

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

High-Performance Silicon-Gate CMOS

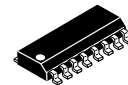
## MC74HC595A, MC74HCT595A

The MC74HC595A/MC74HCT595A consists of an 8-bit shift register and an 8-bit D-type latch with three-state parallel outputs. The shift register accepts serial data and provides a serial output. The shift register also provides parallel data to the 8-bit latch. The shift register and latch have independent clock inputs. This device also has an asynchronous reset for the shift register.

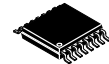
The device directly interfaces with the SPI serial data port on CMOS MPUs and MCUs. The MC74HC595A device inputs are compatible Standard CMOS outputs; with pullup resistors, they are compatible with TTL outputs. The MC74HCT595A device inputs are compatible Standard CMOS or TTL outputs.

### Features

- Output Drive Capability: 15 LSTTL Loads
- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V (HC), 4.5 to 5.5 V (HCT)
- Low Input Current: 1.0  $\mu$ A
- High Noise Immunity Characteristic of CMOS Devices
- In Compliance with the Requirements Defined by JEDEC Standard No. 7 A
- Chip Complexity: 328 FETs or 82 Equivalent Gates
- Improvements over HC595/HCT595
  - ◆ Improved Propagation Delays
  - ◆ 50% Lower Quiescent Power
  - ◆ Improved Input Noise and Latchup Immunity
- -Q Suffix 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



SOIC-16  
D SUFFIX  
CASE 751B

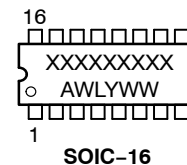


TSSOP-16  
DT SUFFIX  
CASE 948F

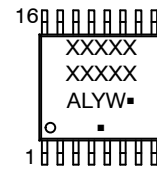


QFN16  
MN SUFFIX  
CASE 485AW

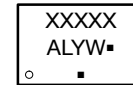
### MARKING DIAGRAMS



SOIC-16



TSSOP-16



QFN16

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

(Note: Microdot may be in either location)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 13 of this data sheet.

# MC74HC595A, MC74HCT595A

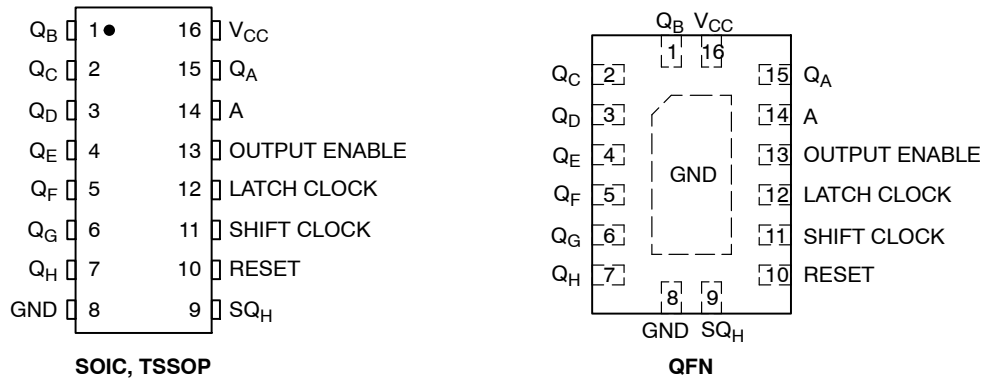
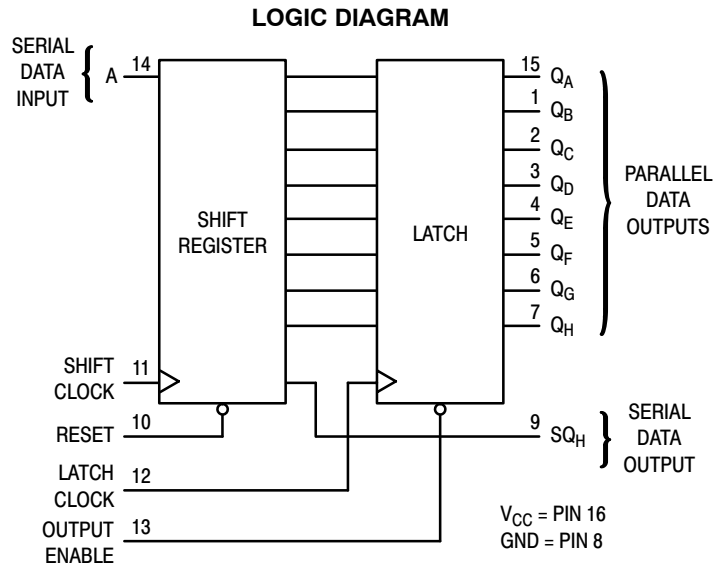


Figure 1. Pin Assignments



# MC74HC595A, MC74HCT595A

## MAXIMUM RATINGS

| Symbol        | Parameter                                                    | Value                                                      | Unit |
|---------------|--------------------------------------------------------------|------------------------------------------------------------|------|
| $V_{CC}$      | DC Supply Voltage                                            | -0.5 to +6.5                                               | V    |
| $V_{IN}$      | DC Input Voltage                                             | -0.5 to $V_{CC} + 0.5$                                     | V    |
| $V_{OUT}$     | DC Output Voltage                                            | -0.5 to $V_{CC} + 0.5$                                     | 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   |
| $I_{IK}$      | Input Clamp Current ( $V_{IN} < 0$ or $V_{IN} > V_{CC}$ )    | $\pm 20$                                                   | mA   |
| $I_{OK}$      | Output Clamp Current ( $V_{OUT} < 0$ or $V_{OUT} > V_{CC}$ ) | $\pm 20$                                                   | mA   |
| $T_{STG}$     | Storage Temperature                                          | -65 to +150                                                | °C   |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds              | 260                                                        | °C   |
| $T_J$         | Junction Temperature Under Bias                              | $\pm 150$                                                  | °C   |
| $\theta_{JA}$ | Thermal Resistance (Note 1)                                  | SOIC-16<br>QFN16<br>TSSOP-16<br>126<br>118<br>159          | °C/W |
| $P_D$         | Power Dissipation in Still Air at 25°C                       | SOIC-16<br>QFN16<br>TSSOP-16<br>995<br>1062<br>787         | mW   |
| MSL           | Moisture Sensitivity                                         | Level 1                                                    | -    |
| $F_R$         | Flammability Rating                                          | Oxygen Index: 28 to 34<br>UL 94 V-0 @<br>0.125 in          | -    |
| $V_{ESD}$     | ESD Withstand Voltage (Note 2)                               | Human Body Model<br>Charged Device Model<br>>3000<br>>1000 | V    |

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. Measured with minimum pad spacing on an FR4 board, using 76mm-by-114mm, 2-ounce copper trace no air flow per JESD51-7.
2. HBM tested to EIA / JESD22-A114-A. CDM tested to JESD22-C101-A. JEDEC recommends that ESD qualification to EIA/JESD22-A115A (Machine Model) be discontinued.

