

# 8-Bit Shift Register with Output Latches

## 74VHC595

### General Description

The VHC595 is an advanced high-speed CMOS Shift Register fabricated with silicon gate CMOS technology. It achieves the high-speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

This device contains an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. The storage register has eight 3-STATE outputs. Separate clocks are provided for both the shift register and the storage register. The shift register has a direct-overriding clear, serial input, and serial output (standard) pins for cascading. Both the shift register and storage register use positive-edge triggered clocks. If both clocks are connected together, the shift register state will always be one clock pulse ahead of the storage register.

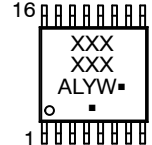
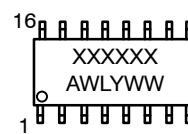
An input protection circuit insures that 0 V to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery backup. This circuit prevents device destruction due to mismatched supply and input voltages.

### Features

- High Speed:  $t_{PD} = 5.4 \text{ ns}$  (Typ.) at  $V_{CC} = 5 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 4 \mu\text{A}$  (Max.) at  $T_A = 25^\circ\text{C}$
- High Noise Immunity:  $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Power Down Protection is Provided on All Inputs
- Low Noise:  $V_{OLP} = 0.9 \text{ V}$  (Typ.)
- Pin and function compatible with 74HC595
- This is a Pb-Free Device



### MARKING DIAGRAMS



XXX = Specific Device Code  
A = Assembly Location  
WL, L = Wafer Lot  
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 9 of this data sheet.

