

**KK74HC4094A**

**8-Bit Serial-Input Shift Register  
With Latched 3-State Outputs  
High-Performance Silicon-Gate CMOS**

The KK74HC4094A is identical in pinout to the LS/ALS4094. The device inputs are compatible with standard CMOS outputs; with pullup resistors, they are compatible with LS/ALSTTL outputs.

This device consists of an 8-bit shift register and 8-bit D-type latch with three-state parallel outputs. Data is shifted serially through the shift register on the positive going transition of the clock input signal. The output of the last stage SQ<sub>H</sub> can be used to cascade several devices.

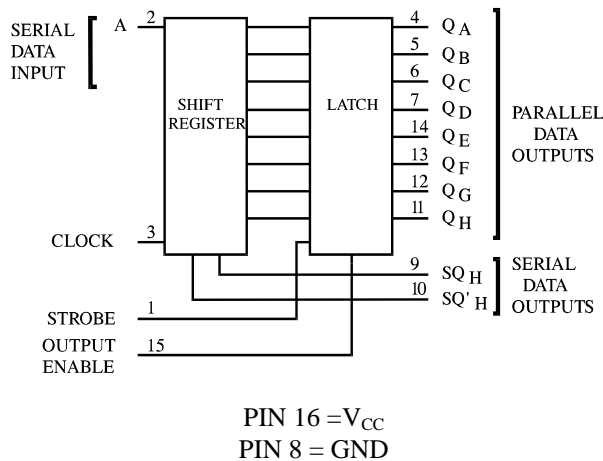
Data on the SQ<sub>H</sub> output is transferred to a second output (SQ<sub>H</sub>') on the following negative transition of the clock input signal. The data of each stage of the shift register is provided with a latch, which latches data on the negative going transition of the Strobe input signal. When the Strobe input is held high, data propagates through the latch to a 3-state output buffer.

This buffer is enabled when Output Enable input is taken high.

- Outputs Directly Interface to CMOS, NMOS, and TTL
- Operating Voltage Range: 2.0 to 6.0 V
- Low Input Current: 1.0 μA
- High Noise Immunity Characteristic of CMOS Devices

**ORDERING INFORMATION**  
 KK74HC4094AN Plastic  
 KK74HC4094AD SOIC  
 T<sub>A</sub> = -55° to 125° C for all packages

**LOGIC DIAGRAM**



**PIN ASSIGNMENT**

|                |     |    |                   |
|----------------|-----|----|-------------------|
| STROBE         | 1 ● | 16 | V <sub>CC</sub>   |
| A              | 2   | 15 | OUTPUT ENABLE     |
| CLOCK          | 3   | 14 | Q <sub>E</sub>    |
| Q <sub>A</sub> | 4   | 13 | Q <sub>F</sub>    |
| Q <sub>B</sub> | 5   | 12 | Q <sub>G</sub>    |
| Q <sub>C</sub> | 6   | 11 | Q <sub>H</sub>    |
| Q <sub>D</sub> | 7   | 10 | SQ <sub>H</sub>   |
| GND            | 8   | 9  | SQ <sub>H</sub> ' |

**FUNCTION TABLE**

| Inputs |               |        |   | Parallel Outputs |                  | Serial Outputs  |                   |
|--------|---------------|--------|---|------------------|------------------|-----------------|-------------------|
| Clock  | Output Enable | Strobe | A | Q <sub>A</sub>   | Q <sub>N</sub>   | SQ <sub>H</sub> | SQ <sub>H</sub> ' |
|        | L             | X      | X | Z                | Z                | Q <sub>6</sub>  | NC                |
|        | L             | X      | X | Z                | Z                | NC              | SQ <sub>H</sub>   |
|        | H             | L      | X | NC               | NC               | Q <sub>6</sub>  | NC                |
|        | H             | H      | L | L                | Q <sub>N-1</sub> | Q <sub>6</sub>  | NC                |
|        | H             | H      | H | H                | Q <sub>N-1</sub> | Q <sub>6</sub>  | NC                |
|        | H             | X      | X | NC               | NC               | NC              | SQ <sub>H</sub>   |

