

# MC14511B

## BCD-To-Seven Segment Latch/Decoder/Driver

The MC14511B BCD-to-seven segment latch/decoder/driver is constructed with complementary MOS (CMOS) enhancement mode devices and NPN bipolar output drivers in a single monolithic structure. The circuit provides the functions of a 4-bit storage latch, an 8421 BCD-to-seven segment decoder, and an output drive capability. Lamp test ( $\overline{LT}$ ), blanking ( $\overline{BI}$ ), and latch enable (LE) inputs are used to test the display, to turn-off or pulse modulate the brightness of the display, and to store a BCD code, respectively. It can be used with seven-segment light-emitting diodes (LED), incandescent, fluorescent, gas discharge, or liquid crystal readouts either directly or indirectly.

Applications include instrument (e.g., counter, DVM, etc.) display driver, computer/calculator display driver, cockpit display driver, and various clock, watch, and timer uses.

### Features

- Low Logic Circuit Power Dissipation
- High-Current Sourcing Outputs (Up to 25 mA)
- Latch Storage of Code
- Blanking Input
- Lamp Test Provision
- Readout Blanking on all Illegal Input Combinations
- Lamp Intensity Modulation Capability
- Time Share (Multiplexing) Facility
- Supply Voltage Range = 3.0 V to 18 V
- Capable of Driving Two Low-power TTL Loads, One Low-power Schottky TTL Load, or Two HTL Loads Over the Rated Temperature Range
- Chip Complexity: 216 FETs or 54 Equivalent Gates
- Triple Diode Protection on all Inputs
- 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 $V_{SS}$ ) (Note 1)

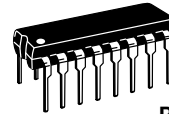
| Symbol      | Parameter  | Value                  | Unit |
|-------------|--|------------------------|------|
| $V_{DD}$    | DC Supply Voltage Range                                      | -0.5 to +18.0          | V    |
| $V_{in}$    | Input Voltage Range, All Inputs                              | -0.5 to $V_{DD} + 0.5$ | V    |
| I           | DC Current Drain per Input Pin                               | 10                     | mA   |
| $P_D$       | Power Dissipation, per Package (Note 2)                      | 500                    | mW   |
| $T_A$       | Operating Temperature Range                                  | -55 to +125            | °C   |
| $T_{stg}$   | Storage Temperature Range                                    | -65 to +150            | °C   |
| $I_{OHmax}$ | Maximum Output Drive Current (Source) per Output             | 25                     | mA   |
| $P_{OHmax}$ | Maximum Continuous Output Power (Source) per Output (Note 3) | 50                     | mA   |

1. Maximum Ratings are those values beyond which damage to the device may occur.
2. Temperature Derating: Plastic "P and D/DW" Packages: -7.0 mW/°C From 65°C to 125°C
3.  $P_{OHmax} = I_{OH} (V_{DD} - V_{OH})$

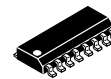
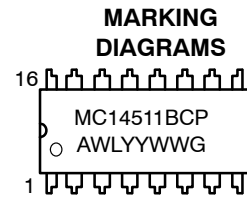


**ON Semiconductor®**

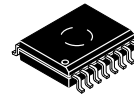
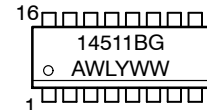
<http://onsemi.com>



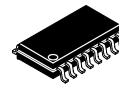
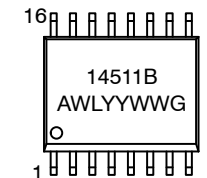
**PDIP-16**  
**P SUFFIX**  
**CASE 648**



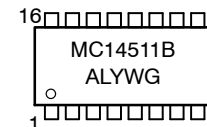
**SOIC-16**  
**D SUFFIX**  
**CASE 751B**



**SO-16**  
**DW SUFFIX**  
**CASE 751G**



**SOEIAJ-16**  
**F SUFFIX**  
**CASE 966**



A = Assembly Location  
WL, L = 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 7 of this data sheet.

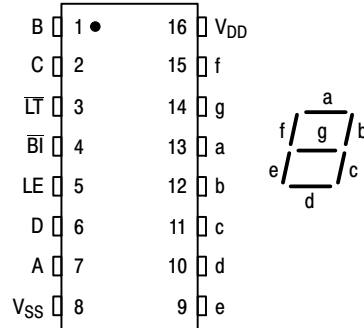
# MC14511B

This device contains protection circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high-impedance circuit. A destructive high current mode may occur if  $V_{in}$  and  $V_{out}$  are not constrained to the range  $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$ .

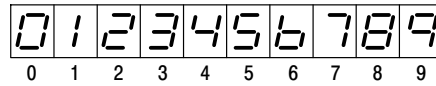
Due to the sourcing capability of this circuit, damage can occur to the device if  $V_{DD}$  is applied, and the outputs are shorted to  $V_{SS}$  and are at a logical 1 (See Maximum Ratings).

