

**IN74LS164**

## 8-Bit Serial-Input/Parallel-Output Shift Register

This 8-bit shift register features gated serial inputs and an asynchronous reset. The gated serial inputs (A and B) permit complete control over incoming data as a low at either (or both) input(s) inhibits entry of the new data and resets the first flip flop to the low level at the next clock pulse. A high level input enables the other input which will then determine the state of the first flip-flop. Data at the serial inputs may be changed while the clock is high or low, but only information meeting the setup requirements will be entered clocking occurs or the low-to-high level transition of the clock input. All inputs are diode-clamped to minimize transmission-line effects.

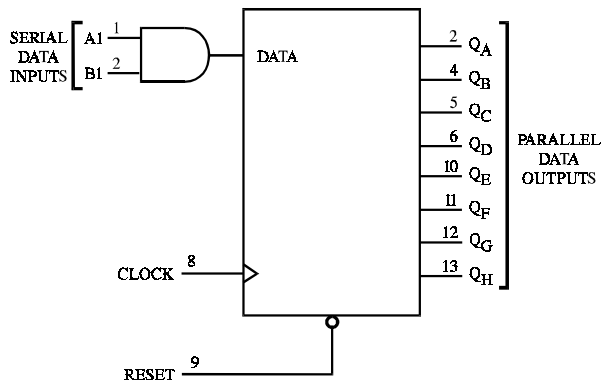
- Gated (Enable/Disable) Serial Inputs
- Fully Buffered Clock and Serial Inputs
- Asynchronous Clear

**N SUFFIX PLASTIC**  
14 1

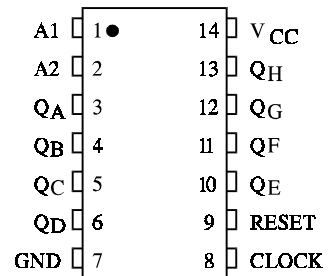
**D SUFFIX SOIC**  
14 1

**ORDERING INFORMATION**  
IN74LS164N Plastic  
IN74LS164D SOIC  
T<sub>A</sub> = 0° to 70°C  
for all packages

### LOGIC DIAGRAM



### PIN ASSIGNMENT



### FUNCTION TABLE

| Inputs |       |    |    | Outputs        |                 |     |                 |
|--------|-------|----|----|----------------|-----------------|-----|-----------------|
| Reset  | Clock | A1 | A2 | Q <sub>A</sub> | Q <sub>B</sub>  | ... | Q <sub>H</sub>  |
| L      | X     | X  | X  | L              | L               | ... | L               |
| H      |       | X  | X  | no change      |                 |     |                 |
| H      |       | H  | D  | D              | Q <sub>An</sub> | ... | Q <sub>Gn</sub> |
| H      |       | D  | H  | D              | Q <sub>An</sub> | ... | Q <sub>Gn</sub> |
| H      |       | L  | L  | L              | Q <sub>An</sub> | ... | Q <sub>Gn</sub> |

D = data input

X = don't care

Q<sub>An</sub> - Q<sub>Gn</sub> = data shifted from the previous stage on a rising edge at the clock input.

## MAXIMUM RATINGS\*

| Symbol           | Parameter                 | Value       | Unit |
|------------------|---------------------------|-------------|------|
| V <sub>CC</sub>  | Supply Voltage            | 7.0         | V    |
| V <sub>IN</sub>  | Input Voltage             | 7.0         | V    |
| V <sub>OUT</sub> | Output Voltage            | 5.5         | V    |
| T <sub>stg</sub> | Storage Temperature Range | -65 to +150 | °C   |

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

## RECOMMENDED OPERATING CONDITIONS

| Symbol             | Parameter                     | Min  | Max  | Unit |
|--------------------|-------------------------------|------|------|------|
| V <sub>CC</sub>    | Supply Voltage                | 4.75 | 5.25 | V    |
| V <sub>IH</sub>    | High Level Input Voltage      | 2.0  |      | V    |
| V <sub>IL</sub>    | Low Level Input Voltage       |      | 0.8  | V    |
| I <sub>OH</sub>    | High Level Output Current     |      | -0.4 | mA   |
| I <sub>OL</sub>    | Low Level Output Current      |      | 8.0  | mA   |
| T <sub>A</sub>     | Ambient Temperature Range     | 0    | +70  | °C   |
| f <sub>clock</sub> | Clock Frequency               | 0    | 25   | MHz  |
| t <sub>su</sub>    | Setup Time, A1 or A2 to Clock | 15   |      | ns   |
| t <sub>h</sub>     | Hold Time, Clock to A1 or A2  | 5    |      | ns   |
| t <sub>w</sub>     | Pulse Width, Clock            | 20   |      | ns   |
| t <sub>w</sub>     | Pulse Width, Reset            | 20   |      | ns   |
| t <sub>rec</sub>   | Recovery Time                 | 5    |      | ns   |