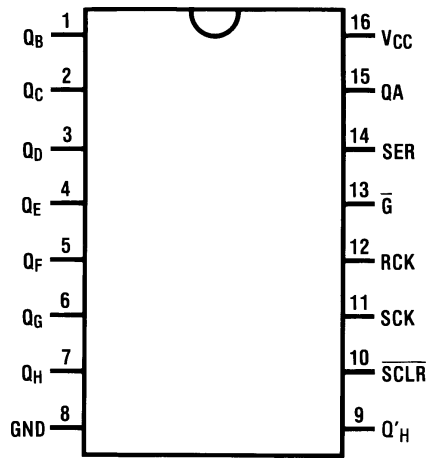


Figure 1. Connection Diagram

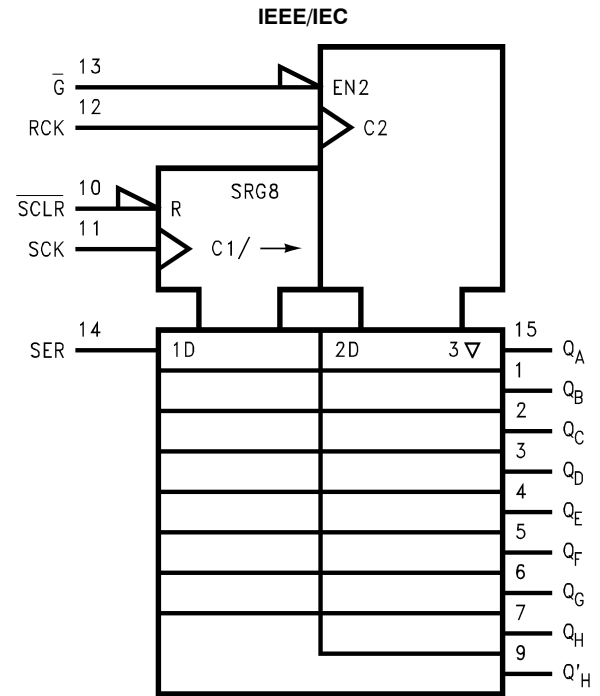


Figure 2. Logic Symbol

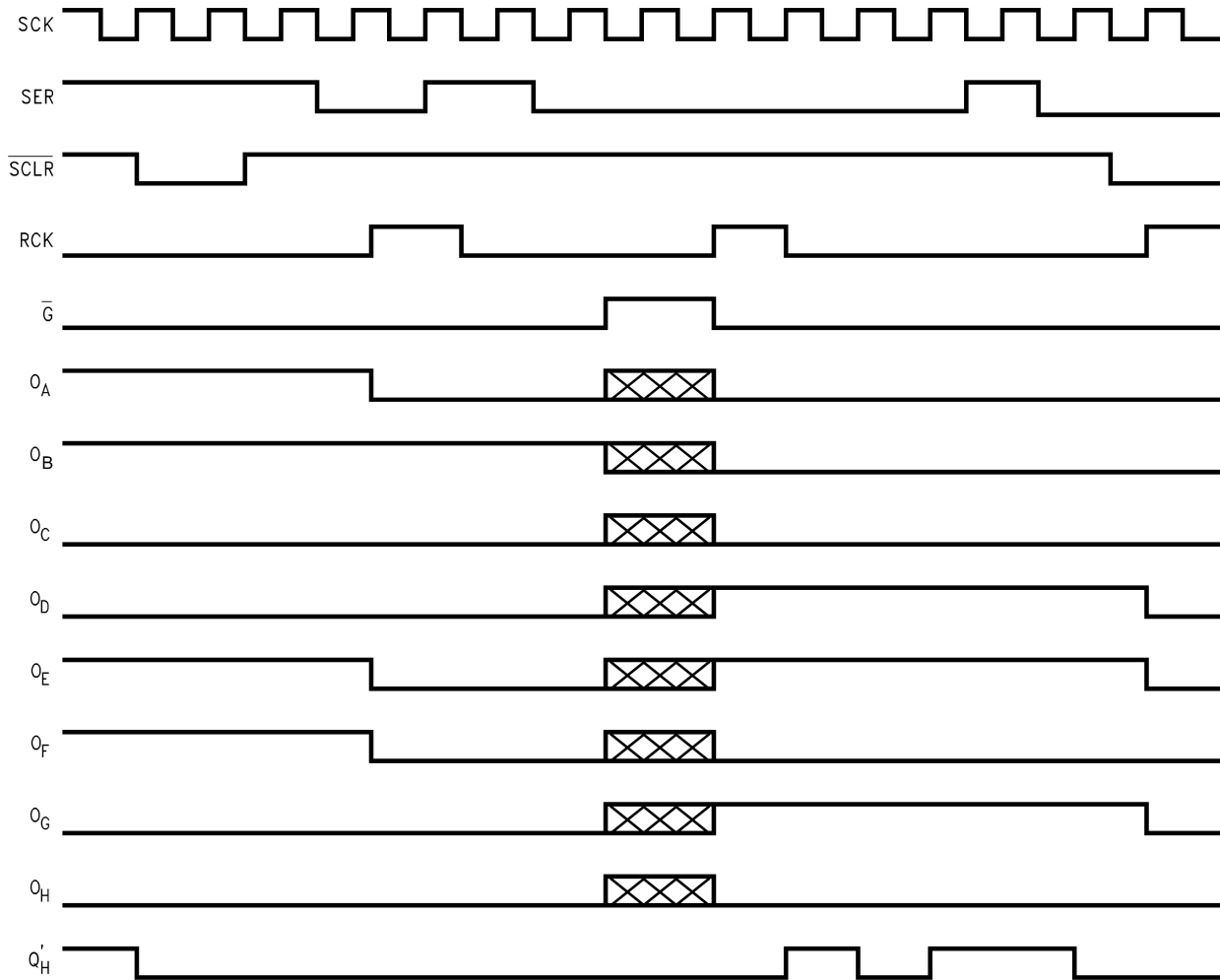
#### PIN DESCRIPTIONS

| Pin Names   | Description                                       |
|-------------|---------------------------------------------------|
| SER         | Serial Data Input                                 |
| SCK         | Shift Register Clock Input (Active rising edge)   |
| RCK         | Storage Register Clock Input (Active rising edge) |
| SCLR        | Reset Input                                       |
| $\bar{G}$   | 3-STATE Output Enable Input (Active LOW)          |
| $Q_A - Q_H$ | Parallel Data Outputs                             |
| $Q'_H$      | Serial Data Output                                |

#### TRUTH TABLE

| Inputs |            |            |      |           | Function                                                  |
|--------|------------|------------|------|-----------|-----------------------------------------------------------|
| SER    | RCK        | SCK        | SCLR | $\bar{G}$ |                                                           |
| X      | X          | X          | X    | H         | $Q_A$ thru $Q_H$ 3-STATE                                  |
| X      | X          | X          | X    | L         | $Q_A$ thru $Q_H$ outputs enabled                          |
| X      | X          | X          | L    | L         | Shift Register cleared: $Q'_H = 0$                        |
| L      | X          | $\uparrow$ | H    | L         | Shift Register clocked: $Q_N = Q_{N-1}$ , $Q_0 = SER = L$ |
| H      | X          | $\uparrow$ | H    | L         | Shift Register clocked: $Q_N = Q_{N-1}$ , $Q_0 = SER = H$ |
| X      | $\uparrow$ | X          | H    | L         | Contents of Shift Register transferred to output latches  |

## Timing Diagram



NOTE:  Implies that the output is in 3-STATE mode.