## RECOMMENDED OPERATING CONDITIONS

| Symbol            | Parameter                                    | Min                                                                                          | Max                | Unit |
|-------------------|----------------------------------------------|----------------------------------------------------------------------------------------------|--------------------|------|
| <b>MC74HC</b>     |                                              |                                                                                              |                    |      |
| $V_{CC}$          | DC Supply Voltage                            | 2.0                                                                                          | 6.0                | V    |
| $V_{IN}, V_{OUT}$ | DC Input Voltage, Output Voltage (Note 3)    | 0                                                                                            | $V_{CC}$           | V    |
| $T_A$             | Operating Free-Air Temperature               | -55                                                                                          | +125               | °C   |
| $t_r, t_f$        | Input Rise or Fall Time                      | $V_{CC} = 2.0\text{ V}$<br>$V_{CC} = 4.5\text{ V}$<br>$V_{CC} = 6.0\text{ V}$<br>0<br>0<br>0 | 1000<br>500<br>400 | ns   |
| <b>MC74HCT</b>    |                                              |                                                                                              |                    |      |
| $V_{CC}$          | DC Supply Voltage                            | 4.5                                                                                          | 5.5                | V    |
| $V_{IN}, V_{OUT}$ | DC Input Voltage, DC Output Voltage (Note 3) | 0                                                                                            | $V_{CC}$           | V    |
| $T_A$             | Operating Free-Air Temperature               | -55                                                                                          | +125               | °C   |
| $t_r, t_f$        | Input Rise or Fall Time                      | 0                                                                                            | 500                | 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.

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



# MC74HC595A, MC74HCT595A

## DC ELECTRICAL CHARACTERISTICS (MC74HC595A)

| Symbol          | Parameter                                                          | Test Conditions                                                                                                                     | V <sub>CC</sub><br>V     | Guaranteed Limit          |                           |                           | Unit |
|-----------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------|---------------------------|---------------------------|------|
|                 |                                                                    |                                                                                                                                     |                          | -55 to<br>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<br>3.0<br>4.5<br>6.0 | 1.5<br>2.1<br>3.15<br>4.2 | 1.5<br>2.1<br>3.15<br>4.2 | 1.5<br>2.1<br>3.15<br>4.2 | V    |
| 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<br>3.0<br>4.5<br>6.0 | 0.5<br>0.9<br>1.35<br>1.8 | 0.5<br>0.9<br>1.35<br>1.8 | 0.5<br>0.9<br>1.35<br>1.8 | V    |
| V <sub>OH</sub> | Minimum High-Level Output Voltage, Q <sub>A</sub> - Q <sub>H</sub> | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                |                          |                           |                           |                           | V    |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 20 μA                                                                                                          | 2.0<br>4.5<br>6.0        | 1.9<br>4.4<br>5.9         | 1.9<br>4.4<br>5.9         | 1.9<br>4.4<br>5.9         |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 2.4 mA                                                                                                         | 3.0                      | 2.48                      | 2.34                      | 2.2                       |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 6.0 mA                                                                                                         | 4.5                      | 3.98                      | 3.84                      | 3.7                       |      |
| V <sub>OL</sub> | Minimum Low-Level Output Voltage, Q <sub>A</sub> - Q <sub>H</sub>  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                |                          |                           |                           |                           | V    |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 20 μA                                                                                                          | 2.0<br>4.5<br>6.0        | 0.1<br>0.1<br>0.1         | 0.1<br>0.1<br>0.1         | 0.1<br>0.1<br>0.1         |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 2.4 mA                                                                                                         | 3.0                      | 0.26                      | 0.33                      | 0.4                       |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 6.0 mA                                                                                                         | 4.5                      | 0.26                      | 0.33                      | 0.4                       |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage, SQ <sub>H</sub>                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                |                          |                           |                           |                           | V    |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 20 μA                                                                                                          | 2.0<br>4.5<br>6.0        | 1.9<br>4.4<br>5.9         | 1.9<br>4.4<br>5.9         | 1.9<br>4.4<br>5.9         |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 2.4 mA                                                                                                         | 3.0                      | 2.48                      | 2.34                      | 2.2                       |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 4.0 mA                                                                                                         | 4.5                      | 3.98                      | 3.84                      | 3.7                       |      |
| V <sub>OL</sub> | Minimum Low-Level Output Voltage, SQ <sub>H</sub>                  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                |                          |                           |                           |                           | V    |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 20 μA                                                                                                          | 2.0<br>4.5<br>6.0        | 0.1<br>0.1<br>0.1         | 0.1<br>0.1<br>0.1         | 0.1<br>0.1<br>0.1         |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 2.4 mA                                                                                                         | 3.0                      | 0.26                      | 0.33                      | 0.4                       |      |
|                 |                                                                    | I <sub>OUT</sub>   ≤ 4.0 mA                                                                                                         | 4.5                      | 0.26                      | 0.33                      | 0.4                       |      |
| 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                                                                                            | 6.0                      | 4.0                       | 40                        | 160                       | μA   |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.



# MC74HC595A, MC74HCT595A

## AC ELECTRICAL CHARACTERISTICS (MC74HC595A)

| Symbol                                 | Parameter                                                                                                | V <sub>CC</sub><br>V                    | Guaranteed Limit |        |         | Unit |
|----------------------------------------|----------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------|--------|---------|------|
|                                        |                                                                                                          |                                         | –55 to 25°C      | ≤ 85°C | ≤ 125°C |      |
| f <sub>max</sub>                       | Maximum Clock Frequency (50% Duty Cycle)<br>(Figures 1 and 7)                                            | 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, Shift Clock to SQ <sub>H</sub><br>(Figures 1 and 7)                           | 2.0                                     | 140              | 175    | 210     | ns   |
|                                        |                                                                                                          | 3.0                                     | 100              | 125    | 150     |      |
|                                        |                                                                                                          | 4.5                                     | 28               | 35     | 42      |      |
|                                        |                                                                                                          | 6.0                                     | 24               | 30     | 36      |      |
| t <sub>PHL</sub>                       | Maximum Propagation Delay, Reset to SQ <sub>H</sub><br>(Figures 2 and 7)                                 | 2.0                                     | 145              | 180    | 220     | ns   |
|                                        |                                                                                                          | 3.0                                     | 100              | 125    | 150     |      |
|                                        |                                                                                                          | 4.5                                     | 29               | 36     | 44      |      |
|                                        |                                                                                                          | 6.0                                     | 25               | 31     | 38      |      |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Latch Clock to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 3 and 7)           | 2.0                                     | 140              | 175    | 210     | ns   |
|                                        |                                                                                                          | 3.0                                     | 100              | 125    | 150     |      |
|                                        |                                                                                                          | 4.5                                     | 28               | 35     | 42      |      |
|                                        |                                                                                                          | 6.0                                     | 24               | 30     | 36      |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 4 and 8)         | 2.0                                     | 150              | 190    | 225     | ns   |
|                                        |                                                                                                          | 3.0                                     | 100              | 125    | 150     |      |
|                                        |                                                                                                          | 4.5                                     | 30               | 38     | 45      |      |
|                                        |                                                                                                          | 6.0                                     | 26               | 33     | 38      |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 4 and 8)         | 2.0                                     | 135              | 170    | 205     | ns   |
|                                        |                                                                                                          | 3.0                                     | 90               | 110    | 130     |      |
|                                        |                                                                                                          | 4.5                                     | 27               | 34     | 41      |      |
|                                        |                                                                                                          | 6.0                                     | 23               | 29     | 35      |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 3 and 7)                     | 2.0                                     | 60               | 75     | 90      | ns   |
|                                        |                                                                                                          | 3.0                                     | 23               | 27     | 31      |      |
|                                        |                                                                                                          | 4.5                                     | 12               | 15     | 18      |      |
|                                        |                                                                                                          | 6.0                                     | 10               | 13     | 15      |      |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, SQ <sub>H</sub><br>(Figures 1 and 7)                                     | 2.0                                     | 75               | 95     | 110     | ns   |
|                                        |                                                                                                          | 3.0                                     | 27               | 32     | 36      |      |
|                                        |                                                                                                          | 4.5                                     | 15               | 19     | 22      |      |
|                                        |                                                                                                          | 6.0                                     | 13               | 16     | 19      |      |
| C <sub>in</sub>                        | Maximum Input Capacitance                                                                                | –                                       | 10               | 10     | 10      | pF   |
| C <sub>out</sub>                       | Maximum Three–State Output Capacitance (Output in High–Impedance State), Q <sub>A</sub> – Q <sub>H</sub> | –                                       | 15               | 15     | 15      | pF   |
| C <sub>PD</sub>                        | Power Dissipation Capacitance (Per Package)*                                                             | Typical @ 25°C, V <sub>CC</sub> = 5.0 V |                  |        |         | pF   |
|                                        |                                                                                                          | 300                                     |                  |        |         |      |