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

## PIN ASSIGNMENT



## DISPLAY



## TRUTH TABLE

| Inputs |                 |                 |   |   |   |   | Outputs |   |   |   |   |   |   |         |
|--------|-----------------|-----------------|---|---|---|---|---------|---|---|---|---|---|---|---------|
| LE     | $\overline{BI}$ | $\overline{LT}$ | D | C | B | A | a       | b | c | d | e | f | g | Display |
| X      | X               | 0               | X | X | X | X | 1       | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| X      | 0               | 1               | X | X | X | X | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 1               | 1               | 0 | 0 | 0 | 0 | 1       | 1 | 1 | 1 | 1 | 1 | 0 | 0       |
| 0      | 1               | 1               | 0 | 0 | 0 | 1 | 0       | 1 | 1 | 0 | 0 | 0 | 0 | 1       |
| 0      | 1               | 1               | 0 | 0 | 1 | 0 | 1       | 1 | 0 | 1 | 1 | 0 | 1 | 2       |
| 0      | 1               | 1               | 0 | 0 | 1 | 1 | 1       | 1 | 1 | 1 | 0 | 0 | 1 | 3       |
| 0      | 1               | 1               | 0 | 1 | 0 | 0 | 0       | 1 | 1 | 0 | 0 | 1 | 1 | 4       |
| 0      | 1               | 1               | 0 | 1 | 0 | 1 | 1       | 0 | 1 | 1 | 0 | 1 | 1 | 5       |
| 0      | 1               | 1               | 0 | 1 | 1 | 0 | 0       | 0 | 1 | 1 | 1 | 1 | 1 | 6       |
| 0      | 1               | 1               | 0 | 1 | 1 | 1 | 1       | 1 | 1 | 0 | 0 | 0 | 0 | 7       |
| 0      | 1               | 1               | 1 | 0 | 0 | 0 | 1       | 1 | 1 | 1 | 1 | 1 | 1 | 8       |
| 0      | 1               | 1               | 1 | 0 | 0 | 1 | 1       | 1 | 1 | 0 | 0 | 1 | 1 | 9       |
| 0      | 1               | 1               | 1 | 0 | 1 | 0 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 1               | 1               | 1 | 0 | 1 | 1 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 1               | 1               | 1 | 1 | 0 | 0 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 1               | 1               | 1 | 1 | 1 | 0 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 0      | 1               | 1               | 1 | 1 | 1 | 1 | 0       | 0 | 0 | 0 | 0 | 0 | 0 | Blank   |
| 1      | 1               | 1               | X | X | X | X | *       |   |   |   |   |   |   | *       |

