                                                                                                    | V <sub>OH</sub> | 5.0<br>10<br>15        | 4.95<br>9.95<br>14.95                                                                                                                                                                                                                                                         | –<br>–<br>–          | 4.95<br>9.95<br>14.95         | 5.0<br>10<br>15                | –<br>–<br>–          | 4.95<br>9.95<br>14.95         | –<br>–<br>–          | Vdc  |
| Input Voltage “0” Level<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)                | V <sub>IL</sub> | 5.0<br>10<br>15        | –<br>–<br>–                                                                                                                                                                                                                                                                   | 1.5<br>3.0<br>4.0    | –<br>–<br>–                   | 2.25<br>4.50<br>6.75           | 1.5<br>3.0<br>4.0    | –<br>–<br>–                   | 1.5<br>3.0<br>4.0    | Vdc  |
| “1” Level<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>IH</sub> | 5.0<br>10<br>15        | 3.5<br>7.0<br>11                                                                                                                                                                                                                                                              | –<br>–<br>–          | 3.5<br>7.0<br>11              | 2.75<br>5.50<br>8.25           | –<br>–<br>–          | 3.5<br>7.0<br>11              | –<br>–<br>–          | Vdc  |
| 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)      | I <sub>OH</sub> | 5.0<br>5.0<br>10<br>15 | –1.2<br>–0.64<br>–1.6<br>–4.2                                                                                                                                                                                                                                                 | –<br>–<br>–<br>–     | –1.0<br>–0.51<br>–1.3<br>–3.4 | –1.7<br>–0.88<br>–2.25<br>–8.8 | –<br>–<br>–<br>–     | –0.7<br>–0.36<br>–0.9<br>–2.4 | –<br>–<br>–<br>–     | mAdc |
| (V <sub>OL</sub> = 0.4 Vdc)<br>(V <sub>OL</sub> = 0.5 Vdc)<br>(V <sub>OL</sub> = 1.5 Vdc)                                                              | I <sub>OL</sub> | 5.0<br>10<br>15        | 0.64<br>1.6<br>4.2                                                                                                                                                                                                                                                            | –<br>–<br>–          | 0.51<br>1.3<br>3.4            | 0.88<br>2.25<br>8.8            | –<br>–<br>–          | 0.36<br>0.9<br>2.4            | –<br>–<br>–          | mAdc |
| Input Current                                                                                                                                          | I <sub>in</sub> | 15                     | –                                                                                                                                                                                                                                                                             | ± 0.1                | –                             | ± 0.00001                      | ± 0.1                | –                             | ± 1.0                | μAdc |
| 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<br>10<br>15        | –<br>–<br>–                                                                                                                                                                                                                                                                   | 5.0<br>10<br>20      | –<br>–<br>–                   | 0.005<br>0.010<br>0.015        | 5.0<br>10<br>20      | –<br>–<br>–                   | 150<br>300<br>600    | μAdc |
| Total Supply Current at an external load Capacitance (C <sub>L</sub> ) and at external timing capacitance (C <sub>X</sub> ), use the formula. (Note 3) | I <sub>T</sub>  | –                      | $I_T(C_L, C_X) = [(C_L + 0.36C_X)V_{DD}f + 2 \times 10^{-8} R_X C_X (V_{DD}^{-2})^2 f] \times 10^{-3}$<br>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. |                      |                               |                                |                      |                               |                      | μAdc |

2. Data labelled “Typ” is not to be used for design purposes but is intended as an indication of the IC’s potential performance.