**Figure 3. Timing Diagram**

Logic Diagram (Positive Logic)

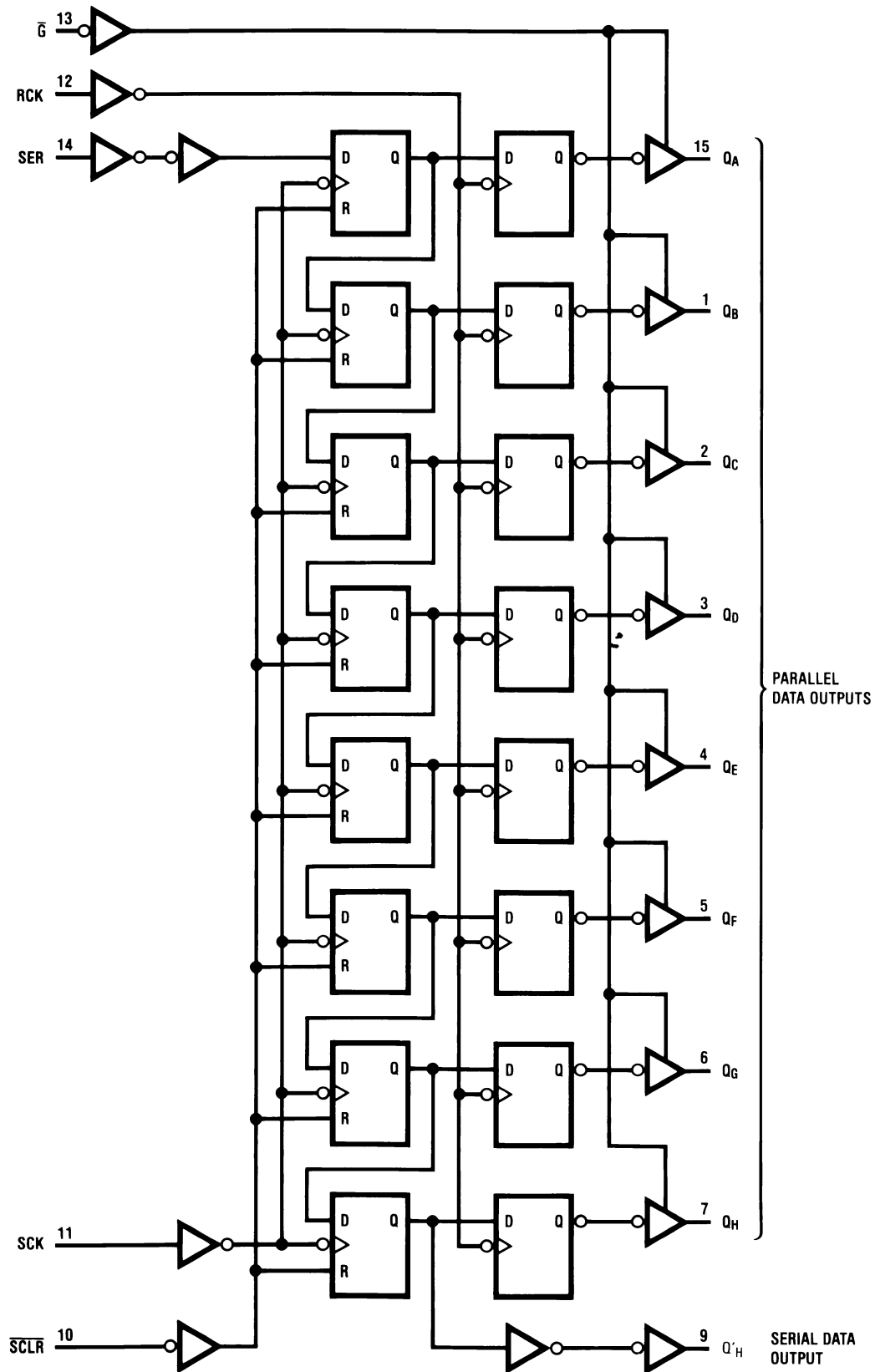


Figure 4. Logic Diagram

## MAXIMUM RATINGS

| Symbol           | Parameter                                       |                        | Value                        | Unit |
|------------------|-------------------------------------------------|------------------------|------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage                               |                        | –0.5 to +6.5                 | V    |
| V <sub>IN</sub>  | DC Input Voltage                                |                        | –0.5 to +6.5                 | V    |
| V <sub>OUT</sub> | DC Output Voltage                               |                        | –0.5 to V <sub>CC</sub> +0.5 | V    |
| I <sub>IN</sub>  | DC Input Current, per Pin                       |                        | ±20                          | mA   |
| I <sub>OUT</sub> | DC Output Current, Per Pin                      |                        | ±25                          | mA   |
| I <sub>CC</sub>  | DC Supply Current, V <sub>CC</sub> and GND Pins |                        | ±75                          | mA   |
| I <sub>IK</sub>  | Input Clamp Current                             |                        | –20                          | mA   |
| I <sub>OK</sub>  | Output Clamp Current                            |                        | ±20                          | mA   |
| T <sub>STG</sub> | Storage Temperature Range                       |                        | –65 to +150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 secs    |                        | 260                          | °C   |
| T <sub>J</sub>   | Junction Temperature Under Bias                 |                        | +150                         | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Note 2)                     | SOIC–16                | 126                          | °C/W |
|                  |                                                 | TSSOP–16               | 159                          |      |
| P <sub>D</sub>   | Power Dissipation in Still Air at 25°C          | SOIC–16                | 995                          | mW   |
|                  |                                                 | TSSOP–16               | 787                          |      |
| MSL              | Moisture Sensitivity                            |                        | Level 1                      | –    |
| F <sub>R</sub>   | Flammability Rating                             | Oxygen Index: 28 to 34 | UL 94 V–0 @ 0.139 in         | –    |
| V <sub>ESD</sub> | ESD Withstand Voltage (Note 3)                  | Human Body Model       | 2000                         | V    |
|                  |                                                 | Charged Device Model   | N/A                          |      |

