

# MC74HC589A

## 8-Bit Serial or Parallel-Input/Serial-Output Shift Register with 3-State Output

### High-Performance Silicon-Gate CMOS

The MC74HC589A device consists of an 8-bit storage latch which feeds parallel data to an 8-bit shift register. Data can also be loaded serially (see the Function Table). The shift register output,  $Q_H$ , is a 3-state output, allowing this device to be used in bus-oriented systems.

The HC589A directly interfaces with the SPI serial data port on CMOS MPUs and MCUs.

#### Features

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 526 FETs or 131.5 Equivalent Gates
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free and are RoHS Compliant

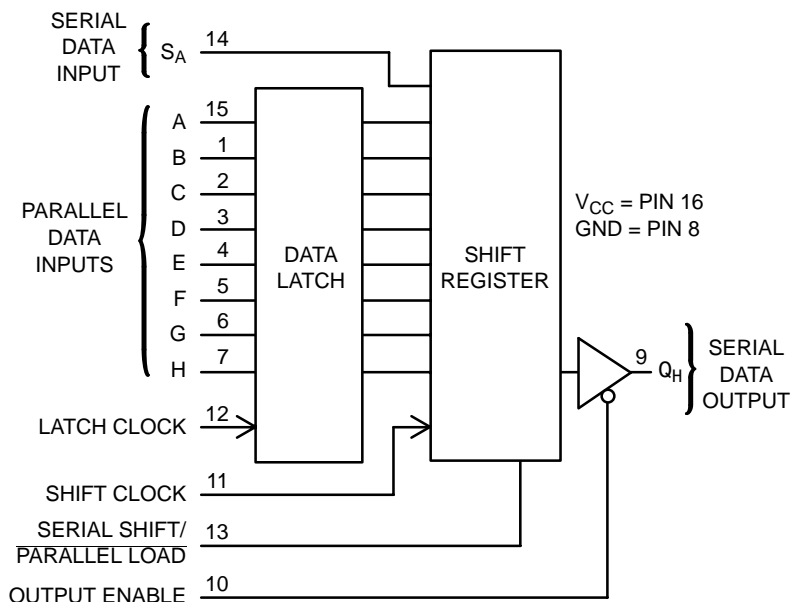
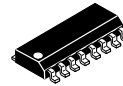


Figure 1. Logic Diagram



ON Semiconductor®

<http://onsemi.com>

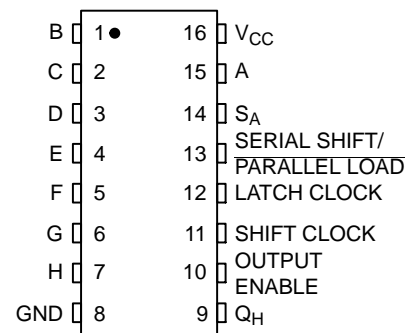


SOIC-16  
D SUFFIX  
CASE 751B

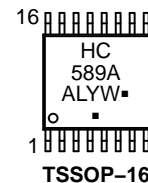
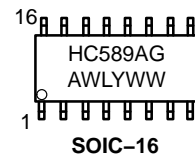


TSSOP-16  
DT SUFFIX  
CASE 948F

#### PIN ASSIGNMENT



#### MARKING DIAGRAMS



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

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

# MC74HC589A

## MAXIMUM RATINGS

| Symbol        | Parameter                                       | Value  | Unit         |
|---------------|---|--|--------------|
| $V_{CC}$      | DC Supply Voltage (Referenced to GND)           | -0.5 to +7.0   | V            |
| $V_{in}$      | DC Input Voltage (Referenced to GND)            | $-0.5 \leq V_{CC} + 0.5$   | V            |
| $V_{out}$     | DC Output Voltage (Referenced to GND)           | $-0.5 \leq V_{CC} + 0.5$   | V            |
| $I_{in}$      | DC Input Current, per Pin                       | $\pm 20$   | mA           |
| $I_{out}$     | DC Output Current, per Pin                      | $\pm 35$   | mA           |
| $I_{CC}$      | DC Supply Current, $V_{CC}$ and GND Pins        | $\pm 75$   | mA           |
| $I_{GND}$     | DC Ground Current per Ground Pin                | $\pm 75$   | mA           |
| $T_{STG}$     | Storage Temperature Range                       | -65 to +150  | °C           |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds | 260  | °C           |
| $T_J$         | Junction Temperature Under Bias                 | +150   | °C           |
| $\theta_{JA}$ | Thermal Resistance                              | PDIP 78<br>SOIC 112<br>TSSOP 148   | °C/W         |
| $P_D$         | Power Dissipation in Still Air at 85°C          | PDIP 750<br>SOIC 500<br>TSSOP 450  | mW           |
| MSL           | Moisture Sensitivity                            | Level 1  |              |
| $F_R$         | Flammability Rating                             | Oxygen Index: 30% – 35%<br>UL 94 V-0 @ 0.125 in  |              |
| $V_{ESD}$     | ESD Withstand Voltage                           | Human Body Model (Note 1) > 4000<br>Machine Model (Note 2) > 200<br>Charged Device Model (Note 3) > 1000 | V            |
| $I_{Latchup}$ | Latchup Performance                             | Above $V_{CC}$ and Below GND at 85°C (Note 4)  | $\pm 300$ mA |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Tested to EIA/JESD22-A114-A.
2. Tested to EIA/JESD22-A115-A.
3. Tested to JESD22-C101-A.
4. Tested to EIA/JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter  | Min  | Max                       | Unit |
|-------------------|--|--|---------------------------|------|
| $V_{CC}$          | DC Supply Voltage (Referenced to GND)                | 2.0  | 6.0                       | V    |
| $V_{in}, V_{out}$ | DC Input Voltage, Output Voltage (Referenced to GND) | 0  | $V_{CC}$                  | V    |
| $T_A$             | Operating Temperature, All Package Types             | -55  | +125                      | °C   |
| $t_r, t_f$        | Input Rise and Fall Time (Figure 2)                  | $V_{CC} = 2.0\text{ V}$ 0<br>$V_{CC} = 3.0\text{ V}$ 0<br>$V_{CC} = 4.5\text{ V}$ 0<br>$V_{CC} = 6.0\text{ V}$ 0 | 1000<br>800<br>500<br>400 | ns   |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

5. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

# MC74HC589A

## DC ELECTRICAL CHARACTERISTICS (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions  | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|-----------------|--|--|----------------------|------------------|--------|---------|------|
|                 |  |  |                      | -55°C to 25°C    | ≤ 85°C | ≤ 125°C |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>out</sub>   ≤ 20 μA   | 2.0                  | 1.5              | 1.5    | 1.5     | V    |
|                 |  |  | 3.0                  | 2.1              | 2.1    | 2.1     |      |
|                 |  |  | 4.5                  | 3.15             | 3.15   | 3.15    |      |
|                 |  |  | 6.0                  | 4.2              | 4.2    | 4.2     |      |
| V <sub>IL</sub> | Maximum Low-Level Input Voltage                | V <sub>out</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V<br> I <sub>out</sub>   ≤ 20 μA   | 2.0                  | 0.5              | 0.5    | 0.5     | V    |
|                 |  |  | 3.0                  | 0.9              | 0.9    | 0.9     |      |
|                 |  |  | 4.5                  | 1.35             | 1.35   | 1.35    |      |
|                 |  |  | 6.0                  | 1.8              | 1.8    | 1.8     |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA  | 2.0                  | 1.9              | 1.9    | 1.9     | V    |
|                 |  |  | 4.5                  | 4.4              | 4.4    | 4.4     |      |
|                 |  |  | 6.0                  | 5.9              | 5.9    | 5.9     |      |
|                 |  | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 2.4 mA<br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA | 3.0                  | 2.48             | 2.34   | 2.20    |      |
|                 |  |  | 4.5                  | 3.98             | 3.84   | 3.70    |      |
|                 |  |  | 6.0                  | 5.48             | 5.34   | 5.20    |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>in</sub> = V <sub>IH</sub><br> I <sub>out</sub>   ≤ 20 μA   | 2.0                  | 0.1              | 0.1    | 0.1     | V    |
|                 |  |  | 4.5                  | 0.1              | 0.1    | 0.1     |      |
|                 |  |  | 6.0                  | 0.1              | 0.1    | 0.1     |      |
|                 |  | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 2.4 mA<br> I <sub>out</sub>   ≤ 6.0 mA<br> I <sub>out</sub>   ≤ 7.8 mA | 3.0                  | 0.26             | 0.33   | 0.40    |      |
|                 |  |  | 4.5                  | 0.26             | 0.33   | 0.40    |      |
|                 |  |  | 6.0                  | 0.26             | 0.33   | 0.40    |      |
| I <sub>in</sub> | Maximum Input Leakage Current                  | V <sub>in</sub> = V <sub>CC</sub> or GND   | 6.0                  | ±0.1             | ±1.0   | ±1.0    | μA   |
| I <sub>oz</sub> | Maximum Three-State Leakage Current            | Output in High-Impedance State<br>V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>V <sub>out</sub> = V <sub>CC</sub> or GND                  | 6.0                  | ±0.5             | ±5.0   | ±10     | μA   |
| I <sub>CC</sub> | Maximum Quiescent Supply Current (per Package) | V <sub>in</sub> = V <sub>CC</sub> or GND<br>I <sub>out</sub> = 0 μA  | 6.0                  | 4                | 40     | 160     | μA   |