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

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## SWITCHING CHARACTERISTICS ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ ) (Note 4)

| Characteristic                                                                                                                                                                                                                                                       | Symbol                   | $C_X$<br>pF | $R_X$<br>k $\Omega$ | $V_{DD}$<br>Vdc | Min                | Typ<br>(Note 5)    | 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>$t_{TLH}$ , $t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$                              | $t_{TLH}$ ,<br>$t_{THL}$ | —           | —                   | 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>$t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$   | $t_{PLH}$ ,<br>$t_{PHL}$ | 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>$t_{PLH}$ , $t_{PHL} = (0.5 \text{ ns/pF}) C_L + 185 \text{ ns}$ | $t_{PLH}$ ,<br>$t_{PHL}$ | 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>$t_W = 0.2 R_X C_X \ln [V_{DD} - V_{SS}]$ ) (Note 6)                                                                                                                            | $t_W$                    | 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 — Reset to Q or $\bar{Q}$                                                                                                                                                                                                                    | $t_{PLH}$ ,<br>$t_{PHL}$ | 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 (Note 7) |                    |                   | $\mu\text{F}$ |

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

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

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

7.  $R_X$  is in  $\Omega$ ,  $C_X$  is in farads,  $V_{DD}$  and  $V_{SS}$  in volts,  $PW_{out}$  in seconds.

# MC14528B

## ORDERING INFORMATION

| Device         | Package              | Shipping <sup>†</sup> |
|----------------|----------------------|-----------------------|
| MC14528BCPG    | PDIP-16<br>(Pb-Free) | 500 Units / Rail      |
| MC14528BDG     | SOIC-16<br>(Pb-Free) | 48 Units / Rail       |
| MC14528BDR2G   | SOIC-16<br>(Pb-Free) | 2500 / Tape & Reel    |
| NLV14528BDR2G* |                      |                       |

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable.

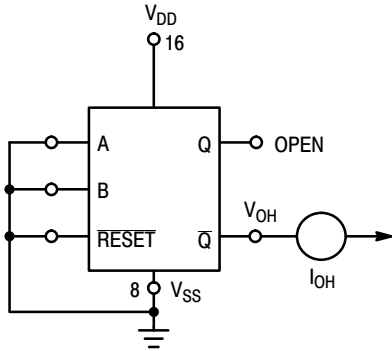


Figure 1. Output Source Current Test Circuit

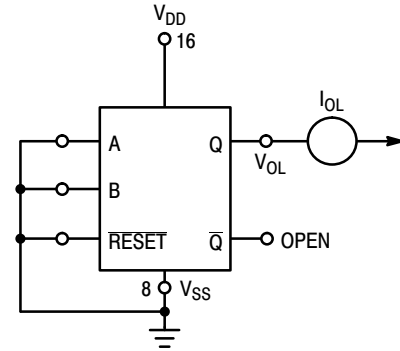


Figure 2. Output Sink Current Test Circuit

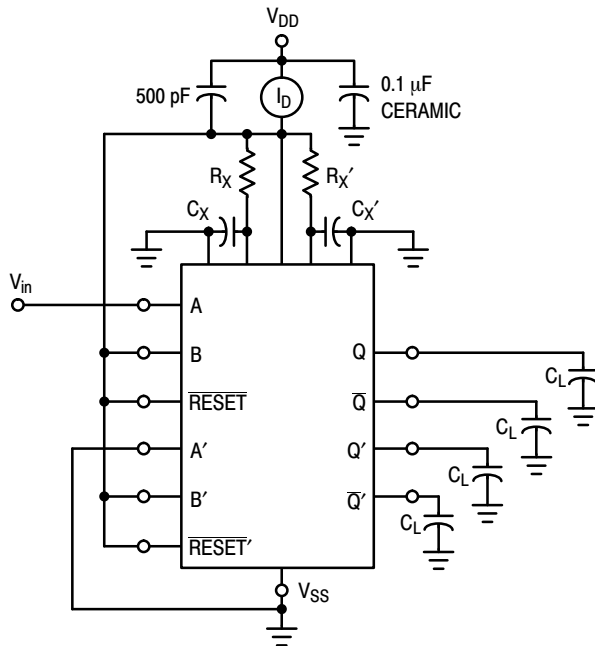
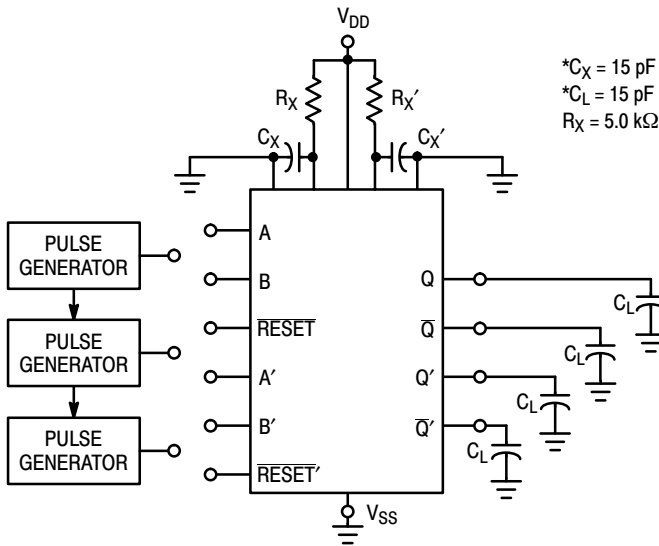