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. Applicable to devices with outputs that may be tri–stated.
2. Measured with minimum pad spacing on an FR4 board, using 76 mm–by–114 mm, 2–ounce copper trace no air flow per JESD51–7.
3. 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 |
|---------------------------------|----------------------------|----------------------------------|-----|-----------------|------|
| V <sub>CC</sub>                 | DC Supply Voltage          |                                  | 2.0 | 5.5             | V    |
| V <sub>IN</sub>                 | DC Input Voltage (Note 4)  |                                  | 0   | 5.5             | V    |
| V <sub>OUT</sub>                | DC Output Voltage (Note 4) |                                  | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature      |                                  | –40 | +85             | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Rate    | V <sub>CC</sub> = 3.0 V to 3.6 V | 0   | 100             | ns/V |
|                                 |                            | V <sub>CC</sub> = 4.5 V to 5.5 V | 0   | 20              |      |

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.

4. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V<sub>CC</sub>). Unused outputs must be left open.



## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                        | V <sub>CC</sub> (V) | Conditions                                                                                                                                               |                          | T <sub>A</sub> = 25°C |     |                       | T <sub>A</sub> = -40°C to +85°C |                       | Unit |
|-----------------|----------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-----------------------|-----|-----------------------|---------------------------------|-----------------------|------|
|                 |                                  |                     |                                                                                                                                                          |                          | Min                   | Typ | Max                   | Min                             | Max                   |      |
| V <sub>IH</sub> | HIGH Level Input Voltage         | 2.0                 |                                                                                                                                                          |                          | 1.5                   |     |                       | 1.5                             |                       | V    |
|                 |                                  | 3.0 – 5.5           |                                                                                                                                                          |                          | 0.7 × V <sub>CC</sub> |     |                       | 0.7 × V <sub>CC</sub>           |                       |      |
| V <sub>IL</sub> | LOW Level Input Voltage          | 2.0                 |                                                                                                                                                          |                          |                       |     | 0.50                  |                                 | 0.50                  | V    |
|                 |                                  | 3.0 – 5.5           |                                                                                                                                                          |                          |                       |     | 0.3 × V <sub>CC</sub> |                                 | 0.3 × V <sub>CC</sub> |      |
| V <sub>OH</sub> | HIGH Level Output Voltage        | 2.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                                     | I <sub>OH</sub> = -50 μA | 1.9                   | 2.0 |                       | 1.9                             |                       | V    |
|                 |                                  | 3.0                 |                                                                                                                                                          |                          | 2.9                   | 3.0 |                       | 2.9                             |                       |      |
|                 |                                  | 4.5                 |                                                                                                                                                          |                          | 4.4                   | 4.5 |                       | 4.4                             |                       |      |
|                 |                                  | 3.0                 | I <sub>OH</sub> = -4 mA                                                                                                                                  |                          | 2.58                  |     |                       | 2.48                            |                       |      |
|                 |                                  | 4.5                 | I <sub>OH</sub> = -8 mA                                                                                                                                  |                          | 3.94                  |     |                       | 3.80                            |                       |      |
|                 |                                  |                     |                                                                                                                                                          |                          |                       |     |                       |                                 |                       |      |
| V <sub>OL</sub> | LOW Level Output Voltage         | 2.0                 | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                                                                                     | I <sub>OL</sub> = 50 μA  |                       | 0.0 | 0.1                   |                                 | 0.1                   | V    |
|                 |                                  | 3.0                 |                                                                                                                                                          |                          |                       | 0.0 | 0.1                   |                                 | 0.1                   |      |
|                 |                                  | 4.5                 |                                                                                                                                                          |                          |                       | 0.0 | 0.1                   |                                 | 0.1                   |      |
|                 |                                  | 3.0                 | I <sub>OL</sub> = 4 mA                                                                                                                                   |                          |                       |     | 0.36                  |                                 | 0.44                  |      |
|                 |                                  | 4.5                 | I <sub>OL</sub> = 8 mA                                                                                                                                   |                          |                       |     | 0.36                  |                                 | 0.44                  |      |
|                 |                                  |                     |                                                                                                                                                          |                          |                       |     |                       |                                 |                       |      |
| I <sub>OZ</sub> | 3-STATE Output Off-State Current | 5.5                 | V <sub>IN</sub> = V <sub>CC</sub> or GND, V <sub>OUT</sub> = V <sub>CC</sub> or GND, V <sub>IN</sub> $\overline{G}$ = V <sub>IH</sub> or V <sub>IL</sub> |                          |                       |     | ±0.25                 |                                 | ±2.5                  | μA   |
| I <sub>IN</sub> | Input Leakage Current            | 0 – 5.5             | V <sub>IN</sub> = 5.5 V or GND                                                                                                                           |                          |                       |     | ±0.1                  |                                 | ±1.0                  | μA   |
| I <sub>CC</sub> | Quiescent Supply Current         | 5.5                 | V <sub>IN</sub> = V <sub>CC</sub> or GND                                                                                                                 |                          |                       |     | 4.0                   |                                 | 40.0                  | 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.