NC = No Change  
 Z = high impedance  
 X = don't care

**MAXIMUM RATINGS\***

| Symbol           | Parameter  | Value                        | Unit |
|------------------|--|------------------------------|------|
| V <sub>CC</sub>  | DC Supply Voltage (Referenced to GND)  | -0.5 to +7.0                 | V    |
| V <sub>IN</sub>  | DC Input Voltage (Referenced to GND)   | -1.5 to V <sub>CC</sub> +1.5 | V    |
| V <sub>OUT</sub> | DC Output Voltage (Referenced to GND)  | -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                                  | ±50                          | mA   |
| P <sub>D</sub>   | Power Dissipation in Still Air, Plastic DIP+<br>SOIC Package+                    | 750<br>500                   | mW   |
| T <sub>stg</sub> | Storage Temperature  | -65 to +150                  | °C   |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds<br>(Plastic DIP or SOIC Package) | 260                          | °C   |

\*Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

+Derating - Plastic DIP: - 10 mW/°C from 65° to 125°C  
SOIC Package: : - 7 mW/°C from 65° to 125°C

**RECOMMENDED OPERATING CONDITIONS**

| Symbol                             | Parameter  | Min | Max             | Unit |
|------------------------------------|--|-----|-----------------|------|
| V <sub>CC</sub>                    | DC Supply Voltage (Referenced to GND)                | 2.0 | 6.0             | V    |
| V <sub>IN</sub> , V <sub>OUT</sub> | DC Input Voltage, Output Voltage (Referenced to GND) | 0   | V <sub>CC</sub> | V    |
| T <sub>A</sub>                     | Operating Temperature, All Package Types             | -55 | +125            | °C   |
| t <sub>r</sub> , t <sub>f</sub>    | Input Rise and Fall Time (Figure 1)                  |     |                 |      |
|                                    | V <sub>CC</sub> =2.0 V                               | 0   | 1000            | ns   |
|                                    | V <sub>CC</sub> =4.5 V                               | 0   | 500             |      |
|                                    | V <sub>CC</sub> =6.0 V                               | 0   | 400             |      |

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>IN</sub> and V<sub>OUT</sub> should be constrained to the range GND ≤ (V<sub>IN</sub> or V<sub>OUT</sub>) ≤ V<sub>CC</sub>.

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** (Voltages Referenced to GND)

| Symbol          | Parameter                                      | Test Conditions  | V <sub>CC</sub><br>V | Guaranteed Limit     |           |            | Unit |
|-----------------|--|--|----------------------|----------------------|-----------|------------|------|
|                 |  |  |                      | 25 °C<br>to<br>-55°C | ≤85<br>°C | ≤125<br>°C |      |
| V <sub>IH</sub> | Minimum High-Level Input Voltage               | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> -0.1 V<br>  I <sub>OUT</sub>   ≤ 20 μA   | 2.0                  | 1.5                  | 1.5       | 1.5        | V    |
|                 |  |  | 4.5                  | 3.15                 | 3.15      | 3.15       |      |
|                 |  |  | 6.0                  | 4.2                  | 4.2       | 4.2        |      |
| V <sub>IL</sub> | Maximum Low - Level Input Voltage              | V <sub>OUT</sub> =0.1 V or V <sub>CC</sub> -0.1 V<br>  I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 0.5                  | 0.5       | 0.5        | V    |
|                 |  |  | 4.5                  | 1.35                 | 1.35      | 1.35       |      |
|                 |  |  | 6.0                  | 1.8                  | 1.8       | 1.8        |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage              | V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub><br>  I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 1.9                  | 1.9       | 1.9        | V    |
|                 |  |  | 4.5                  | 4.4                  | 4.4       | 4.4        |      |
|                 |  | 6.0  | 5.9                  | 5.9                  | 5.9       |            |      |
|                 |  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>  I <sub>OUT</sub>   ≤ 4.0 mA<br>  I <sub>OUT</sub>   ≤ 5.2 mA             | 4.5                  | 3.98                 | 3.84      | 3.7        |      |
| 6.0             | 5.48   | 5.34   | 5.2                  |                      |           |            |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage               | V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub><br>  I <sub>OUT</sub>   ≤ 20 μA  | 2.0                  | 0.1                  | 0.1       | 0.1        | V    |
|                 |  |  | 4.5                  | 0.1                  | 0.1       | 0.1        |      |
|                 |  | 6.0  | 0.1                  | 0.1                  | 0.1       |            |      |
|                 |  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>  I <sub>OUT</sub>   ≤ 4.0 mA<br>  I <sub>OUT</sub>   ≤ 5.2 mA             | 4.5                  | 0.26                 | 0.33      | 0.4        |      |
| 6.0             | 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<br>I <sub>OUT</sub> =0μA   | 6.0                  | 4.0                  | 40        | 160        | μA   |