# MC74HC595A, MC74HCT595A

## TIMING REQUIREMENTS (MC74HC595A)

| Symbol                          | Parameter                                                            | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|---------------------------------|----------------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|                                 |                                                                      |                      | 25°C to –55°C    | ≤ 85°C | ≤ 125°C |      |
| t <sub>su</sub>                 | Minimum Setup Time, Serial Data Input A to Shift Clock<br>(Figure 5) | 2.0                  | 50               | 65     | 75      | ns   |
|                                 |                                                                      | 3.0                  | 40               | 50     | 60      |      |
|                                 |                                                                      | 4.5                  | 10               | 13     | 15      |      |
|                                 |                                                                      | 6.0                  | 9.0              | 11     | 13      |      |
| t <sub>su</sub>                 | Minimum Setup Time, Shift Clock to Latch Clock<br>(Figure 6)         | 2.0                  | 75               | 95     | 110     | ns   |
|                                 |                                                                      | 3.0                  | 60               | 70     | 80      |      |
|                                 |                                                                      | 4.5                  | 15               | 19     | 22      |      |
|                                 |                                                                      | 6.0                  | 13               | 16     | 19      |      |
| t <sub>h</sub>                  | Minimum Hold Time, Shift Clock to Serial Data Input A<br>(Figure 5)  | 2.0                  | 5.0              | 5.0    | 5.0     | ns   |
|                                 |                                                                      | 3.0                  | 5.0              | 5.0    | 5.0     |      |
|                                 |                                                                      | 4.5                  | 5.0              | 5.0    | 5.0     |      |
|                                 |                                                                      | 6.0                  | 5.0              | 5.0    | 5.0     |      |
| t <sub>rec</sub>                | Minimum Recovery Time, Reset Inactive to Shift Clock<br>(Figure 2)   | 2.0                  | 50               | 65     | 75      | ns   |
|                                 |                                                                      | 3.0                  | 40               | 50     | 60      |      |
|                                 |                                                                      | 4.5                  | 10               | 13     | 15      |      |
|                                 |                                                                      | 6.0                  | 9.0              | 11     | 13      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Reset<br>(Figure 2)                             | 2.0                  | 60               | 75     | 90      | ns   |
|                                 |                                                                      | 3.0                  | 45               | 60     | 70      |      |
|                                 |                                                                      | 4.5                  | 12               | 15     | 18      |      |
|                                 |                                                                      | 6.0                  | 10               | 13     | 15      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Shift Clock<br>(Figure 1)                       | 2.0                  | 50               | 65     | 75      | ns   |
|                                 |                                                                      | 3.0                  | 40               | 50     | 60      |      |
|                                 |                                                                      | 4.5                  | 10               | 13     | 15      |      |
|                                 |                                                                      | 6.0                  | 9.0              | 11     | 13      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Latch Clock<br>(Figure 6)                       | 2.0                  | 50               | 65     | 75      | ns   |
|                                 |                                                                      | 3.0                  | 40               | 50     | 60      |      |
|                                 |                                                                      | 4.5                  | 10               | 13     | 15      |      |
|                                 |                                                                      | 6.0                  | 9.0              | 11     | 13      |      |
| t <sub>r</sub> , t <sub>f</sub> | Maximum Input Rise and Fall Times<br>(Figure 1)                      | 2.0                  | 1000             | 1000   | 1000    | ns   |
|                                 |                                                                      | 3.0                  | 800              | 800    | 800     |      |
|                                 |                                                                      | 4.5                  | 500              | 500    | 500     |      |
|                                 |                                                                      | 6.0                  | 400              | 400    | 400     |      |



# MC74HC595A, MC74HCT595A

## DC ELECTRICAL CHARACTERISTICS (MC74HCT595A)

| Symbol           | Parameter                                                            | Test Conditions                                                                                                                     | V <sub>CC</sub><br>V | Guaranteed Limit |             |         | Unit |
|------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------|-------------|---------|------|
|                  |                                                                      |                                                                                                                                     |                      | – 55 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                                                  | 4.5 to 5.5           | 2.0              | 2.0         | 2.0     | V    |
| 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                                                  | 4.5 to 5.5           | 0.8              | 0.8         | 0.8     | V    |
| V <sub>OH</sub>  | Minimum High–Level Output Voltage, Q <sub>A</sub> – Q <sub>H</sub>   | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5                  | 4.4              | 4.4         | 4.4     | V    |
|                  |                                                                      | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 6.0 mA                                                   | 4.5                  | 3.98             | 3.84        | 3.7     |      |
| V <sub>OL</sub>  | Maximum Low–Level Output Voltage, Q <sub>A</sub> – Q <sub>H</sub>    | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5                  | 0.1              | 0.1         | 0.1     | V    |
|                  |                                                                      | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 6.0 mA                                                   | 4.5                  | 0.26             | 0.33        | 0.4     |      |
| V <sub>OH</sub>  | Minimum High–Level Output Voltage, SQ <sub>H</sub>                   | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5                  | 4.4              | 4.4         | 4.4     | V    |
|                  |                                                                      | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 4.0 mA                                                   | 4.5                  | 3.98             | 3.84        | 3.7     |      |
| V <sub>OL</sub>  | Maximum Low–Level Output Voltage, SQ <sub>H</sub>                    | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub><br> I <sub>out</sub>   ≤ 20 μA                                                 | 4.5                  | 0.1              | 0.1         | 0.1     | V    |
|                  |                                                                      | V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>  I <sub>out</sub>   ≤ 4.0 mA                                                   | 4.5                  | 0.26             | 0.33        | 0.4     |      |
| I <sub>in</sub>  | Maximum Input Leakage Current                                        | V <sub>in</sub> = V <sub>CC</sub> or GND                                                                                            | 5.5                  | ± 0.1            | ± 1.0       | ± 1.0   | μA   |
| I <sub>OZ</sub>  | Maximum Three–State Leakage Current, Q <sub>A</sub> – Q <sub>H</sub> | 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 | 5.5                  | ± 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                                                                 | 5.5                  | 4.0              | 40          | 160     | μA   |
| ΔI <sub>CC</sub> | Additional Quiescent Supply Current                                  | V <sub>in</sub> = 2.4V, Any One Input<br>V <sub>in</sub> = V <sub>CC</sub> or GND, Other Inputs<br>I <sub>out</sub> = 0μA           | 5.5                  | ≥ –55°C          | 25 to 125°C |         | mA   |
|                  |                                                                      |                                                                                                                                     |                      | 2.9              | 2.4         |         |      |