## NOISE CHARACTERISTICS

| Symbol                       | Parameter                                    | V <sub>CC</sub> (V) | Conditions             | T <sub>A</sub> = 25°C |        | Unit |
|------------------------------|----------------------------------------------|---------------------|------------------------|-----------------------|--------|------|
|                              |                                              |                     |                        | Typ                   | Limits |      |
| V <sub>OLP</sub><br>(Note 5) | Quiet Output Maximum Dynamic V <sub>OL</sub> | 5.0                 | C <sub>L</sub> = 50 pF | 0.9                   | 1.2    | V    |
| V <sub>OLV</sub><br>(Note 5) | Quiet Output Minimum Dynamic V <sub>OL</sub> | 5.0                 | C <sub>L</sub> = 50 pF | -0.9                  | -1.2   | V    |
| V <sub>IHD</sub><br>(Note 5) | Minimum HIGH Level Dynamic Input Voltage     | 5.0                 | C <sub>L</sub> = 50 pF |                       | 3.5    | V    |
| V <sub>ILD</sub><br>(Note 5) | Maximum LOW Level Dynamic Input Voltage      | 5.0                 | C <sub>L</sub> = 50 pF |                       | 1.5    | V    |

5. Parameter guaranteed by design.



## AC ELECTRICAL CHARACTERISTICS

| Symbol                                | Parameter                                                       | V <sub>CC</sub> (V) | Conditions              |                        | T <sub>A</sub> = +25°C |      |      | T <sub>A</sub> = −40°C to +85°C |      | Unit |
|---------------------------------------|-----------------------------------------------------------------|---------------------|-------------------------|------------------------|------------------------|------|------|---------------------------------|------|------|
|                                       |                                                                 |                     |                         |                        | Min                    | Typ  | Max  | Min                             | Max  |      |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time, RCK to Q <sub>A</sub> –Q <sub>H</sub>   | 3.3 ± 0.3           |                         | C <sub>L</sub> = 15 pF |                        | 7.7  | 11.9 | 1.0                             | 13.5 | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 10.2 | 15.4 | 1.0                             | 17.0 |      |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 15 pF |                        | 5.4  | 7.4  | 1.0                             | 8.5  | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 6.9  | 9.4  | 1.0                             | 10.5 |      |
| t <sub>PLH</sub> , t <sub>PHL</sub>   | Propagation Delay Time, SCK–Q'H                                 | 3.3 ± 0.3           |                         | C <sub>L</sub> = 15 pF |                        | 8.8  | 13.0 | 1.0                             | 15.0 | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 11.3 | 16.5 | 1.0                             | 18.5 |      |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 15 pF |                        | 6.2  | 8.2  | 1.0                             | 9.4  | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 7.7  | 10.2 | 1.0                             | 11.4 |      |
| t <sub>PHL</sub>                      | Propagation Delay Time, SCLR–Q'H                                | 3.3 ± 0.3           |                         | C <sub>L</sub> = 15 pF |                        | 8.4  | 12.8 | 1.0                             | 13.7 | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 10.9 | 16.3 | 1.0                             | 17.2 |      |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 15 pF |                        | 5.9  | 8.0  | 1.0                             | 9.1  | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 7.4  | 10.0 | 1.0                             | 11.1 |      |
| t <sub>PZL</sub> , t <sub>PZH</sub>   | Output Enable Time, $\bar{G}$ to Q <sub>A</sub> –Q <sub>H</sub> | 3.3 ± 0.3           | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 15 pF |                        | 7.5  | 11.5 | 1.0                             | 13.5 | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 9.0  | 15.0 | 1.0                             | 17.0 |      |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 15 pF |                        | 4.8  | 8.6  | 1.0                             | 10.0 | ns   |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF |                        | 8.3  | 10.6 | 1.0                             | 12.0 |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub>   | Output Enable Time, $\bar{G}$ to Q <sub>A</sub> –Q <sub>H</sub> | 3.3 ± 0.3           | R <sub>L</sub> = 1 kΩ   | C <sub>L</sub> = 50 pF |                        | 12.1 | 15.7 | 1.0                             | 16.2 | ns   |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 50 pF |                        | 7.6  | 10.3 | 1.0                             | 11.0 |      |
| f <sub>MAX</sub>                      | Maximum Clock Frequency                                         | 3.3 ± 0.3           |                         | C <sub>L</sub> = 15 pF | 80                     | 150  |      | 70                              |      | MHz  |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF | 55                     | 130  |      | 50                              |      |      |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 15 pF | 135                    | 185  |      | 115                             |      | MHz  |
|                                       |                                                                 |                     |                         | C <sub>L</sub> = 50 pF | 95                     | 155  |      | 85                              |      |      |
| t <sub>OSLH</sub> , t <sub>OSHL</sub> | Output to Output Skew                                           | 3.3 ± 0.3           | (Note 6)                | C <sub>L</sub> = 50 pF |                        |      | 1.5  |                                 | 1.5  | ns   |
|                                       |                                                                 | 5.0 ± 0.5           |                         | C <sub>L</sub> = 50 pF |                        |      | 1.0  |                                 | 1.0  |      |
| C <sub>IN</sub>                       | Input Capacitance                                               |                     | V <sub>CC</sub> = Open  |                        |                        | 5.0  | 10   |                                 | 10   | pF   |
| C <sub>OUT</sub>                      | Output Capacitance                                              |                     | V <sub>CC</sub> = 5.0 V |                        |                        | 6.0  |      |                                 |      | pF   |
| C <sub>PD</sub>                       | Power Dissipation Capacitance                                   |                     | (Note 7)                |                        |                        | 87   |      |                                 |      | pF   |