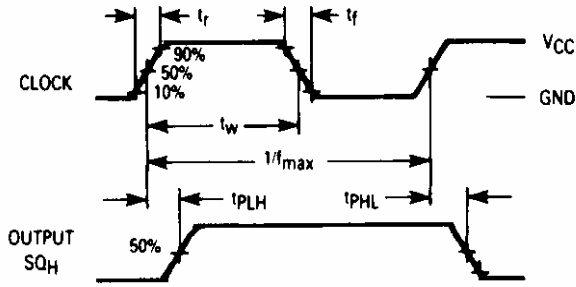
**AC ELECTRICAL CHARACTERISTICS** ( $C_L=50\text{pF}$ , Input  $t_r=t_f=6.0\text{ ns}$ )

| Symbol                              | Parameter  | V <sub>CC</sub><br>V | Guaranteed Limit     |       |        | Unit |
|-------------------------------------|--|----------------------|----------------------|-------|--------|------|
|                                     |  |                      | 25 °C<br>to<br>-55°C | ≤85°C | ≤125°C |      |
| f <sub>max</sub>                    | Maximum Clock Frequency (50% Duty Cycle)<br>(Figures 1 and 5)  | 2.0                  | 6                    | 5     | 4      | MHz  |
|                                     |  | 4.5                  | 30                   | 25    | 20     |      |
|                                     |  | 6.0                  | 35                   | 28    | 23     |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Maximum Propagation Delay, Clock to SQ <sub>H</sub><br>(Figures 1 and 5)                                   | 2.0                  | 150                  | 190   | 225    | ns   |
|                                     |  | 4.5                  | 30                   | 38    | 45     |      |
|                                     |  | 6.0                  | 26                   | 33    | 38     |      |
| t <sub>PLH</sub> , t <sub>PHL</sub> | Maximum Propagation Delay, Clock to Q <sub>A</sub> -Q <sub>H</sub><br>(Figures 2 and 5)                    | 2.0                  | 195                  | 245   | 295    | ns   |
|                                     |  | 4.5                  | 40                   | 50    | 60     |      |
|                                     |  | 6.0                  | 33                   | 42    | 50     |      |
| t <sub>PLZ</sub> , t <sub>PHZ</sub> | Maximum Propagation Delay ,Output Enable to<br>Q <sub>A</sub> -Q <sub>H</sub> (Figures 3 and 6)            | 2.0                  | 125                  | 155   | 190    | ns   |
|                                     |  | 4.5                  | 25                   | 31    | 38     |      |
|                                     |  | 6.0                  | 21                   | 26    | 32     |      |
| t <sub>PZL</sub> , t <sub>PZH</sub> | Maximum Propagation Delay ,Output Enable to<br>Q <sub>A</sub> -Q <sub>H</sub> (Figures 3 and 6)            | 2.0                  | 175                  | 220   | 265    | ns   |
|                                     |  | 4.5                  | 35                   | 44    | 53     |      |
|                                     |  | 6.0                  | 30                   | 37    | 45     |      |
| C <sub>IN</sub>                     | Maximum Input Capacitance  | -                    | 10                   | 10    | 10     | pF   |
| C <sub>OUT</sub>                    | Maximum Three-State Output Capacitance<br>(Output in High-Impedance State), Q <sub>A</sub> -Q <sub>H</sub> | -                    | 15                   | 15    | 15     | pF   |