X = Don't Care

\*Depends upon the BCD code previously applied when LE = 0

# MC14511B

## 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 4) | Max   | Min   | Max   |      |      |     |
| Output Voltage<br>V <sub>in</sub> = V <sub>DD</sub> or 0   | “0” Level   | 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>in</sub> = 0 or V <sub>DD</sub>   | “1” Level   | V <sub>OH</sub>  | 5.0   | 4.1   | –    | 4.1             | 4.57  | –     | 4.1   | –    | Vdc  |     |
|  |   |  | 10  | 9.1   | –    | 9.1             | 9.58  | –     | 9.1   | –    |      |     |
|  |   |  | 15  | 14.1  | –    | 14.1            | 14.59 | –     | 14.1  | –    |      |     |
| Input Voltage #<br>(V <sub>O</sub> = 3.8 or 0.5 Vdc)<br>(V <sub>O</sub> = 8.8 or 1.0 Vdc)<br>(V <sub>O</sub> = 13.8 or 1.5 Vdc)  | “0” Level   | 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  |      |     |
|  | “1” Level<br>(V <sub>O</sub> = 0.5 or 3.8 Vdc)<br>(V <sub>O</sub> = 1.0 or 8.8 Vdc)<br>(V <sub>O</sub> = 1.5 or 13.8 Vdc) | “1” Level  | 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 Voltage<br>(I <sub>OH</sub> = 0 mA)<br>(I <sub>OH</sub> = 5.0 mA)<br>(I <sub>OH</sub> = 10 mA)<br>(I <sub>OH</sub> = 15 mA)<br>(I <sub>OH</sub> = 20 mA)<br>(I <sub>OH</sub> = 25 mA) | Source  | V <sub>OH</sub>  | 5.0   | 4.1   | –    | 4.1             | 4.57  | –     | 4.1   | –    | Vdc  |     |
|  |   |  |   | –     | –    | –               | 4.24  | –     | –     | –    |      |     |
|  |   |  |   | 3.9   | –    | 3.9             | 4.12  | –     | 3.5   | –    |      |     |
|  |   |  |   | –     | –    | –               | 3.94  | –     | –     | –    |      |     |
|  |   |  |   | 3.4   | –    | 3.4             | 3.70  | –     | 3.0   | –    |      |     |
|  |   |  |   | –     | –    | –               | 3.54  | –     | –     | –    |      |     |
|  |   | (I <sub>OH</sub> = 0 mA)<br>(I <sub>OH</sub> = 5.0 mA)<br>(I <sub>OH</sub> = 10 mA)<br>(I <sub>OH</sub> = 15 mA)<br>(I <sub>OH</sub> = 20 mA)<br>(I <sub>OH</sub> = 25 mA) | V <sub>OH</sub>                                   | 10    | 9.1  | –               | 9.1   | 9.58  | –     | 9.1  | –    | Vdc |
|  |   |  |   |       | –    | –               | –     | 9.26  | –     | –    | –    |     |
|  |   |  |   |       | 9.0  | –               | 9.0   | 9.17  | –     | 8.6  | –    |     |
|  |   |  |   |       | –    | –               | –     | 9.04  | –     | –    | –    |     |
|  |   |  |   |       | 8.6  | –               | 8.6   | 8.90  | –     | 8.2  | –    |     |
|  |   |  |   |       | –    | –               | –     | 8.70  | –     | –    | –    |     |
| (I <sub>OH</sub> = 0 mA)<br>(I <sub>OH</sub> = 5.0 mA)<br>(I <sub>OH</sub> = 10 mA)<br>(I <sub>OH</sub> = 15 mA)<br>(I <sub>OH</sub> = 20 mA)<br>(I <sub>OH</sub> = 25 mA)                         | V <sub>OH</sub>   | 15   | 14.1  | –     | 14.1 | 14.59           | –     | 14.1  | –     | Vdc  |      |     |
|  |   |  | –   | –     | –    | 14.27           | –     | –     | –     |      |      |     |
|  |   |  | 14  | –     | 14   | 14.18           | –     | 13.6  | –     |      |      |     |
|  |   |  | –   | –     | –    | 14.07           | –     | –     | –     |      |      |     |
|  |   |  | 13.6  | –     | 13.6 | 13.95           | –     | 13.2  | –     |      |      |     |
|  |   |  | –   | –     | –    | 13.70           | –     | –     | –     |      |      |     |
| Output Drive Current<br>(V <sub>OL</sub> = 0.4 V)<br>(V <sub>OL</sub> = 0.5 V)<br>(V <sub>OL</sub> = 1.5 V)  | Sink  | I <sub>OL</sub>  | 5.0   | 0.64  | –    | 0.51            | 0.88  | –     | 0.36  | –    | mAdc |     |
|  |   |  | 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 | μAdc |      |     |
| Input Capacitance  | C <sub>in</sub>   | –  | –   | –     | –    | 5.0             | 7.5   | –     | –     | pF   |      |     |
| Quiescent Current<br>(Per Package) V <sub>in</sub> = 0 or V <sub>DD</sub> ,<br>I <sub>out</sub> = 0 μA   | I <sub>DD</sub>   | 5.0  | –   | 5.0   | –    | 0.005           | 5.0   | –     | 150   | μAdc |      |     |
|  |   | 10   | –   | 10    | –    | 0.010           | 10    | –     | 300   |      |      |     |
|  |   | 15   | –   | 20    | –    | 0.015           | 20    | –     | 600   |      |      |     |
| Total Supply Current (Notes 5 & 6)<br>(Dynamic plus Quiescent,<br>Per Package)<br>(C <sub>L</sub> = 50 pF on all outputs, all<br>buffers switching)  | I <sub>T</sub>  | 5.0  | I <sub>T</sub> = (1.9 μA/kHz) f + I <sub>DD</sub> |       |      |                 |       |       | μAdc  |      |      |     |
|  |   | 10   | I <sub>T</sub> = (3.8 μA/kHz) f + I <sub>DD</sub> |       |      |                 |       |       |       |      |      |     |
|  |   | 15   | I <sub>T</sub> = (5.7 μA/kHz) f + I <sub>DD</sub> |       |      |                 |       |       |       |      |      |     |

4. Noise immunity specified for worst–case input combination.

Noise Margin for both “1” and “0” level =

1.0 Vdc min @ V<sub>DD</sub> = 5.0 Vdc

2.0 Vdc min @ V<sub>DD</sub> = 10 Vdc

2.5 Vdc min @ V<sub>DD</sub> = 15 Vdc

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

6. To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + 3.5 \times 10^{-3} (C_L - 50) V_{DD}f$$

where: I<sub>T</sub> is in μA (per package), C<sub>L</sub> in pF, V<sub>DD</sub> in Vdc, and f in kHz is input frequency.