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.

6. Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLH</sub> max - t<sub>PLH</sub> min|; t<sub>OSHL</sub> = |t<sub>PHL</sub> max - t<sub>PHL</sub> min|.

7. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

$$I_{CC} (\text{Opr.}) = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$$



## AC OPERATING REQUIREMENTS

| Symbol                                | Parameter                       | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |                    | T <sub>A</sub> = -40°C<br>to +85°C | Unit |
|---------------------------------------|---------------------------------|---------------------|-----------------------|--------------------|------------------------------------|------|
|                                       |                                 |                     | Typ                   | Guaranteed Minimum |                                    |      |
| t <sub>S</sub>                        | Minimum Setup Time (SER–SCK)    | 3.3 ± 0.3           |                       | 3.5                | 3.5                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 3.0                | 3.0                                |      |
| t <sub>S</sub>                        | Minimum Setup Time (SCK–RCK)    | 3.3 ± 0.3           |                       | 8.0                | 8.5                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 5.0                | 5.0                                |      |
| t <sub>S</sub>                        | Minimum Setup Time (SCLR–RCK)   | 3.3 ± 0.3           |                       | 8.0                | 9.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 5.0                | 5.0                                |      |
| t <sub>H</sub>                        | Minimum Hold Time (SER–SCK)     | 3.3 ± 0.3           |                       | 1.5                | 1.5                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 2.0                | 2.0                                |      |
| t <sub>H</sub>                        | Minimum Hold Time (SCK–RCK)     | 3.3 ± 0.3           |                       | 0.0                | 0.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 0.0                | 0.0                                |      |
| t <sub>H</sub>                        | Minimum Hold Time (SCLR–RCK)    | 3.3 ± 0.3           |                       | 0.0                | 0.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 0.0                | 0.0                                |      |
| t <sub>W(L)</sub>                     | Minimum Pulse Width (SCLR)      | 3.3 ± 0.3           |                       | 5.0                | 5.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 5.0                | 5.0                                |      |
| t <sub>W(L)</sub> , t <sub>W(H)</sub> | Minimum Pulse Width (SCK)       | 3.3 ± 0.3           |                       | 5.0                | 5.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 5.0                | 5.0                                |      |
| t <sub>W(L)</sub> , t <sub>W(H)</sub> | Minimum Pulse Width (RCK)       | 3.3 ± 0.3           |                       | 5.0                | 5.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 5.0                | 5.0                                |      |
| t <sub>rem</sub>                      | Minimum Removal Time (SCLR–SCK) | 3.3 ± 0.3           |                       | 3.0                | 3.0                                | ns   |
|                                       |                                 | 5.0 ± 0.5           |                       | 2.5                | 2.5                                |      |