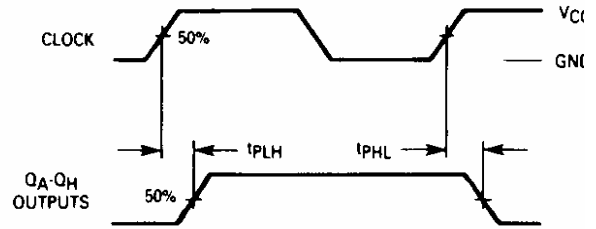
|                 |   |                                       |  |  |    |
|-----------------|---|---------------------------------------|--|--|----|
| C <sub>PD</sub> | Power Dissipation Capacitance (Per Package)   | Typical @25°C, V <sub>CC</sub> =5.0 V |  |  | pF |
|                 | Used to determine the no-load dynamic power consumption: $P_D=C_{PD}V_{CC}^2f+I_{CC}V_{CC}$ | 300                                   |  |  |    |

**TIMING REQUIREMENTS**( $C_L=50\text{pF}$ , Input  $t_r=t_f=6.0\text{ ns}$ )

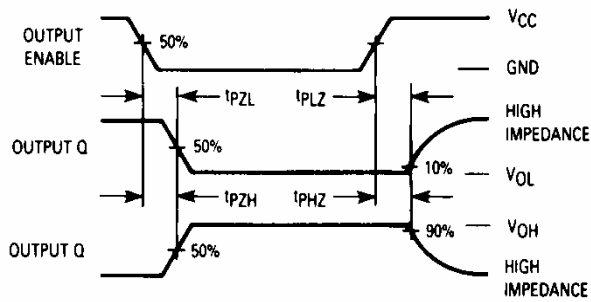
| Symbol                          | Parameter  | V <sub>CC</sub><br>V | Guaranteed Limit  |       |        | Unit |
|---------------------------------|--|----------------------|-------------------|-------|--------|------|
|                                 |  |                      | 25 °C to<br>-55°C | ≤85°C | ≤125°C |      |
| t <sub>su</sub>                 | Minimum Setup Time, Serial Data<br>Input A to Clock (Figure 4) | 2.0                  | 50                | 65    | 75     | ns   |
|                                 |  | 4.5                  | 10                | 13    | 15     |      |
|                                 |  | 6.0                  | 9.0               | 11    | 13     |      |
| t <sub>h</sub>                  | Minimum Hold Time, Clock to Data<br>Input A (Figure 4)         | 2.0                  | 3                 | 3     | 3      | ns   |
|                                 |  | 4.5                  | 3                 | 3     | 3      |      |
|                                 |  | 6.0                  | 3                 | 3     | 3      |      |
| t <sub>w</sub>                  | Minimum Pulse Width, Strobe<br>(Figure 1)                      | 2.0                  | 80                | 100   | 120    | ns   |
|                                 |  | 4.5                  | 16                | 20    | 24     |      |
|                                 |  | 6.0                  | 14                | 17    | 20     |      |
| t <sub>r</sub> , t <sub>f</sub> | Maximum Input Rise and Fall Times<br>(Figure 1)                | 2.0                  | 1000              | 1000  | 1000   | ns   |
|                                 |  | 4.5                  | 500               | 500   | 500    |      |
|                                 |  | 6.0                  | 400               | 400   | 400    |      |