# MC74HC589A

## AC ELECTRICAL CHARACTERISTICS ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

| Symbol                                 | Parameter  | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|--|--|----------------------|------------------|--------|---------|------|
|  |  |                      | -55°C to 25°C    | ≤ 85°C | ≤ 125°C |      |
| f <sub>max</sub>                       | Maximum Clock Frequency (50% Duty Cycle)<br>(Figures 3 and 9)                                | 2.0                  | 6.0              | 4.8    | 4.0     | MHz  |
|  |  | 3.0                  | 15               | 10     | 8.0     |      |
|  |  | 4.5                  | 30               | 24     | 20      |      |
|  |  | 6.0                  | 35               | 28     | 24      |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Latch Clock to Q <sub>H</sub><br>(Figures 2 and 9)                | 2.0                  | 175              | 225    | 275     | ns   |
|  |  | 3.0                  | 100              | 110    | 125     |      |
|  |  | 4.5                  | 40               | 50     | 60      |      |
|  |  | 6.0                  | 30               | 40     | 50      |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Shift Clock to Q <sub>H</sub><br>(Figures 3 and 9)                | 2.0                  | 160              | 200    | 240     | ns   |
|  |  | 3.0                  | 90               | 130    | 160     |      |
|  |  | 4.5                  | 30               | 40     | 48      |      |
|  |  | 6.0                  | 25               | 30     | 40      |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Serial Shift/Parallel Load to Q <sub>H</sub><br>(Figures 5 and 9) | 2.0                  | 160              | 200    | 240     | ns   |
|  |  | 3.0                  | 90               | 130    | 160     |      |
|  |  | 4.5                  | 30               | 40     | 48      |      |
|  |  | 6.0                  | 25               | 30     | 40      |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Q <sub>H</sub><br>(Figures 4 and 10)             | 2.0                  | 150              | 170    | 200     | ns   |
|  |  | 3.0                  | 80               | 100    | 130     |      |
|  |  | 4.5                  | 27               | 30     | 40      |      |
|  |  | 6.0                  | 23               | 25     | 30      |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Q <sub>H</sub><br>(Figures 4 and 10)             | 2.0                  | 150              | 170    | 200     | ns   |
|  |  | 3.0                  | 80               | 100    | 130     |      |
|  |  | 4.5                  | 27               | 30     | 40      |      |
|  |  | 6.0                  | 23               | 25     | 30      |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Any Output<br>(Figures 2 and 9)                              | 2.0                  | 60               | 75     | 90      | ns   |
|  |  | 3.0                  | 23               | 27     | 31      |      |
|  |  | 4.5                  | 12               | 15     | 18      |      |
|  |  | 6.0                  | 10               | 13     | 15      |      |
| C <sub>in</sub>                        | Maximum Input Capacitance  | –                    | 10               | 10     | 10      | pF   |
| C <sub>out</sub>                       | Maximum Three-State Output Capacitance<br>(Output in High-Impedance State)                   | –                    | 15               | 15     | 15      | pF   |

| C <sub>PD</sub> | Power Dissipation Capacitance (per Package)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |  | pF |
|-----------------|--|---|--|----|
|                 |  | 50                                      |  |    |
|                 |  |   |  |    |

\*Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

# MC74HC589A

## TIMING REQUIREMENTS (Input $t_r = t_f = 6$ ns)

| Symbol                          | Parameter   | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|---------------------------------|---|----------------------|------------------|--------|---------|------|
|                                 |   |                      | -55°C to 25°C    | ≤ 85°C | ≤ 125°C |      |
| t <sub>su</sub>                 | Minimum Setup Time, A–H to Latch Clock<br>(Figure 6)                              | 2.0                  | 100              | 125    | 150     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 20               | 25     | 30      |      |
|                                 |   | 6.0                  | 17               | 21     | 26      |      |
| t <sub>su</sub>                 | Minimum Setup Time, Serial Data Input S <sub>A</sub> to Shift Clock<br>(Figure 7) | 2.0                  | 100              | 125    | 150     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 20               | 25     | 30      |      |
|                                 |   | 6.0                  | 17               | 21     | 26      |      |
| t <sub>su</sub>                 | Minimum Setup Time, Serial Shift/Parallel Load to Shift Clock<br>(Figure 8)       | 2.0                  | 100              | 125    | 150     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 20               | 25     | 30      |      |
|                                 |   | 6.0                  | 17               | 21     | 26      |      |
| t <sub>h</sub>                  | Minimum Hold Time, Latch Clock to A–H<br>(Figure 6)                               | 2.0                  | 25               | 30     | 40      | ns   |
|                                 |   | 3.0                  | 10               | 12     | 15      |      |
|                                 |   | 4.5                  | 5                | 6      | 8       |      |
|                                 |   | 6.0                  | 5                | 6      | 7       |      |
| t <sub>h</sub>                  | Minimum Hold Time, Shift Clock to Serial Data Input S <sub>A</sub><br>(Figure 7)  | 2.0                  | 5                | 5      | 5       | ns   |
|                                 |   | 3.0                  | 5                | 5      | 5       |      |
|                                 |   | 4.5                  | 5                | 5      | 5       |      |
|                                 |   | 6.0                  | 5                | 5      | 5       |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Shift Clock<br>(Figure 3)                                    | 2.0                  | 75               | 95     | 110     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 15               | 19     | 23      |      |
|                                 |   | 6.0                  | 13               | 16     | 19      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Latch Clock<br>(Figure 2)                                    | 2.0                  | 80               | 100    | 120     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 16               | 20     | 24      |      |
|                                 |   | 6.0                  | 14               | 17     | 20      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Serial Shift/Parallel Load<br>(Figure 5)                     | 2.0                  | 80               | 100    | 120     | ns   |
|                                 |   | 3.0                  | 40               | 50     | 60      |      |
|                                 |   | 4.5                  | 16               | 20     | 24      |      |
|                                 |   | 6.0                  | 14               | 17     | 20      |      |
| t <sub>r</sub> , t <sub>f</sub> | Maximum Input Rise and Fall Times<br>(Figure 2)                                   | 2.0                  | 1000             | 1000   | 1000    | ns   |
|                                 |   | 3.0                  | 800              | 800    | 800     |      |
|                                 |   | 4.5                  | 500              | 500    | 500     |      |
|                                 |   | 6.0                  | 400              | 400    | 400     |      |