## 74VHC595

### ORDERING INFORMATION

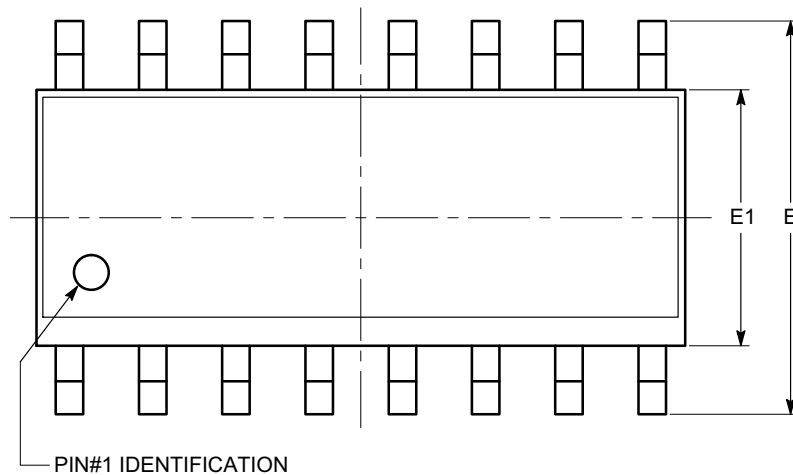
| Device       | Marking    | Package  | Shipping†                |
|--------------|------------|----------|--------------------------|
| 74VHC595MX   | VHC595G    | SOIC-16  | 2500 Units / Tape & Reel |
| 74VHC595MTCX | VHC<br>595 | TSSOP-16 | 2500 Units / Tape & Reel |

†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](#).



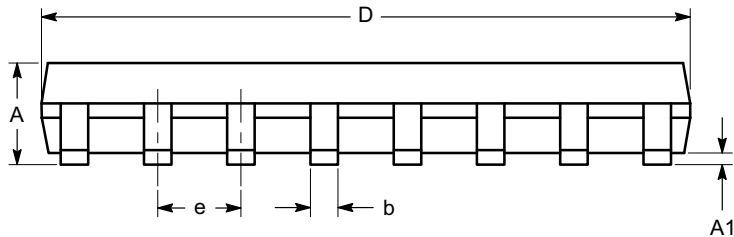
**SOIC-16, 150 mils**  
CASE 751BG  
ISSUE O

DATE 19 DEC 2008

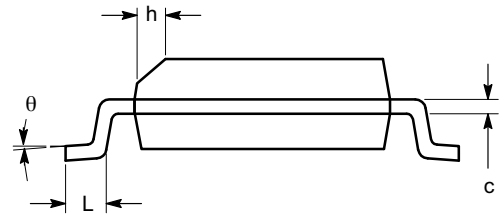


| SYMBOL | MIN      | NOM  | MAX   |
|--------|----------|------|-------|
| A      | 1.35     |      | 1.75  |
| A1     | 0.10     |      | 0.25  |
| b      | 0.33     |      | 0.51  |
| c      | 0.19     |      | 0.25  |
| D      | 9.80     | 9.90 | 10.00 |
| E      | 5.80     | 6.00 | 6.20  |
| E1     | 3.80     | 3.90 | 4.00  |
| e      | 1.27 BSC |      |       |
| h      | 0.25     |      | 0.50  |
| L      | 0.40     |      | 1.27  |
| θ      | 0°       |      | 8°    |