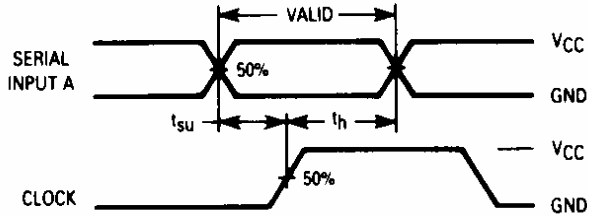
**Figure 1. Switching Waveforms**



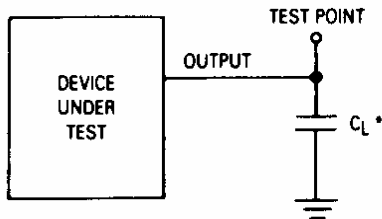
**Figure 2. Switching Waveforms**



**Figure 3. Switching Waveforms**

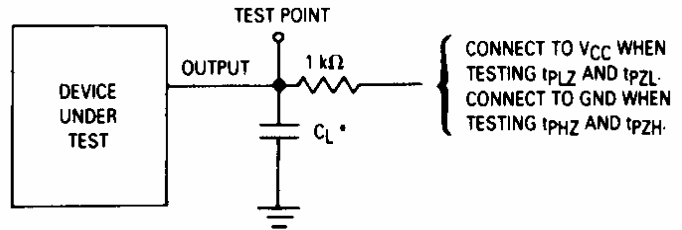


**Figure 4. Switching Waveforms**



\*Includes all probe and jig capacitance.