# MC74HC595A, MC74HCT595A

## AC ELECTRICAL CHARACTERISTICS (MC74HCT595A)

| Symbol                                 | Parameter                                                                                                | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|----------------------------------------|----------------------------------------------------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|                                        |                                                                                                          |                      | – 55 to 25°C     | ≤ 85°C | ≤ 125°C |      |
| f <sub>max</sub>                       | Maximum Clock Frequency (50% Duty Cycle)<br>(Figures 1 and 7)                                            | 4.5 to 5.5           | 30               | 24     | 20      | MHz  |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Shift Clock to SQ <sub>H</sub><br>(Figures 1 and 7)                           | 4.5 to 5.5           | 28               | 35     | 42      | ns   |
| t <sub>PHL</sub>                       | Maximum Propagation Delay, Reset to SQ <sub>H</sub><br>(Figures 2 and 7)                                 | 4.5 to 5.5           | 29               | 36     | 44      | ns   |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Maximum Propagation Delay, Latch Clock to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 3 and 7)           | 4.5 to 5.5           | 28               | 35     | 42      | ns   |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Maximum Propagation Delay, Output Enable to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 4 and 8)         | 4.5 to 5.5           | 30               | 38     | 45      | ns   |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Maximum Propagation Delay, Output Enable to Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 4 and 8)         | 4.5 to 5.5           | 27               | 34     | 41      | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, Q <sub>A</sub> – Q <sub>H</sub><br>(Figures 3 and 7)                     | 4.5 to 5.5           | 12               | 15     | 18      | ns   |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Maximum Output Transition Time, SQ <sub>H</sub><br>(Figures 1 and 7)                                     | 4.5 to 5.5           | 15               | 19     | 22      | ns   |
| C <sub>in</sub>                        | Maximum Input Capacitance                                                                                | —                    | 10               | 10     | 10      | pF   |
| C <sub>out</sub>                       | Maximum Three-State Output Capacitance (Output in High-Impedance State), Q <sub>A</sub> – Q <sub>H</sub> | —                    | 15               | 15     | 15      | pF   |

| C <sub>PD</sub> | Power Dissipation Capacitance (Per Package)* | Typical @ 25°C, V <sub>CC</sub> = 5.0 V | pF |
|-----------------|----------------------------------------------|-----------------------------------------|----|
|                 |                                              | 300                                     |    |

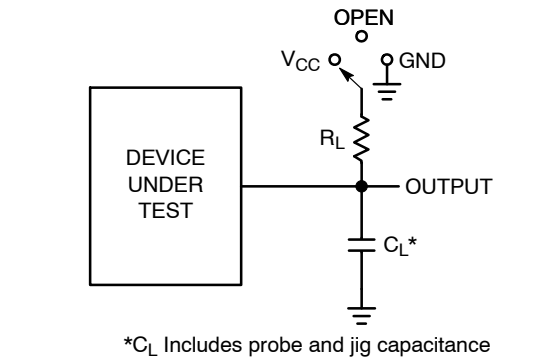
\* Used to determine the no-load dynamic power consumption:  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ .

## TIMING REQUIREMENTS (MC74HCT595A)

| Symbol                          | Parameter                                                            | V <sub>CC</sub><br>V | Guaranteed Limit |        |         | Unit |
|---------------------------------|----------------------------------------------------------------------|----------------------|------------------|--------|---------|------|
|                                 |                                                                      |                      | 25°C to –55°C    | ≤ 85°C | ≤ 125°C |      |
| t <sub>su</sub>                 | Minimum Setup Time, Serial Data Input A to Shift Clock<br>(Figure 5) | 4.5 to 5.5           | 10               | 13     | 15      | ns   |
| t <sub>su</sub>                 | Minimum Setup Time, Shift Clock to Latch Clock<br>(Figure 6)         | 4.5 to 5.5           | 15               | 19     | 22      | ns   |
| t <sub>h</sub>                  | Minimum Hold Time, Shift Clock to Serial Data Input A<br>(Figure 5)  | 4.5 to 5.5           | 5.0              | 5.0    | 5.0     | ns   |
| t <sub>rec</sub>                | Minimum Recovery Time, Reset Inactive to Shift Clock<br>(Figure 2)   | 4.5 to 5.5           | 10               | 13     | 15      | ns   |
| t <sub>w</sub>                  | Minimum Pulse Width, Reset<br>(Figure 2)                             | 4.5 to 5.5           | 12               | 15     | 18      | ns   |
| t <sub>w</sub>                  | Minimum Pulse Width, Shift Clock<br>(Figure 1)                       | 4.5 to 5.5           | 10               | 13     | 15      | ns   |
| t <sub>w</sub>                  | Minimum Pulse Width, Latch Clock<br>(Figure 6)                       | 4.5 to 5.5           | 10               | 13     | 15      | ns   |
| t <sub>r</sub> , t <sub>f</sub> | Maximum Input Rise and Fall Times<br>(Figure 1)                      | 4.5 to 5.5           | 500              | 500    | 500     | ns   |