# MC74HC589A

## FUNCTION TABLE

| Operation  | Inputs        |                                |                  |                  |                    |                     | Resulting Function  |                                       |                         |
|--|---------------|--------------------------------|------------------|------------------|--------------------|---------------------|---------------------|---------------------------------------|-------------------------|
|  | Output Enable | Serial Shift/<br>Parallel Load | Latch Clock      | Shift Clock      | Serial Input $S_A$ | Parallel Inputs A-H | Data Latch Contents | Shift Register Contents               | Output $Q_H$            |
| Force Output into High Impedance State                                     | H             | X                              | X                | X                | X                  | X                   | X                   | X                                     | Z                       |
| Load Parallel Data into Data Latch   | L             | H                              | $\swarrow$       | L, H, $\swarrow$ | X                  | a-h                 | a-h                 | U                                     | U                       |
| Transfer Latch Contents to Shift Register                                  | L             | L                              | L, H, $\swarrow$ | X                | X                  | X                   | U                   | $LR_N \rightarrow SR_N$               | $LR_H$                  |
| Contents of Input Latch and Shift Register are Unchanged                   | L             | H                              | L, H, $\swarrow$ | L, H, $\swarrow$ | X                  | X                   | U                   | U                                     | U                       |
| Load Parallel Data into Data Latch and Shift Register                      | L             | L                              | $\swarrow$       | X                | X                  | a-h                 | a-h                 | a-h                                   | h                       |
| Shift Serial Data into Shift Register                                      | L             | H                              | X                | $\swarrow$       | D                  | X                   | *                   | $SR_A = D, SR_N \rightarrow SR_{N+1}$ | $SR_G \rightarrow SR_H$ |
| Load Parallel Data in Data Latch and Shift Serial Data into Shift Register | L             | H                              | $\swarrow$       | $\swarrow$       | D                  | a-h                 | a-h                 | $SR_A = D, SR_N \rightarrow SR_{N+1}$ | $SR_G \rightarrow SR_H$ |

LR = latch register contents  
 SR = shift register contents  
 a-h = data at parallel data inputs A-H  
 D = data (L, H) at serial data input  $S_A$

U = remains unchanged  
 X = don't care  
 Z = high impedance  
 \* = depends on Latch Clock input

## SWITCHING WAVEFORMS

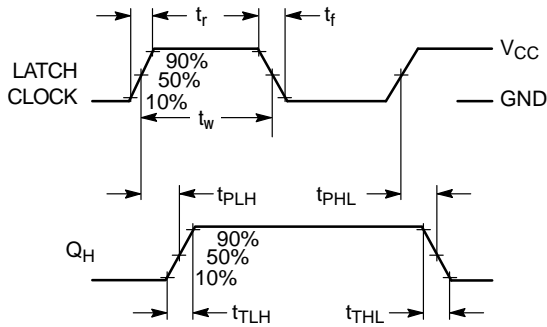


Figure 2. (Serial Shift/Parallel Load = L)

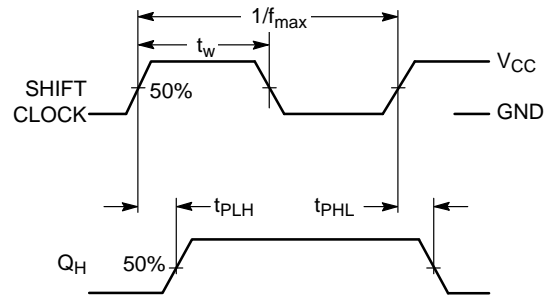


Figure 3. (Serial Shift/Parallel Load = H)

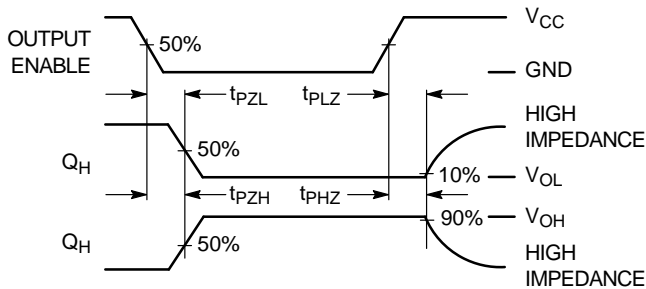


Figure 4.