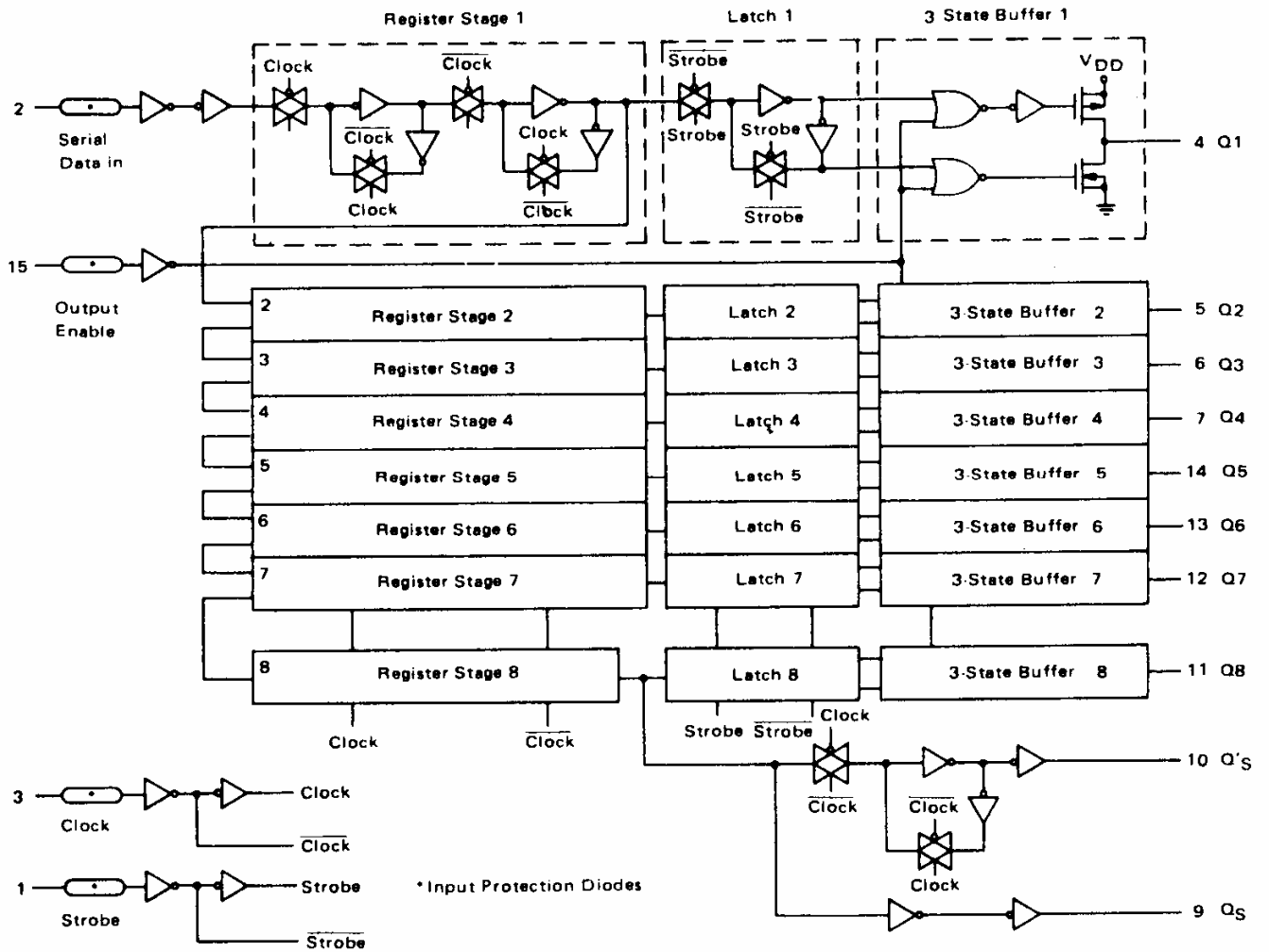
**Figure 5. Test Circuit**

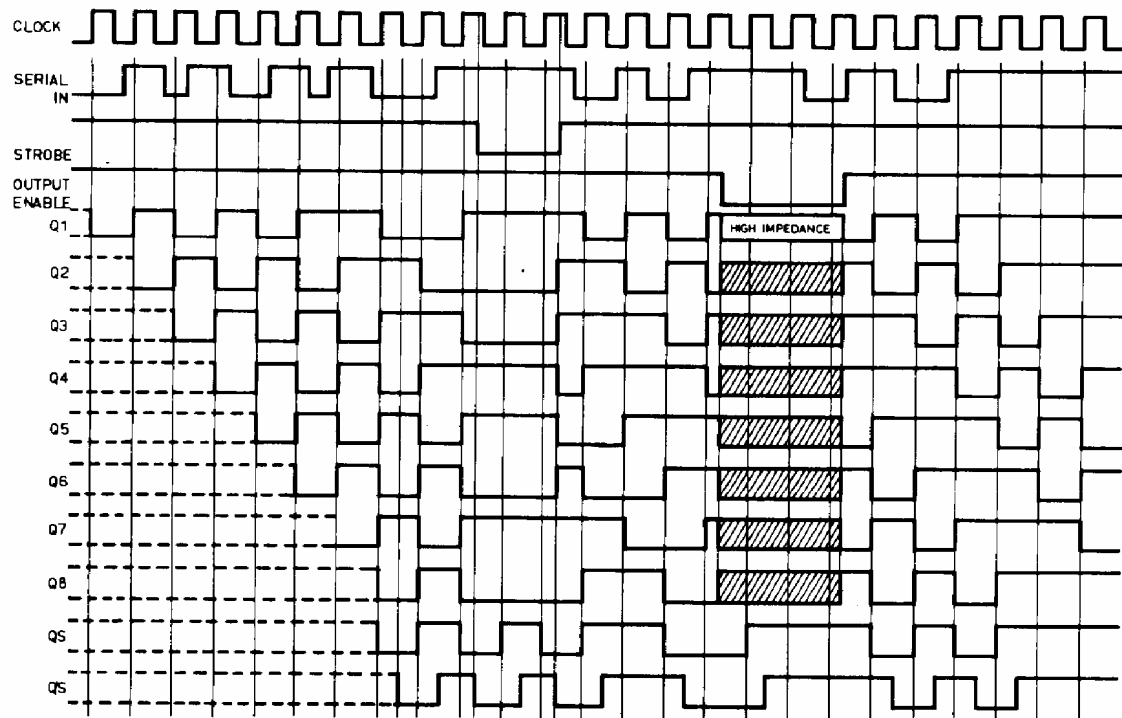


\*Includes all probe and jig capacitance.