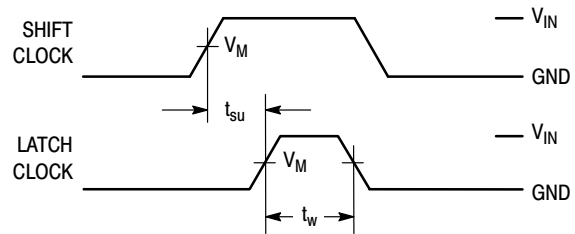
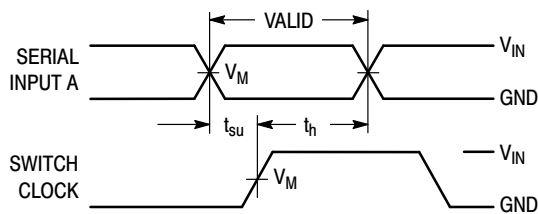
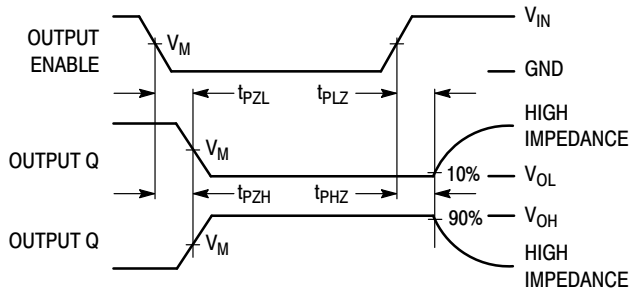
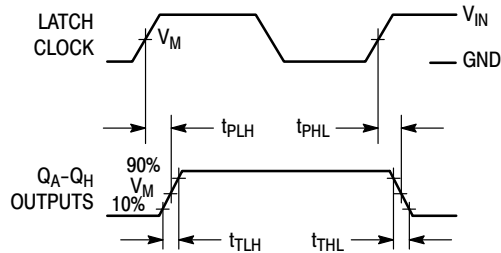
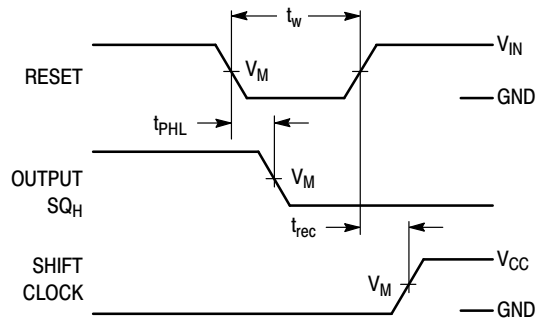
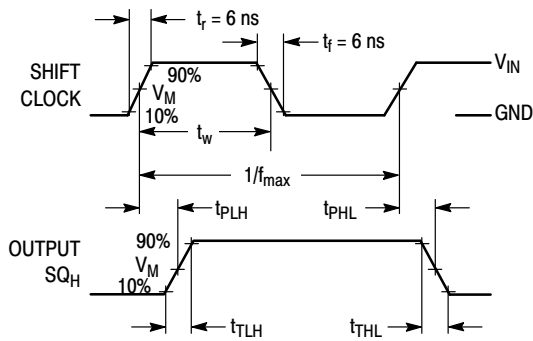


# MC74HC595A, MC74HCT595A



| Test                                | Switch Position | C <sub>L</sub> | R <sub>L</sub> |
|-------------------------------------|-----------------|----------------|----------------|
| t <sub>PLH</sub> / t <sub>PHL</sub> | Open            | 50 pF          | 1 kΩ           |
| t <sub>PLZ</sub> / t <sub>PZL</sub> | V <sub>CC</sub> |                |                |
| t <sub>PHZ</sub> / t <sub>PZH</sub> | GND             |                |                |

Figure 1. Test Circuit



| Device      | V <sub>IN</sub> , V | V <sub>m</sub> , V    |
|-------------|---------------------|-----------------------|
| MC74HC595A  | V <sub>CC</sub>     | 50% x V <sub>CC</sub> |
| MC74HCT595A | 3 V                 | 1.3 V                 |

Figure 2. Switching Waveforms

# MC74HC595A, MC74HCT595A

FUNCTION TABLE

| Operation                                          | Inputs |                |             |             |               | Resulting Function                                           |                                   |                                   |                                                  |
|----------------------------------------------------|--------|----------------|-------------|-------------|---------------|--------------------------------------------------------------|-----------------------------------|-----------------------------------|--------------------------------------------------|
|                                                    | Reset  | Serial Input A | Shift Clock | Latch Clock | Output Enable | Shift Register Contents                                      | Latch Register Contents           | Serial Output SQ <sub>H</sub>     | Parallel Outputs Q <sub>A</sub> – Q <sub>H</sub> |
| Reset shift register                               | L      | X              | X           | L, H, ↓     | L             | L                                                            | U                                 | L                                 | U                                                |
| Shift data into shift register                     | H      | D              | ↑           | L, H, ↓     | L             | D → SR <sub>A</sub> ;<br>SR <sub>N</sub> → SR <sub>N+1</sub> | U                                 | SR <sub>G</sub> → SR <sub>H</sub> | U                                                |
| Shift register remains unchanged                   | H      | X              | L, H, ↓     | L, H, ↓     | L             | U                                                            | U                                 | U                                 | U                                                |
| Transfer shift register contents to latch register | H      | X              | L, H, ↓     | ↑           | L             | U                                                            | SR <sub>N</sub> → LR <sub>N</sub> | U                                 | SR <sub>N</sub>                                  |
| Latch register remains unchanged                   | X      | X              | X           | L, H, ↓     | L             | *                                                            | U                                 | *                                 | U                                                |
| Enable parallel outputs                            | X      | X              | X           | X           | L             | *                                                            | **                                | *                                 | Enabled                                          |
| Force outputs into high impedance state            | X      | X              | X           | X           | H             | *                                                            | **                                | *                                 | Z                                                |

SR = shift register contents  
LR = latch register contents

D = data (L, H) logic level  
U = remains unchanged

↑ = Low-to-High  
↓ = High-to-Low

\* = depends on Reset and Shift Clock inputs  
\*\* = depends on Latch Clock input

## PIN DESCRIPTIONS

### INPUTS

#### A (Pin 14)

Serial Data Input. The data on this pin is shifted into the 8-bit serial shift register.

### CONTROL INPUTS

#### Shift Clock (Pin 11)

Shift Register Clock Input. A low-to-high transition on this input causes the data at the Serial Input pin to be shifted into the 8-bit shift register.

#### Reset (Pin 10)

Active-low, Asynchronous, Shift Register Reset Input. A low on this pin resets the shift register portion of this device only. The 8-bit latch is not affected.

#### Latch Clock (Pin 12)

Storage Latch Clock Input. A low-to-high transition on this input latches the shift register data.

#### Output Enable (Pin 13)

Active-low Output Enable. A low on this input allows the data from the latches to be presented at the outputs. A high on this input forces the outputs (Q<sub>A</sub>–Q<sub>H</sub>) into the high-impedance state. The serial output is not affected by this control unit.

### OUTPUTS

#### Q<sub>A</sub> – Q<sub>H</sub> (Pins 15, 1, 2, 3, 4, 5, 6, 7)

Noninverted, 3-state, latch outputs.