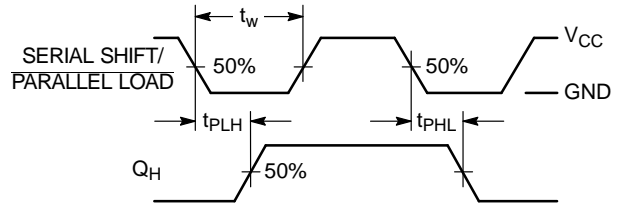


Figure 5.

# MC74HC589A

## SWITCHING WAVEFORMS

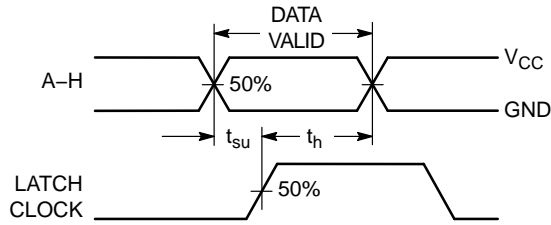


Figure 6.

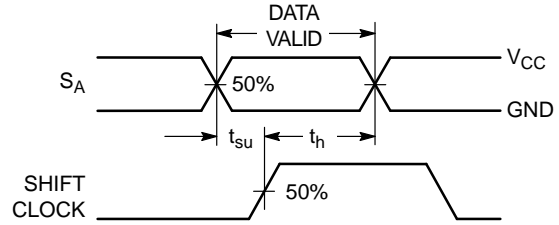


Figure 7.

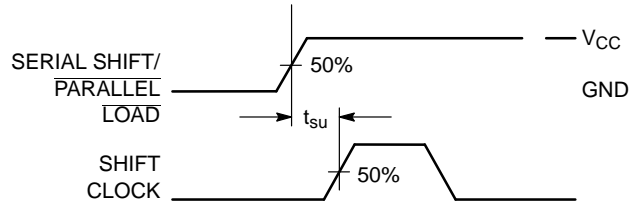
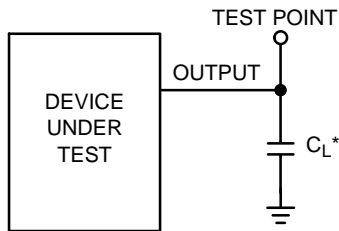
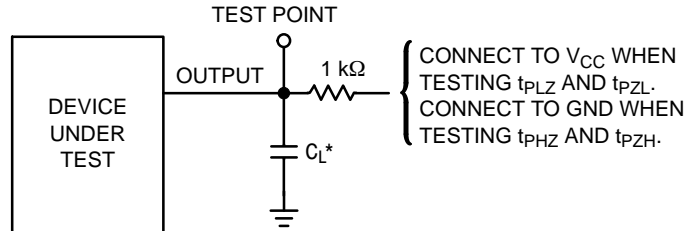


Figure 8.



\*Includes all probe and jig capacitance.

Figure 9. Test Circuit



\*Includes all probe and jig capacitance.

Figure 10. Test Circuit

## PIN DESCRIPTIONS

### Data Inputs

#### A, B, C, D, E, F, G, H (Pins 15, 1, 2, 3, 4, 5, 6, 7)

Parallel data inputs. Data on these inputs are stored in the data latch on the rising edge of the Latch Clock input.

#### S<sub>A</sub> (Pin 14)

Serial data input. Data on this input is shifted into the shift register on the rising edge of the Shift Clock input if Serial Shift/Parallel Load is high. Data on this input is ignored when Serial Shift/Parallel Load is low.

### Control Inputs

#### Serial Shift/Parallel Load (Pin 13)

Shift register mode control. When a high level is applied to this pin, the shift register is allowed to serially shift data. When a low level is applied to this pin, the shift register accepts parallel data from the data latch.

#### Shift Clock (Pin 11)

Serial shift clock. A low-to-high transition on this input shifts data on the serial data input into the shift register and

data in stage H is shifted out Q<sub>H</sub>, being replaced by the data previously stored in stage G.

#### Latch Clock (Pin 12)

Data latch clock. A low-to-high transition on this input loads the parallel data on inputs A–H into the data latch.

#### Output Enable (Pin 10)

Active-low output enable A high level applied to this pin forces the Q<sub>H</sub> output into the high impedance state. A low level enables the output. This control does not affect the state of the input latch or the shift register.

### Output

#### Q<sub>H</sub> (Pin 9)

Serial data output. This pin is the output from the last stage of the shift register. This is a 3-state output.