# MC14511B

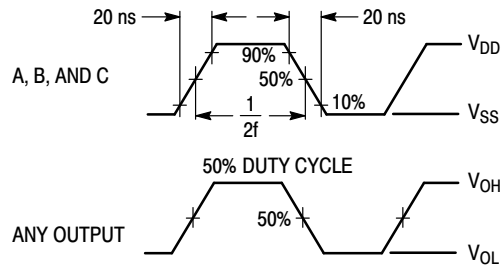
## SWITCHING CHARACTERISTICS (Note 7) ( $C_L = 50 \text{ pF}$ , $T_A = 25^\circ\text{C}$ )

| Characteristic   | Symbol                             | $V_{DD}$<br>Vdc                        | Min                            | Typ  | Max  | Unit |
|--|------------------------------------|--|--------------------------------|--|--|------|
| Output Rise Time<br>$t_{TLH} = (0.40 \text{ ns/pF}) C_L + 20 \text{ ns}$<br>$t_{TLH} = (0.25 \text{ ns/pF}) C_L + 17.5 \text{ ns}$<br>$t_{TLH} = (0.20 \text{ ns/pF}) C_L + 15 \text{ ns}$   | $t_{TLH}$                          | 5.0<br>10<br>15                        | –<br>–<br>–                    | 40<br>30<br>25                             | 80<br>60<br>50                               | ns   |
| Output Fall Time<br>$t_{THL} = (1.5 \text{ ns/pF}) C_L + 50 \text{ ns}$<br>$t_{THL} = (0.75 \text{ ns/pF}) C_L + 37.5 \text{ ns}$<br>$t_{THL} = (0.55 \text{ ns/pF}) C_L + 37.5 \text{ ns}$  | $t_{THL}$                          | 5.0<br>10<br>15                        | –<br>–<br>–                    | 125<br>75<br>65                            | 250<br>150<br>130                            | ns   |
| Data Propagation Delay Time<br>$t_{PLH} = (0.40 \text{ ns/pF}) C_L + 620 \text{ ns}$<br>$t_{PLH} = (0.25 \text{ ns/pF}) C_L + 237.5 \text{ ns}$<br>$t_{PLH} = (0.20 \text{ ns/pF}) C_L + 165 \text{ ns}$<br>$t_{PHL} = (1.3 \text{ ns/pF}) C_L + 655 \text{ ns}$<br>$t_{PHL} = (0.60 \text{ ns/pF}) C_L + 260 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 182.5 \text{ ns}$         | $t_{PLH}$<br><br><br><br>$t_{PHL}$ | 5.0<br>10<br>15<br><br>5.0<br>10<br>15 | –<br>–<br>–<br><br>–<br>–<br>– | 640<br>250<br>175<br><br>720<br>290<br>200 | 1280<br>500<br>350<br><br>1440<br>580<br>400 | ns   |
| Blank Propagation Delay Time<br>$t_{PLH} = (0.30 \text{ ns/pF}) C_L + 585 \text{ ns}$<br>$t_{PLH} = (0.25 \text{ ns/pF}) C_L + 187.5 \text{ ns}$<br>$t_{PLH} = (0.15 \text{ ns/pF}) C_L + 142.5 \text{ ns}$<br>$t_{PHL} = (0.85 \text{ ns/pF}) C_L + 442.5 \text{ ns}$<br>$t_{PHL} = (0.45 \text{ ns/pF}) C_L + 177.5 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 142.5 \text{ ns}$ | $t_{PLH}$<br><br><br><br>$t_{PHL}$ | 5.0<br>10<br>15<br><br>5.0<br>10<br>15 | –<br>–<br>–<br><br>–<br>–<br>– | 600<br>200<br>150<br><br>485<br>200<br>160 | 750<br>300<br>220<br><br>970<br>400<br>320   | ns   |
| Lamp Test Propagation Delay Time<br>$t_{PLH} = (0.45 \text{ ns/pF}) C_L + 290.5 \text{ ns}$<br>$t_{PLH} = (0.25 \text{ ns/pF}) C_L + 112.5 \text{ ns}$<br>$t_{PLH} = (0.20 \text{ ns/pF}) C_L + 80 \text{ ns}$<br>$t_{PHL} = (1.3 \text{ ns/pF}) C_L + 248 \text{ ns}$<br>$t_{PHL} = (0.45 \text{ ns/pF}) C_L + 102.5 \text{ ns}$<br>$t_{PHL} = (0.35 \text{ ns/pF}) C_L + 72.5 \text{ ns}$  | $t_{PLH}$<br><br><br><br>$t_{PHL}$ | 5.0<br>10<br>15<br><br>5.0<br>10<br>15 | –<br>–<br>–<br><br>–<br>–<br>– | 313<br>125<br>90<br><br>313<br>125<br>90   | 625<br>250<br>180<br><br>625<br>250<br>180   | ns   |
| Setup Time   | $t_{su}$                           | 5.0<br>10<br>15                        | 100<br>40<br>30                | –<br>–<br>–                                | –<br>–<br>–                                  | ns   |
| Hold Time  | $t_h$                              | 5.0<br>10<br>15                        | 60<br>40<br>30                 | –<br>–<br>–                                | –<br>–<br>–                                  | ns   |
| Latch Enable Pulse Width   | $t_{WL}$                           | 5.0<br>10<br>15                        | 520<br>220<br>130              | 260<br>110<br>65                           | –<br>–<br>–                                  | ns   |