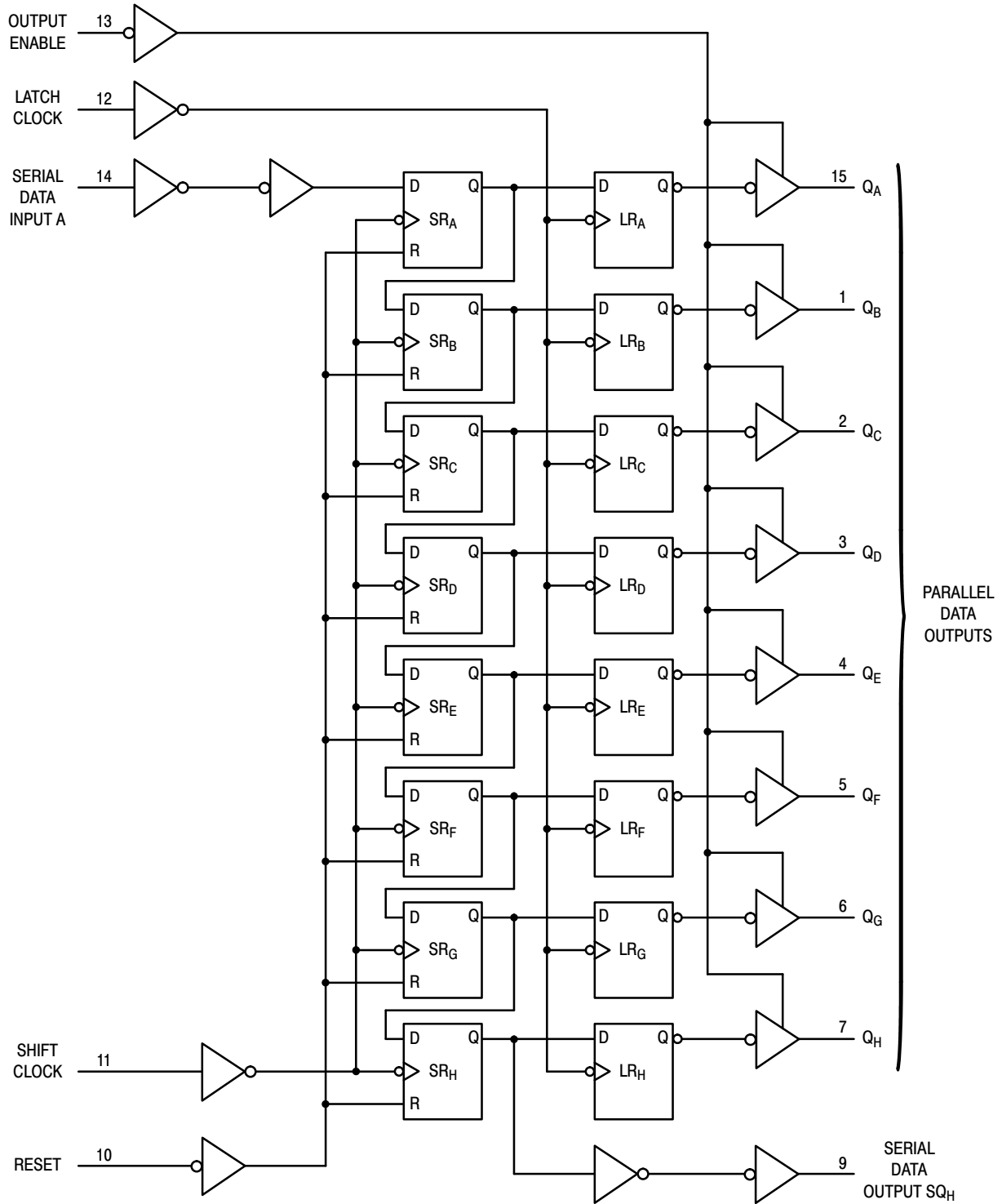
#### SQ<sub>H</sub> (Pin 9)

Noninverted, Serial Data Output. This is the output of the eighth stage of the 8-bit shift register. This output does not have three-state capability.



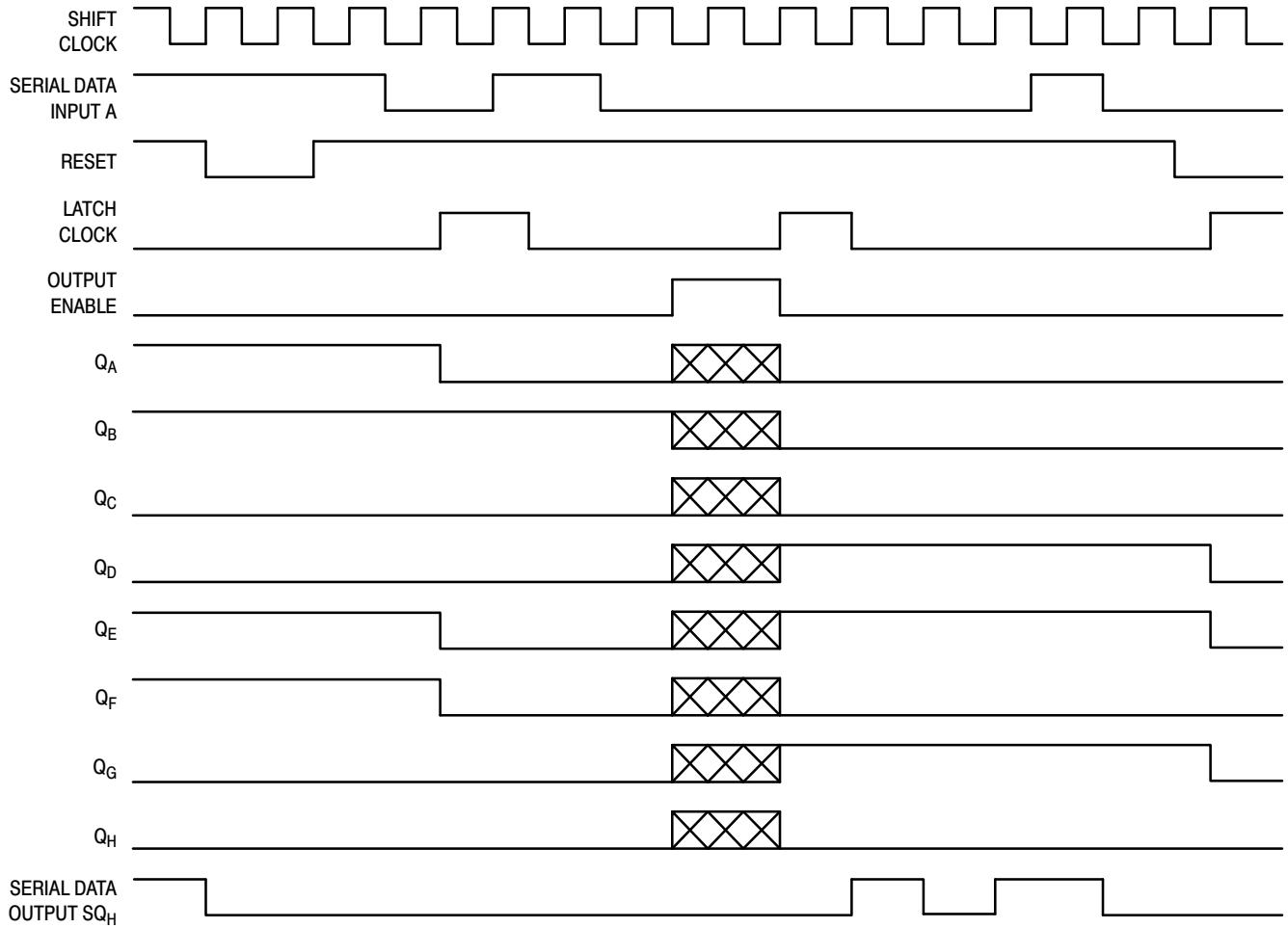
# MC74HC595A, MC74HCT595A

## EXPANDED LOGIC DIAGRAM



# MC74HC595A, MC74HCT595A

## TIMING DIAGRAM



NOTE: **XXXX** implies that the output is in a high-impedance state.