# MC74HC589A

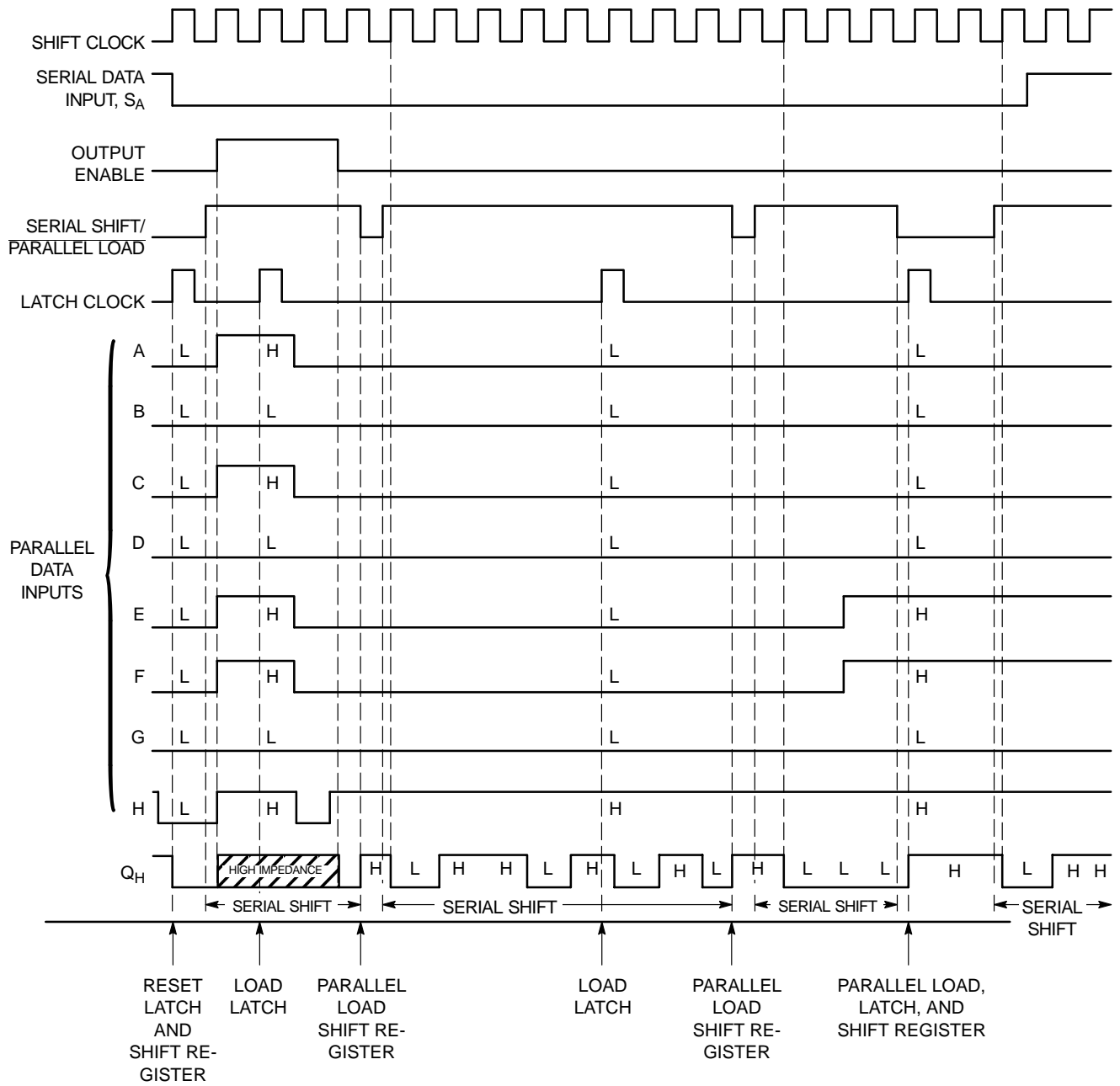
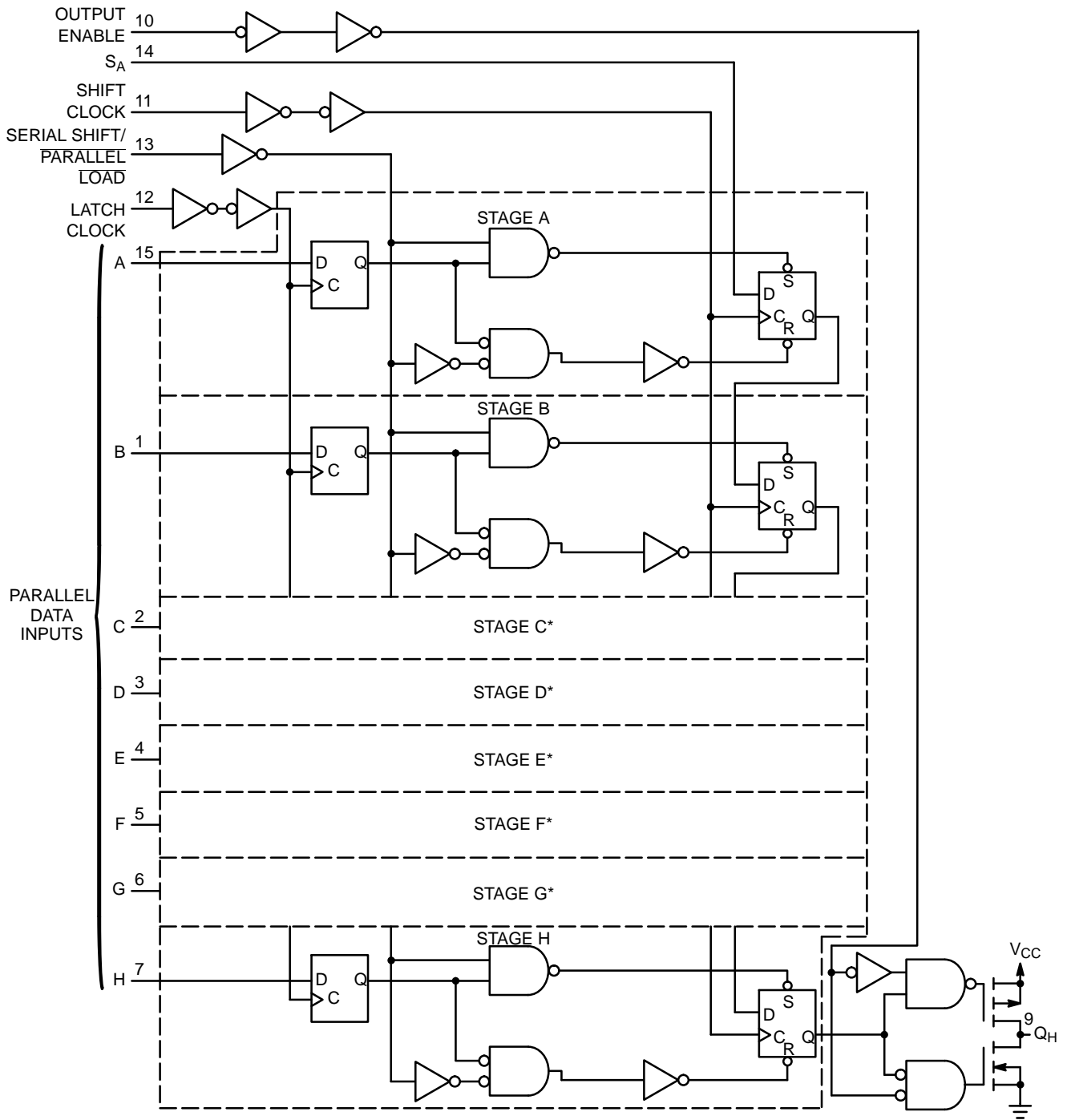