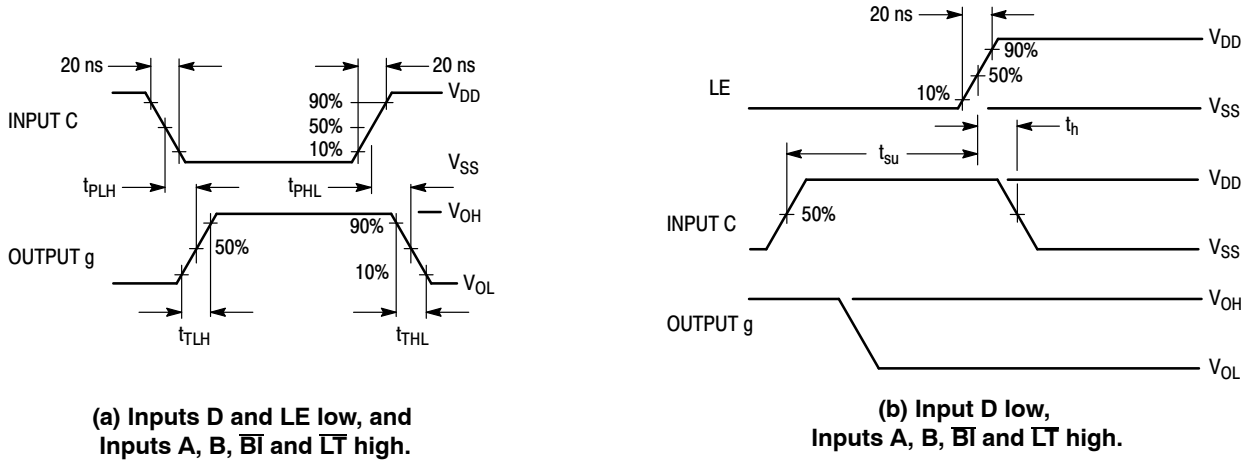
7. The formulas given are for the typical characteristics only.

# MC14511B

Input LE low, and Inputs D,  $\overline{B1}$  and  $\overline{L1}$  high.  
 $f$  in respect to a system clock.  
 All outputs connected to respective  $C_L$  loads.



**Figure 1. Dynamic Power Dissipation Signal Waveforms**

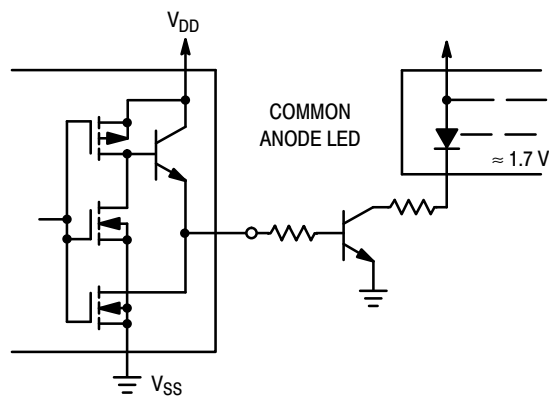
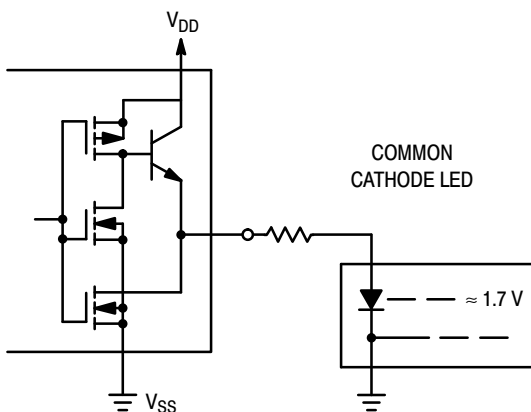