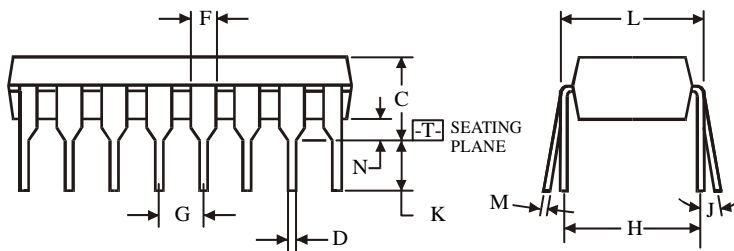
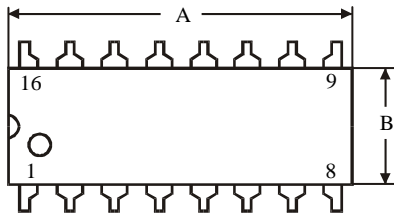
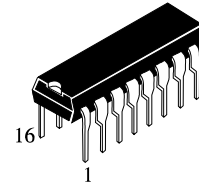
**Figure 6. Test Circuit**

**EXPANDED LOGIC DIAGRAM**



**TIMING DIAGRAM**

### N SUFFIX PLASTIC DIP (MS - 001BB)



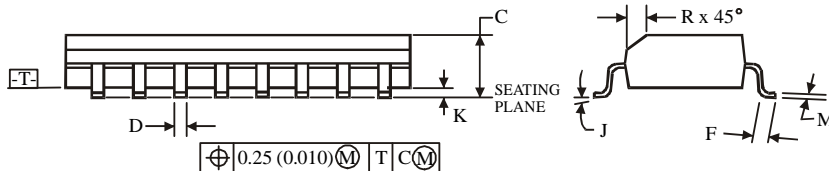
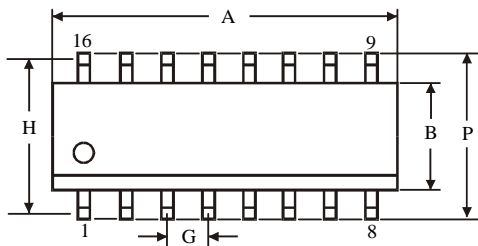
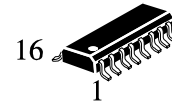
$\oplus 0.25 (0.010) \text{ (M) T}$

**NOTES:**

- Dimensions "A", "B" do not include mold flash or protrusions.  
Maximum mold flash or protrusions 0.25 mm (0.010) per side.

| Symbol | Dimension, mm |       |
|--------|---------------|-------|
|        | MIN           | MAX   |
| A      | 18.67         | 19.69 |
| B      | 6.1           | 7.11  |
| C      |               | 5.33  |
| D      | 0.36          | 0.56  |
| F      | 1.14          | 1.78  |
| G      | 2.54          |       |
| H      | 7.62          |       |
| J      | 0°            | 10°   |
| K      | 2.92          | 3.81  |
| L      | 7.62          | 8.26  |
| M      | 0.2           | 0.36  |
| N      | 0.38          |       |

### D SUFFIX SOIC (MS - 012AC)



$\oplus 0.25 (0.010) \text{ (M) T C (M)}$

**NOTES:**

- Dimensions A and B do not include mold flash or protrusion.
- Maximum mold flash or protrusion 0.15 mm (0.006) per side for A; for B - 0.25 mm (0.010) per side.

| Symbol | Dimension, mm |      |
|--------|---------------|------|
|        | MIN           | MAX  |
| A      | 9.8           | 10   |
| B      | 3.8           | 4    |
| C      | 1.35          | 1.75 |
| D      | 0.33          | 0.51 |
| F      | 0.4           | 1.27 |
| G      | 1.27          |      |
| H      | 5.72          |      |
| J      | 0°            | 8°   |
| K      | 0.1           | 0.25 |
| M      | 0.19          | 0.25 |
| P      | 5.8           | 6.2  |
| R      | 0.25          | 0.5  |