Figure 3. Power Dissipation Test Circuit and Waveforms

# MC14528B



## INPUT CONNECTIONS

| Characteristics                                       | Reset    | A        | B        |
|-------------------------------------------------------|----------|----------|----------|
| $t_{PLH}$ , $t_{PHL}$ , $t_{TLH}$ , $t_{THL}$ , $t_W$ | $V_{DD}$ | PG1      | $V_{DD}$ |
| $t_{PLH}$ , $t_{PHL}$ , $t_{TLH}$ , $t_{THL}$ , $t_W$ | $V_{DD}$ | $V_{SS}$ | PG2      |
| $t_{PLH(R)}$ , $t_{PHL(R)}$ , $t_W$                   | PG3      | PG1      | PG2      |

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

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

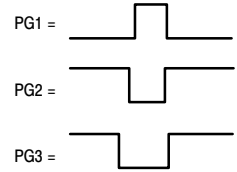


Figure 4. AC Test Circuit

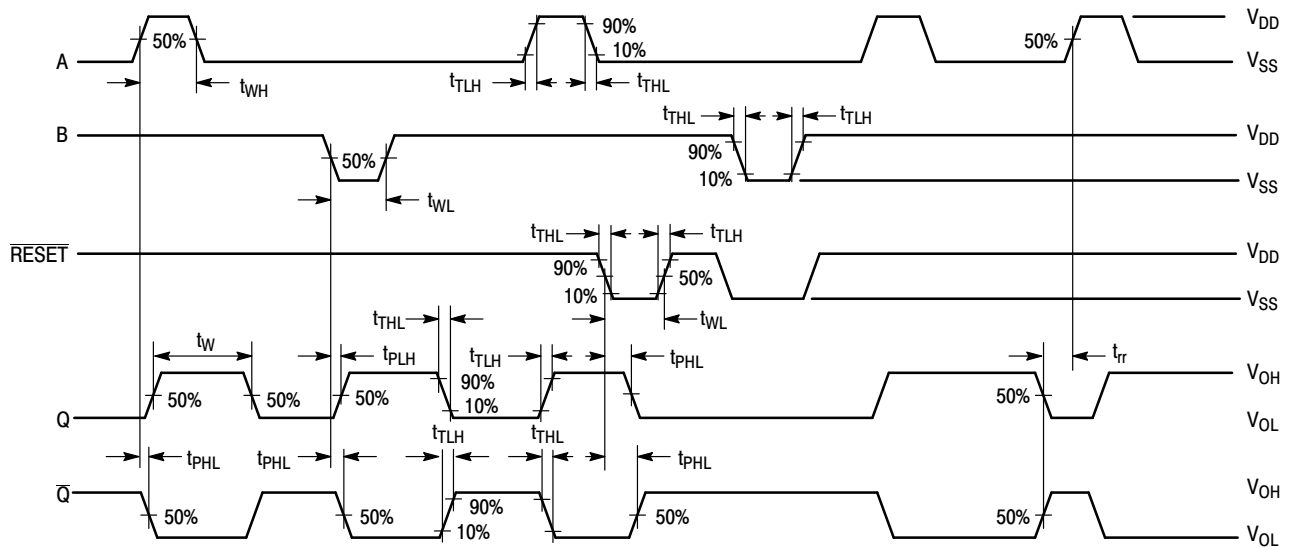


Figure 5. AC Test Waveforms

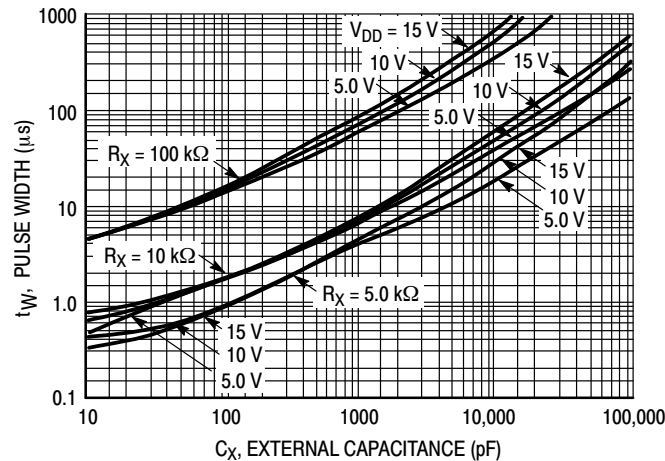
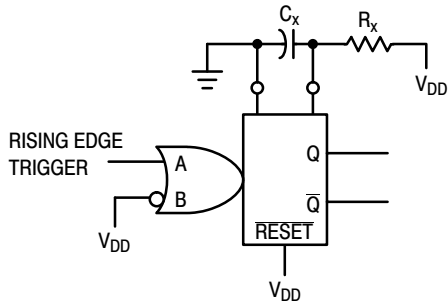
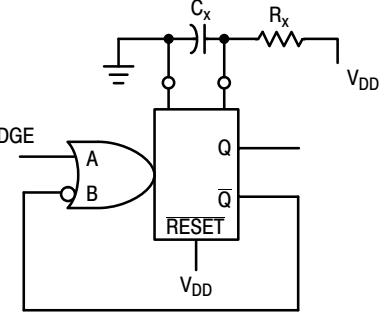
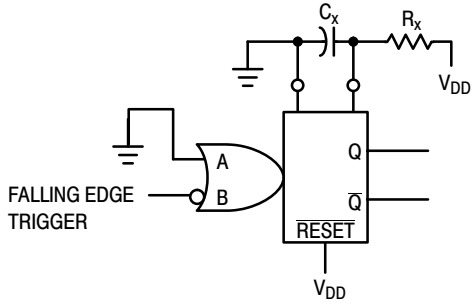


Figure 6. Pulse Width versus  $C_X$

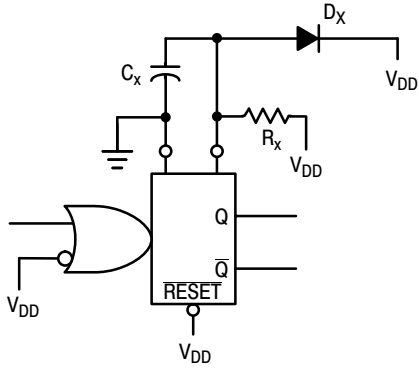
TYPICAL APPLICATIONS



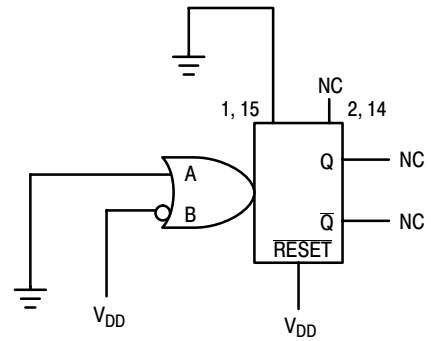
**Figure 7. Retriggerable Monostables Circuitry**