**Figure 2. Dynamic Signal Waveforms**

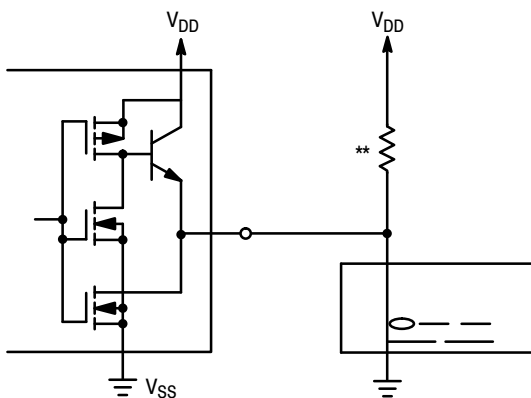
# MC14511B

## CONNECTIONS TO VARIOUS DISPLAY READOUTS

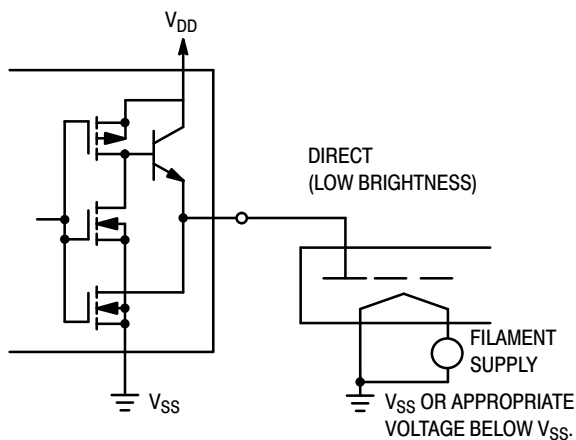
### LIGHT EMITTING DIODE (LED) READOUT



### INCANDESCENT READOUT

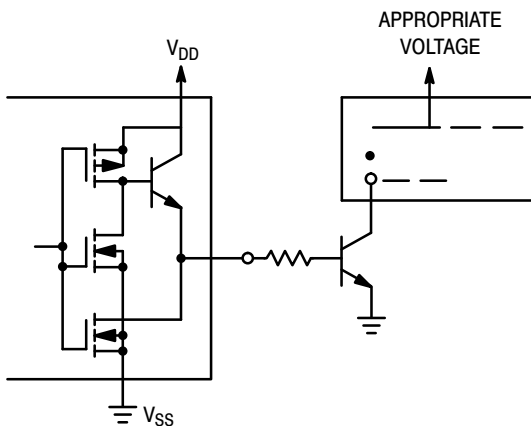


### FLUORESCENT READOUT

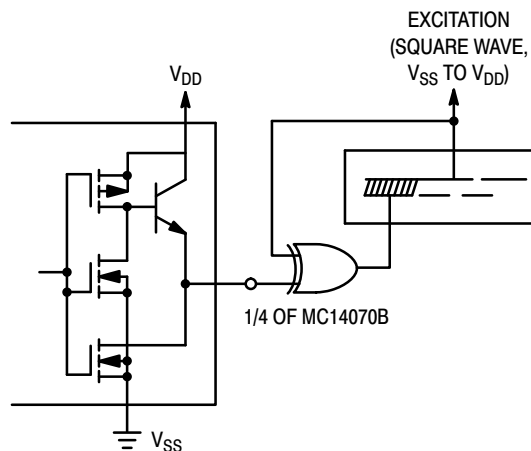


(CAUTION: Maximum working voltage = 18.0 V)

### GAS DISCHARGE READOUT



### LIQUID CRYSTAL (LCD) READOUT



\*\* A filament pre-warm resistor is recommended to reduce filament thermal shock and increase the effective cold resistance of the filament.

Direct DC drive of LCD's not recommended for life of LCD readouts.