**TOP VIEW**



**SIDE VIEW**



**END VIEW**

**Notes:**

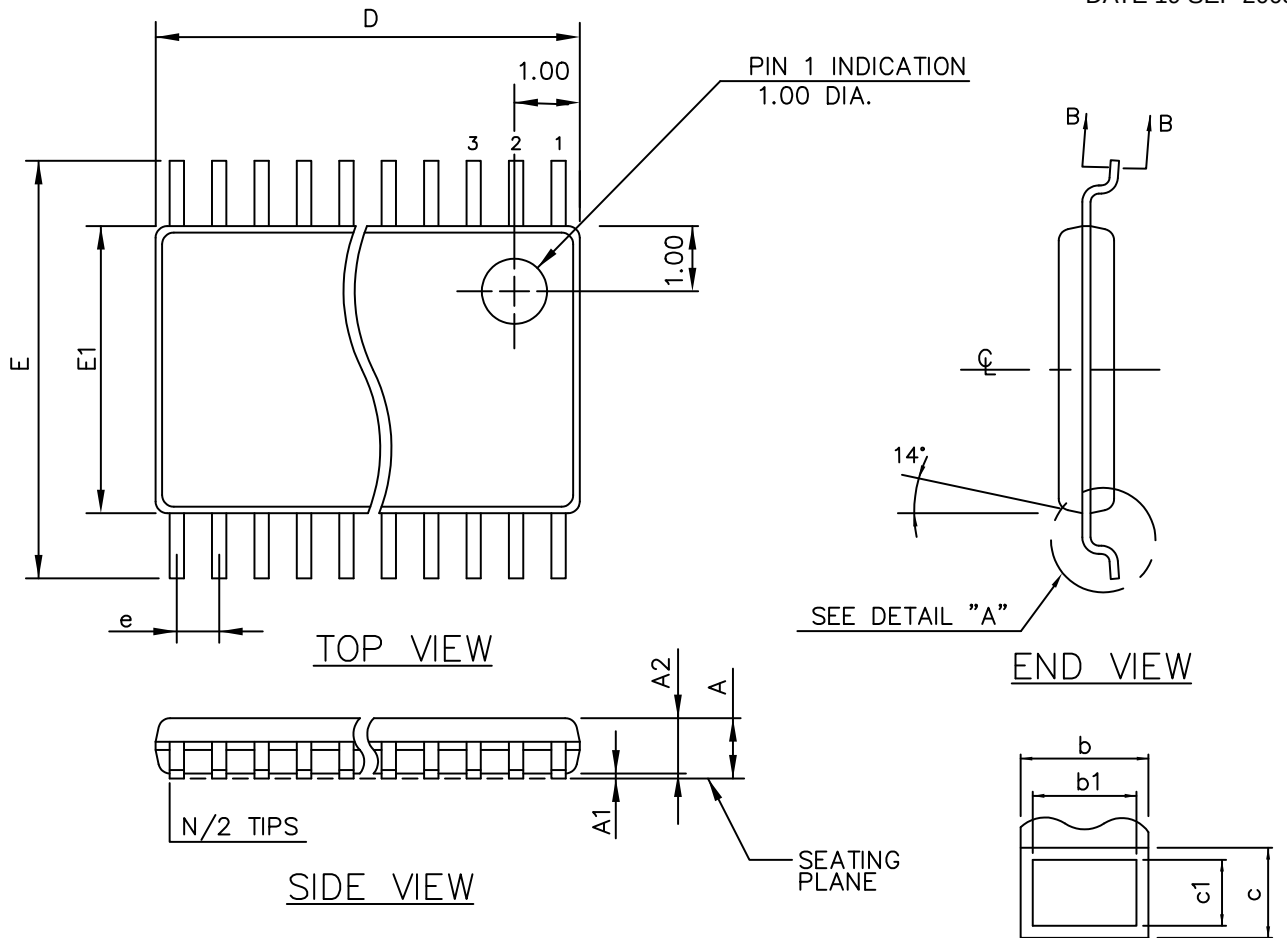
- (1) All dimensions are in millimeters. Angles in degrees.
- (2) Complies with JEDEC MS-012.

|                         |                          |                                                                                                                                                                                     |
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| <b>DESCRIPTION:</b>     | <b>SOIC-16, 150 mils</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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**TSSOP 16**  
**CASE 948AH**  
**ISSUE O**

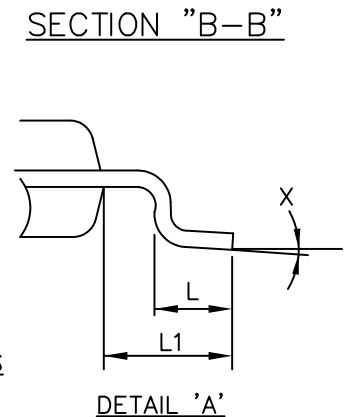
DATE 19 SEP 2008



THIS TABLE FOR 0.65mm PITCH

| SYMBOL         | COMMON DIMENSIONS |       |      | NOTE VARIATIONS | D        | N  |
|----------------|-------------------|-------|------|-----------------|----------|----|
|                | MIN.              | NOM.  | MAX. |                 |          |    |
| A              | —                 | —     | 1.10 | AA/AAT          | 3.00 BSC | 8  |
| A <sub>1</sub> | 0.05              | —     | 0.15 | AB-1/ABT        | 5.00 BSC | 14 |
| A <sub>2</sub> | 0.85              | 0.90  | 0.95 | AB/ABT          | 5.00 BSC | 16 |
| b              | 0.19              | —     | 0.30 | AD/ADT          | 7.80 BSC | 24 |
| b <sub>1</sub> | 0.19              | 0.22  | 0.25 |                 |          |    |
| c              | 0.09              | —     | 0.20 |                 |          |    |
| c <sub>1</sub> | 0.09              | 0.127 | 0.16 |                 |          |    |
| D              | SEE VARIATIONS    |       |      |                 |          |    |
| E <sub>1</sub> | 4.30              | 4.40  | 4.50 |                 |          |    |
| e              | 0.65 BSC          |       |      |                 |          |    |
| E              | 6.40 BSC          |       |      |                 |          |    |
| L              | 0.50              | 0.60  | 0.70 |                 |          |    |
| L <sub>1</sub> | 1.00 REF          |       |      |                 |          |    |
| N              | SEE VARIATIONS    |       |      |                 |          |    |
| X              | 0°                | —     | 8°   |                 |          |    |

ALL DIMENSIONS IN MILLIMETERS



MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15mm ON D PER SIDE

|                         |                    |                                                                                                                                                                                     |
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