## MC74HC595A, MC74HCT595A

### ORDERING INFORMATION

| Device              | Package  | Marking     | Shipping <sup>†</sup>                          |
|---------------------|----------|-------------|------------------------------------------------|
| MC74HC595ADG        | SOIC-16  | HC595A      | 48 Units / Rail                                |
| MC74HC595ADR2G      | SOIC-16  | HC595A      | 2500 / Tape & Reel                             |
| MC74HC595ADR2G-Q*   | SOIC-16  | HC595A      | 2500 / Tape & Reel                             |
| MC74HC595ADTG       | TSSOP-16 | HC<br>595A  | 96 Units / Rail                                |
| MC74HC595ADTR2G     | TSSOP-16 | HC<br>595A  | 2500 / Tape & Reel                             |
| MC74HC595ADTR2G-Q*  | TSSOP-16 | HC<br>595A  | 2500 / Tape & Reel                             |
| MC74HC595AMN1TWG-Q* | QFN16    | V595A       | 3000 / Tape & Reel<br>(8mm pitch carrier tape) |
| MC74HCT595ADG       | SOIC-16  | HCT595A     | 48 Units / Rail                                |
| MC74HCT595ADR2G     | SOIC-16  | HCT595A     | 2500 / Tape & Reel                             |
| MC74HCT595ADTG      | TSSOP-16 | HCT<br>595A | 96 Units / Rail                                |
| MC74HCT595ADTR2G    | TSSOP-16 | HCT<br>595A | 2500 / Tape & Reel                             |

<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.

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

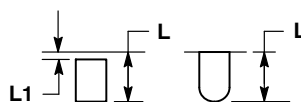
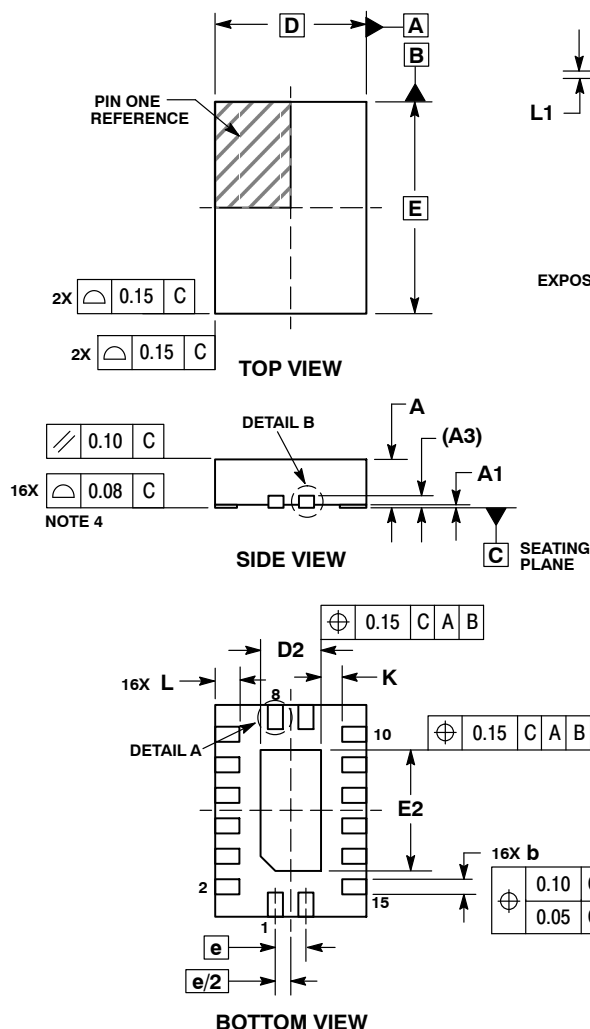
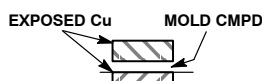




SCALE 2:1

**QFN16, 2.5x3.5, 0.5P**  
CASE 485AW  
ISSUE O

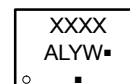
DATE 11 DEC 2008


**DETAIL A**  
ALTERNATE TERMINAL  
CONSTRUCTIONS

**DETAIL B**  
ALTERNATE  
CONSTRUCTIONS

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSIONS b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

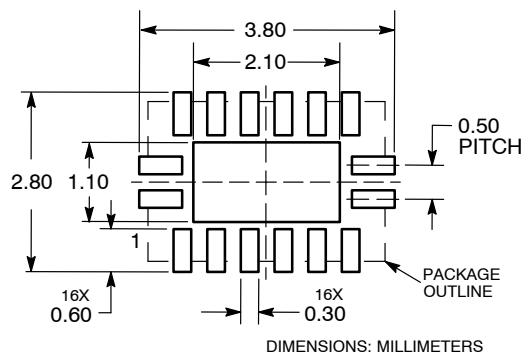
| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.80        | 1.00 |
| A1  | 0.00        | 0.05 |
| A3  | 0.20 REF    |      |
| b   | 0.20        | 0.30 |
| D   | 2.50 BSC    |      |
| D2  | 0.85        | 1.15 |
| E   | 3.50 BSC    |      |
| E2  | 1.85        | 2.15 |
| e   | 0.50 BSC    |      |
| K   | 0.20        | ---  |
| L   | 0.35        | 0.45 |
| L1  | ---         | 0.15 |

**GENERIC MARKING  
DIAGRAM\***


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

(Note: Microdot may be in either location)

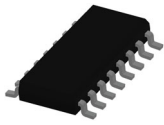
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

**RECOMMENDED  
SOLDERING FOOTPRINT\***


\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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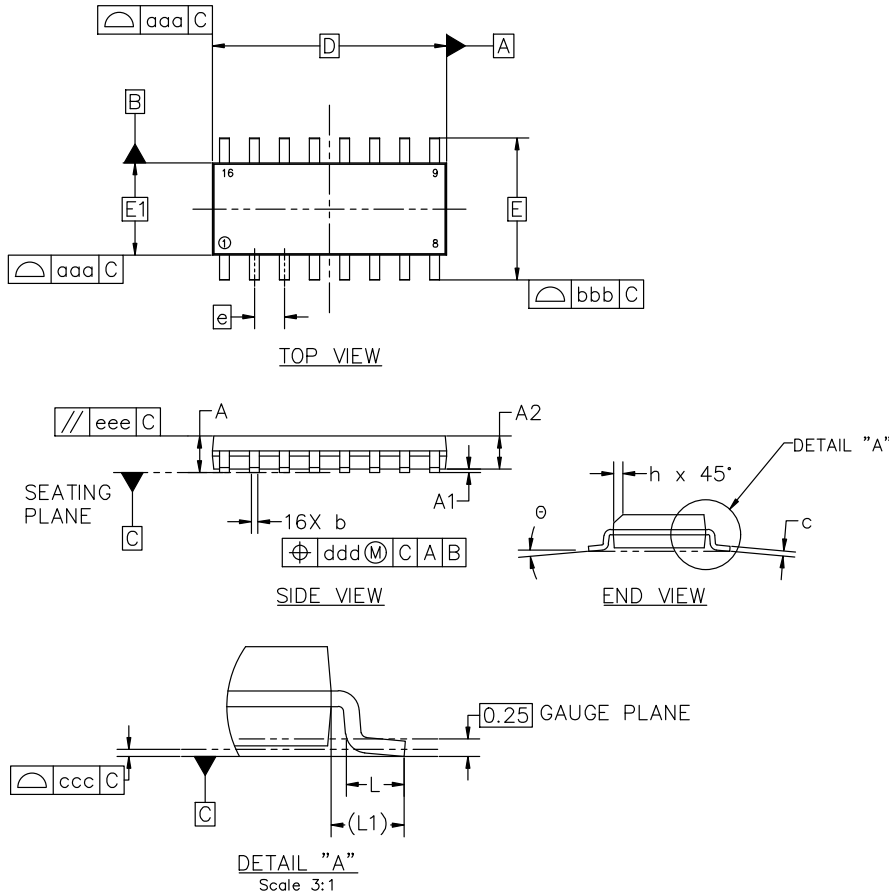
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**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