# MC14511B

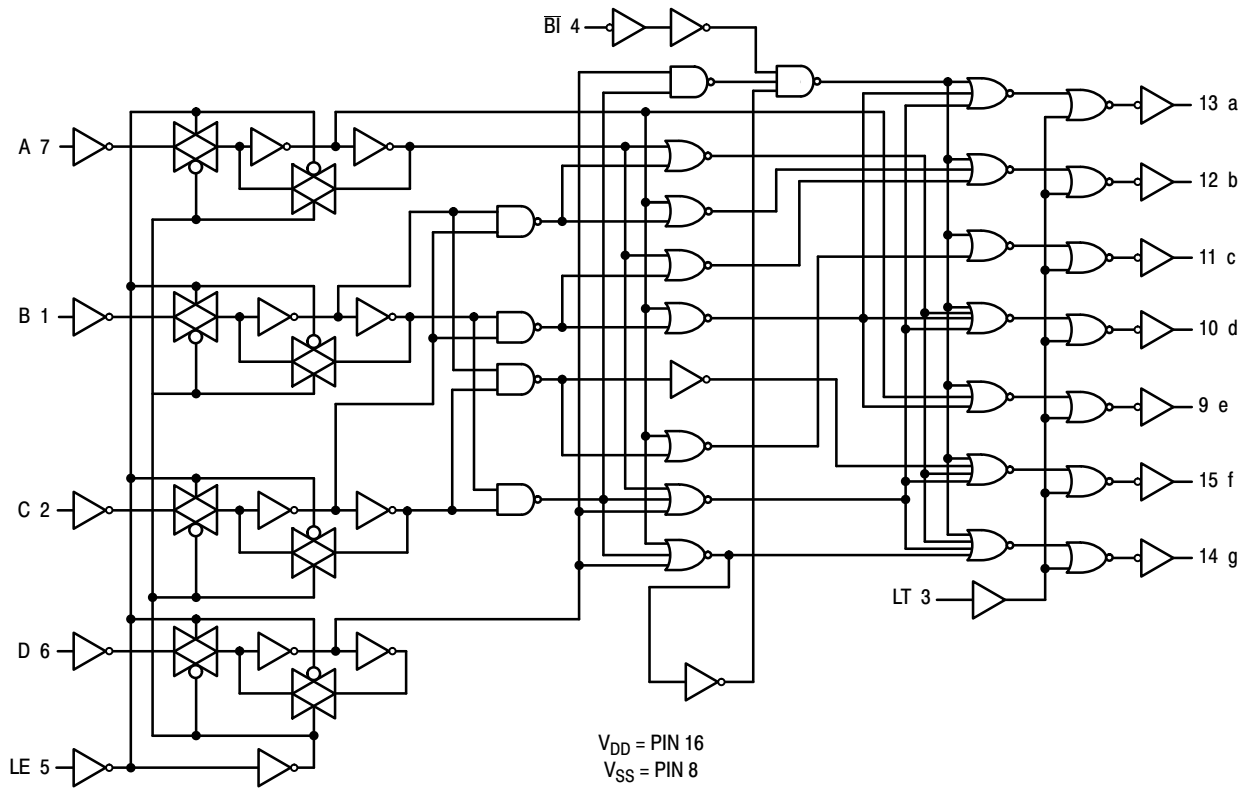


Figure 3. Logic Diagram

## ORDERING INFORMATION

| Device          | Package                | Shipping†             |
|-----------------|------------------------|-----------------------|
| MC14511BCPG     | PDIP-16<br>(Pb-Free)   | 500 / Tape & Ammo Box |
| MC14511BDG      | SOIC-16<br>(Pb-Free)   | 48 Units / Rail       |
| MC14511BDR2G    | SOIC-16<br>(Pb-Free)   | 2500 / Tape & Reel    |
| MC14511BDWR2G   | SO-16 WB<br>(Pb-Free)  | 1000 / Tape & Reel    |
| NLV14511BDWR2G* |                        |                       |
| MC14511BFG      | SOEIAJ-16<br>(Pb-Free) | 50 Units / Rail       |
| MC14511BFELG    | SOEIAJ-16<br>(Pb-Free) | 2000 / Tape & Reel    |

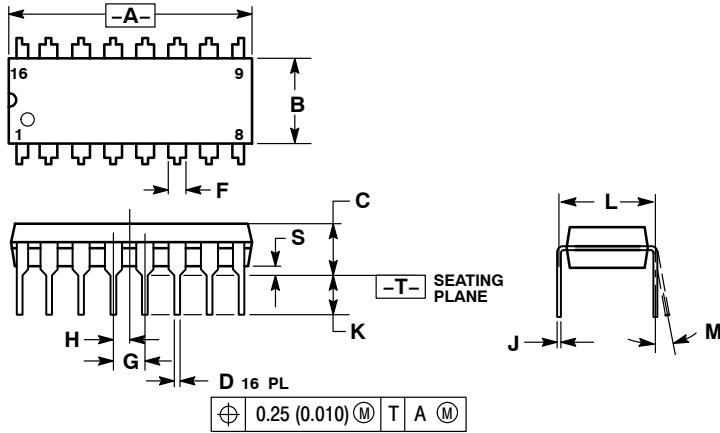
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

# MC14511B

## PACKAGE DIMENSIONS

PDIP-16  
CASE 648-08  
ISSUE T

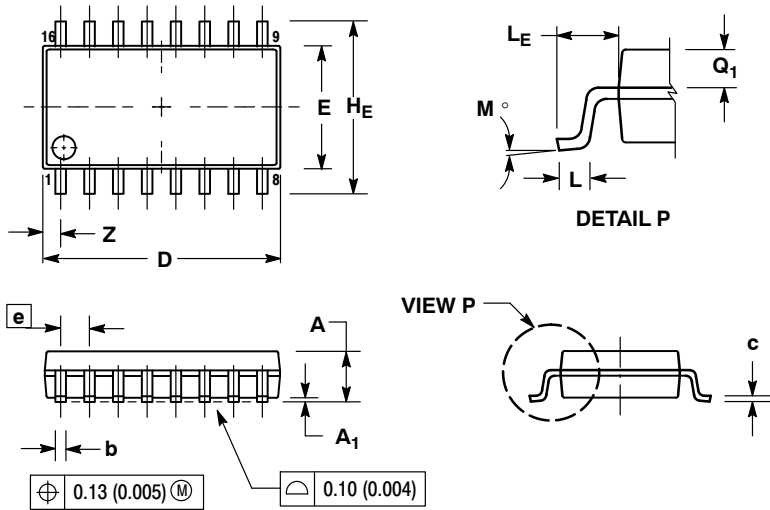


NOTES:

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  |

SOEIAJ-16  
CASE 966-01  
ISSUE A



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

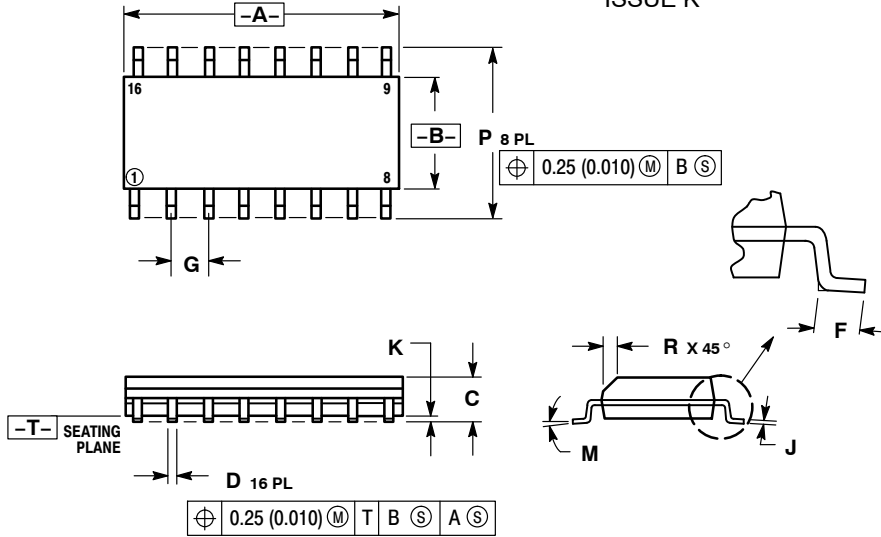
| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.10        | 0.20  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| H <sub>E</sub> | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| L <sub>E</sub> | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |



# MC14511B

## PACKAGE DIMENSIONS

SOIC-16  
D SUFFIX  
PLASTIC SOIC PACKAGE  
CASE 751B-05  
ISSUE K

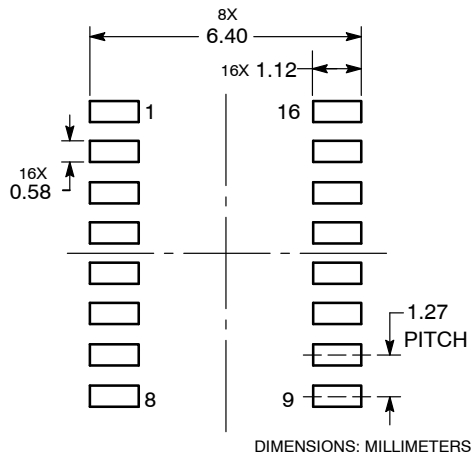


### NOTES:

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 |

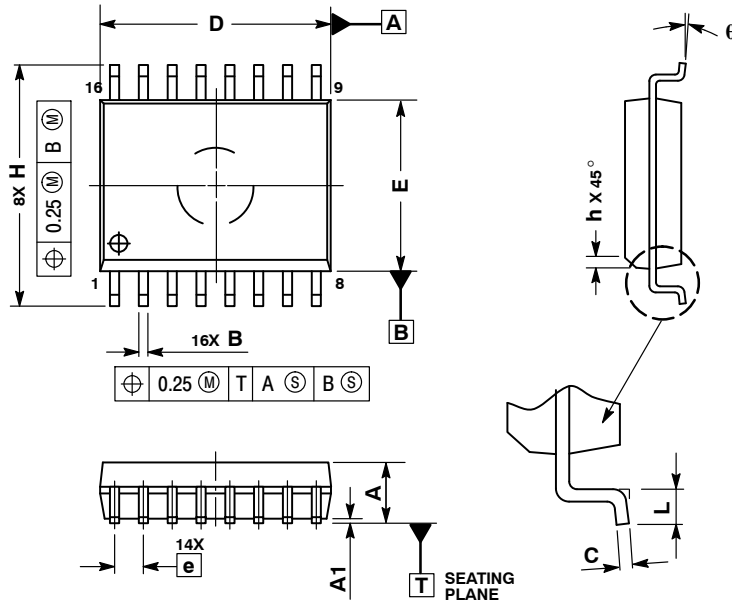
### SOLDERING FOOTPRINT



# MC14511B

## PACKAGE DIMENSIONS

SOIC-16 WB  
CASE 751G-03  
ISSUE D

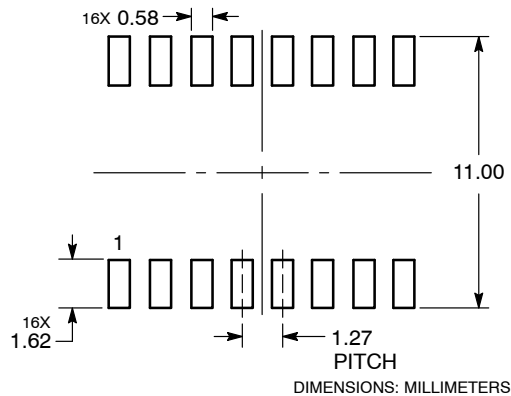


### NOTES:

1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       |
|-----|-------------|-------|
|     | MIN         | MAX   |
| A   | 2.35        | 2.65  |
| A1  | 0.10        | 0.25  |
| B   | 0.35        | 0.49  |
| C   | 0.23        | 0.32  |
| D   | 10.15       | 10.45 |
| E   | 7.40        | 7.60  |
| e   | 1.27 BSC    |       |
| H   | 10.05       | 10.55 |
| h   | 0.25        | 0.75  |
| L   | 0.50        | 0.90  |
| q   | 0°          | 7°    |

### SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

#### LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

N. American Technical Support: 800-282-9855 Toll Free  
USA/Canada  
Europe, Middle East and Africa Technical Support:  
Phone: 421 33 790 2910  
Japan Customer Focus Center  
Phone: 81-3-5817-1050

ON Semiconductor Website: [www.onsemi.com](http://www.onsemi.com)

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local Sales Representative