Figure 11. Timing Diagram



# MC74HC589A



\*Stages C thru G (not shown in detail) are identical to stages A and B above.

Figure 12. Logic Detail

# MC74HC589A

## ORDERING INFORMATION

| Device            | Package               | Shipping†        |
|-------------------|-----------------------|------------------|
| MC74HC589ADG      | SOIC-16<br>(Pb-Free)  | 48 Units / Rail  |
| NLV74HC589ADG*    | SOIC-16<br>(Pb-Free)  | 48 Units / Rail  |
| MC74HC589ADR2G    | SOIC-16<br>(Pb-Free)  | 2500 Tape & Reel |
| NLV74HC589ADR2G*  | SOIC-16<br>(Pb-Free)  | 2500 Tape & Reel |
| MC74HC589ADTR2G   | TSSOP-16<br>(Pb-Free) | 2500 Tape & Reel |
| NLV74HC589ADTR2G* | TSSOP-16<br>(Pb-Free) | 2500 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.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

ON Semiconductor®



SCALE 1:1

## SOIC-16 CASE 751B-05 ISSUE K

DATE 29 DEC 2006



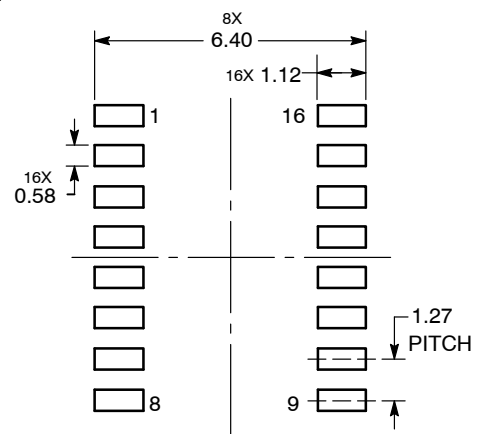
NOTES:

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 |

- |   |   |   |   |
|---|---|---|---|
| <p>STYLE 1:</p> <p>PIN 1. COLLECTOR<br/>2. BASE<br/>3. EMITTER<br/>4. NO CONNECTION<br/>5. EMITTER<br/>6. BASE<br/>7. COLLECTOR<br/>8. COLLECTOR<br/>9. BASE<br/>10. EMITTER<br/>11. NO CONNECTION<br/>12. EMITTER<br/>13. BASE<br/>14. COLLECTOR<br/>15. EMITTER<br/>16. COLLECTOR</p>                           | <p>STYLE 2:</p> <p>PIN 1. CATHODE<br/>2. ANODE<br/>3. NO CONNECTION<br/>4. CATHODE<br/>5. CATHODE<br/>6. NO CONNECTION<br/>7. ANODE<br/>8. CATHODE<br/>9. CATHODE<br/>10. ANODE<br/>11. NO CONNECTION<br/>12. CATHODE<br/>13. CATHODE<br/>14. NO CONNECTION<br/>15. ANODE<br/>16. CATHODE</p> | <p>STYLE 3:</p> <p>PIN 1. COLLECTOR, DYE #1<br/>2. BASE, #1<br/>3. EMITTER, #1<br/>4. COLLECTOR, #1<br/>5. COLLECTOR, #2<br/>6. BASE, #2<br/>7. EMITTER, #2<br/>8. COLLECTOR, #2<br/>9. COLLECTOR, #3<br/>10. BASE, #3<br/>11. EMITTER, #3<br/>12. COLLECTOR, #3<br/>13. COLLECTOR, #4<br/>14. BASE, #4<br/>15. EMITTER, #4<br/>16. COLLECTOR, #4</p>   | <p>STYLE 4:</p> <p>PIN 1. COLLECTOR, DYE #1<br/>2. COLLECTOR, #1<br/>3. COLLECTOR, #2<br/>4. COLLECTOR, #2<br/>5. COLLECTOR, #3<br/>6. COLLECTOR, #3<br/>7. COLLECTOR, #4<br/>8. COLLECTOR, #4<br/>9. BASE, #4<br/>10. EMITTER, #4<br/>11. BASE, #3<br/>12. EMITTER, #3<br/>13. BASE, #2<br/>14. EMITTER, #2<br/>15. BASE, #1<br/>16. EMITTER, #1</p> |
| <p>STYLE 5:</p> <p>PIN 1. DRAIN, DYE #1<br/>2. DRAIN, #1<br/>3. DRAIN, #2<br/>4. DRAIN, #2<br/>5. DRAIN, #3<br/>6. DRAIN, #3<br/>7. DRAIN, #4<br/>8. DRAIN, #4<br/>9. GATE, #4<br/>10. SOURCE, #4<br/>11. GATE, #3<br/>12. SOURCE, #3<br/>13. GATE, #2<br/>14. SOURCE, #2<br/>15. GATE, #1<br/>16. SOURCE, #1</p> | <p>STYLE 6:</p> <p>PIN 1. CATHODE<br/>2. CATHODE<br/>3. CATHODE<br/>4. CATHODE<br/>5. CATHODE<br/>6. CATHODE<br/>7. CATHODE<br/>8. CATHODE<br/>9. ANODE<br/>10. ANODE<br/>11. ANODE<br/>12. ANODE<br/>13. ANODE<br/>14. ANODE<br/>15. ANODE<br/>16. ANODE</p>                                 | <p>STYLE 7:</p> <p>PIN 1. SOURCE N-CH<br/>2. COMMON DRAIN (OUTPUT)<br/>3. COMMON DRAIN (OUTPUT)<br/>4. GATE P-CH<br/>5. COMMON DRAIN (OUTPUT)<br/>6. COMMON DRAIN (OUTPUT)<br/>7. COMMON DRAIN (OUTPUT)<br/>8. SOURCE P-CH<br/>9. SOURCE P-CH<br/>10. COMMON DRAIN (OUTPUT)<br/>11. COMMON DRAIN (OUTPUT)<br/>12. COMMON DRAIN (OUTPUT)<br/>13. GATE N-CH<br/>14. COMMON DRAIN (OUTPUT)<br/>15. COMMON DRAIN (OUTPUT)<br/>16. SOURCE N-CH</p> |   |

### SOLDERING FOOTPRINT



DIMENSIONS: MILLIMETERS

|                  |             |  |
|------------------|-------------|--|
| DOCUMENT NUMBER: | 98ASB42566B | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | SOIC-16     | PAGE 1 OF 1  |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

ON Semiconductor®



TSSOP-16  
CASE 948F-01  
ISSUE B

DATE 19 OCT 2006



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH. PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. DIMENSION K DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE K DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
7. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 4.90        | 5.10 | 0.193     | 0.200 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.20 | ---       | 0.047 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.75 | 0.020     | 0.030 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| H   | 0.18        | 0.28 | 0.007     | 0.011 |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

SOLDERING FOOTPRINT



GENERIC MARKING DIAGRAM\*



- XXXX = Specific Device Code
- A = Assembly Location
- L = Wafer Lot
- Y = Year
- W = Work Week
- G or ■ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present.

|                  |             |  |
|------------------|-------------|--|
| DOCUMENT NUMBER: | 98ASH70247A | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | TSSOP-16    | PAGE 1 OF 1  |

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'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). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** 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:

Email Requests to: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

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

### TECHNICAL SUPPORT

**North American Technical Support:**

Voice Mail: 1 800-282-9855 Toll Free USA/Canada

Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**

Phone: 00421 33 790 2910

For additional information, please contact your local Sales Representative