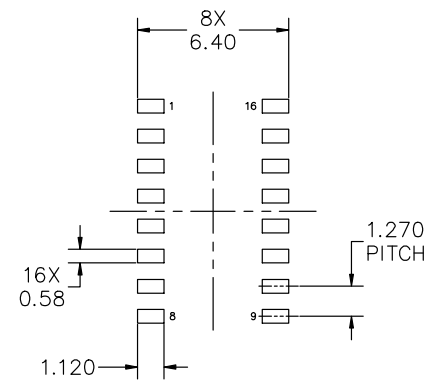
DATE 18 OCT 2024

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.



| MILLIMETERS                    |          |      |      |
|--------------------------------|----------|------|------|
| DIM                            | MIN      | NOM  | MAX  |
| A                              | 1.35     | 1.55 | 1.75 |
| A1                             | 0.10     | 0.18 | 0.25 |
| A2                             | 1.25     | 1.37 | 1.50 |
| b                              | 0.35     | 0.42 | 0.49 |
| c                              | 0.19     | 0.22 | 0.25 |
| D                              | 9.90 BSC |      |      |
| E                              | 6.00 BSC |      |      |
| E1                             | 3.90 BSC |      |      |
| e                              | 1.27 BSC |      |      |
| h                              | 0.25     | ---  | 0.50 |
| L                              | 0.40     | 0.83 | 1.25 |
| L1                             | 1.05 REF |      |      |
| θ                              | 0°       | ---  | 7°   |
| TOLERANCE OF FORM AND POSITION |          |      |      |
| aaa                            | 0.10     |      |      |
| bbb                            | 0.20     |      |      |
| ccc                            | 0.10     |      |      |
| ddd                            | 0.25     |      |      |
| eee                            | 0.10     |      |      |



\*FOR ADDITIONAL INFORMATION ON OUR  
PB-FREE STRATEGY AND SOLDERING DETAILS,  
PLEASE DOWNLOAD THE onsemi SOLDERING  
AND MOUNTING TECHNIQUES REFERENCE  
MANUAL, SOLDERM/D

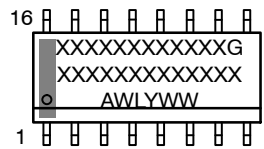
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SOIC-16 9.90x3.90x1.37 1.27P  
CASE 751B  
ISSUE M

DATE 18 OCT 2024

GENERIC  
MARKING DIAGRAM\*

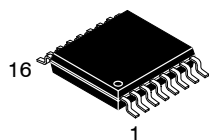


XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

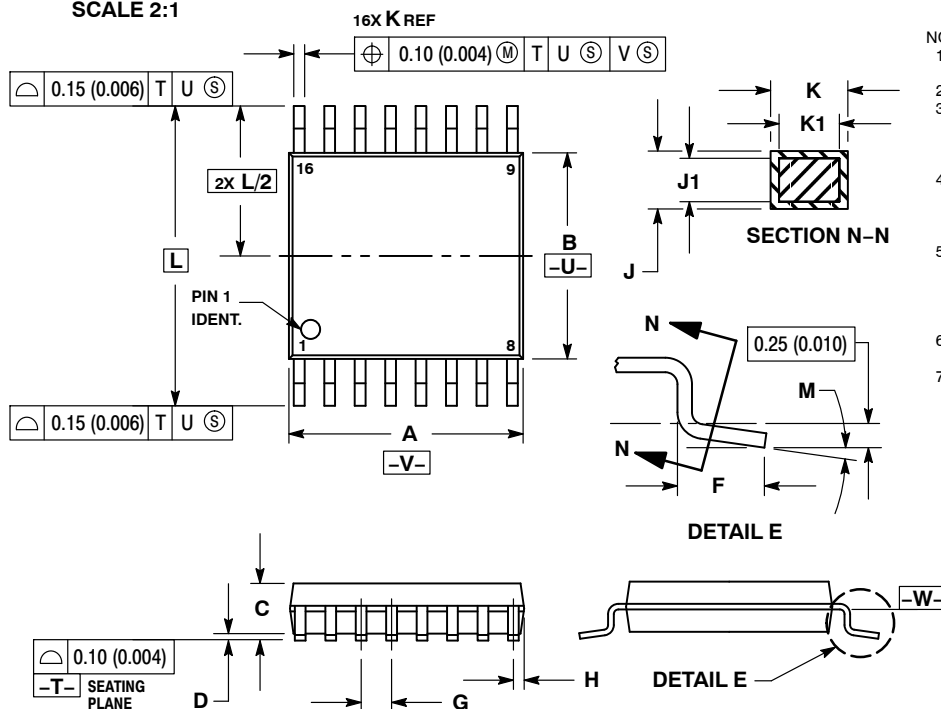
\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

|                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| STYLE 1:<br>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                           | STYLE 2:<br>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 | STYLE 3:<br>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                                                                                         | STYLE 4:<br>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 |
| STYLE 5:<br>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 | STYLE 6:<br>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                                 | STYLE 7:<br>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 |                                                                                                                                                                                                                                                                                                                             |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                              |                                                                                                                                                                                     |
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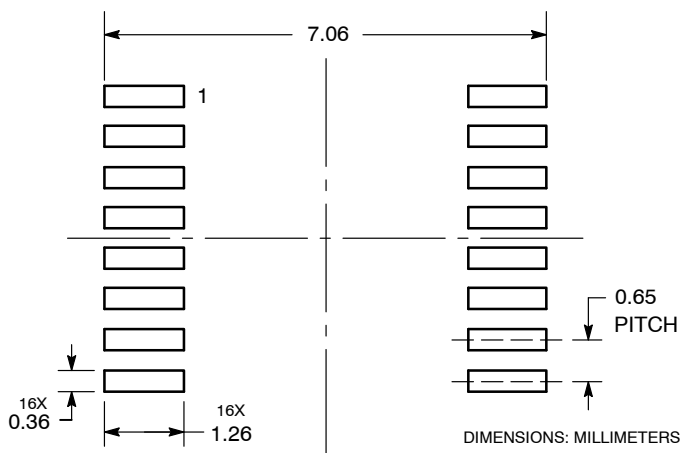
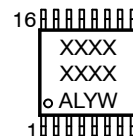

**TSSOP-16 WB**  
**CASE 948F**  
**ISSUE B**

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°    |

**RECOMMENDED  
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. Some products may not follow the Generic Marking.

\*For additional information on our Pb-Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

|                         |                    |                                                                                                                                                                                  |
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