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



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

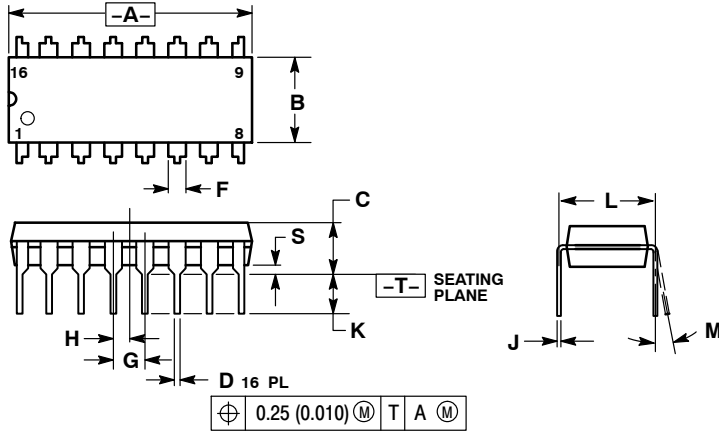


**Figure 10. Connection of Unused Sections**

# MC14528B

## PACKAGE DIMENSIONS

PDIP-16  
CASE 648-08  
ISSUE T



### 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.

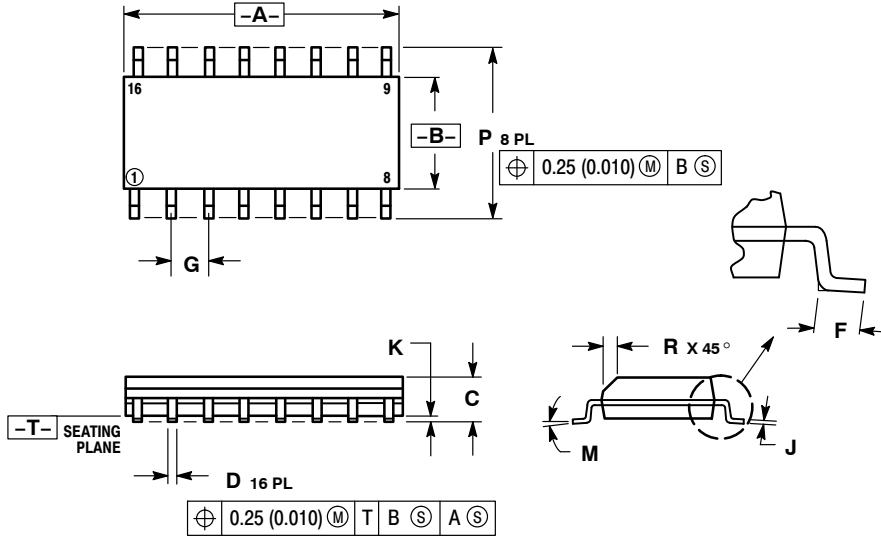
| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| 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  |



# MC14528B

## PACKAGE DIMENSIONS

SOIC-16  
CASE 751B-05  
ISSUE K

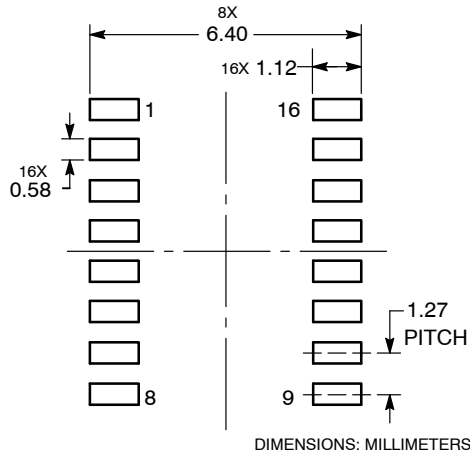


### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

## SOLDERING FOOTPRINT



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