## DC ELECTRICAL CHARACTERISTICS over full operating conditions

| Symbol          | Parameter                    | Test Conditions  | Guaranteed Limit |      | Unit |
|-----------------|------------------------------|--|------------------|------|------|
|                 |                              |  | Min              | Max  |      |
| V <sub>IK</sub> | Input Clamp Voltage          | V <sub>CC</sub> = min, I <sub>IN</sub> = -18 mA        |                  | -1.5 | V    |
| V <sub>OH</sub> | High Level Output Voltage    | V <sub>CC</sub> = min, I <sub>OH</sub> = -0.4 mA       | 2.7              |      | V    |
| V <sub>OL</sub> | Low Level Output Voltage     | V <sub>CC</sub> = min, I <sub>OL</sub> = 4 mA          |                  | 0.4  | V    |
|                 |                              | V <sub>CC</sub> = min, I <sub>OL</sub> = 8 mA          |                  | 0.5  |      |
| I <sub>IH</sub> | High Level Input Current     | V <sub>CC</sub> = max, V <sub>IN</sub> = 2.7 V         |                  | 20   | mA   |
|                 |                              | V <sub>CC</sub> = max, V <sub>IN</sub> = 7.0 V         |                  | 0.1  | mA   |
| I <sub>IL</sub> | Low Level Input Current      | V <sub>CC</sub> = max, V <sub>IN</sub> = 0.4 V         |                  | -0.4 | mA   |
| I <sub>O</sub>  | Output Short Circuit Current | V <sub>CC</sub> = max, V <sub>O</sub> = 0 V (Nootte 1) | -20              | -100 | mA   |
| I <sub>CC</sub> | Supply Current               | V <sub>CC</sub> = max (Note 2)                         |                  | 27   | mA   |

Note 1: Not more than one output should be shorted at a time, and duration should not exceed one second.

Note 2: I<sub>CC</sub> is measured with outputs open, serial inputs grounded, the clock input at 2.4 V, and a momentary ground, then 4.5 V applied.

**AC ELECTRICAL CHARACTERISTICS** ( $T_A=25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{ V}$ ,  $C_L = 15\text{ pF}$ ,  $R_L = 2\text{ k}\Omega$ ,  $t_r=15\text{ ns}$ ,  $t_f = 6.0\text{ ns}$ )

| Symbol    | Parameter                          | Min | Max | Unit |
|-----------|------------------------------------|-----|-----|------|
| $t_{PLH}$ | Propagation Delay Time, Clock to Q |     | 27  | ns   |
| $t_{PHL}$ | Propagation Delay Time, Clock to Q |     | 32  | ns   |
| $t_{PHL}$ | Propagation Delay Time, Reset to Q |     | 36  | ns   |
| $t_{su}$  | Setup Time, A1 or A2 to Clock      | 15  |     | ns   |
| $t_h$     | Hold Time, Clock to A1 or A2       | 5   |     | ns   |
| $t_w$     | Pulse Width, Clock                 | 20  |     | ns   |
| $t_w$     | Pulse Width, Reset                 | 20  |     | ns   |

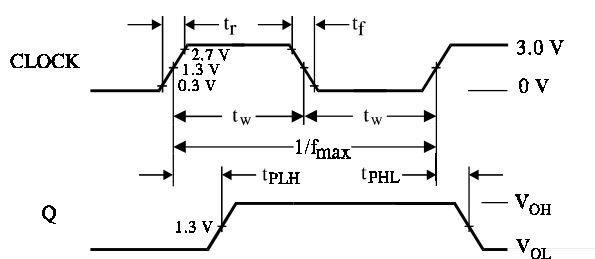


Figure 1. Switching Waveforms

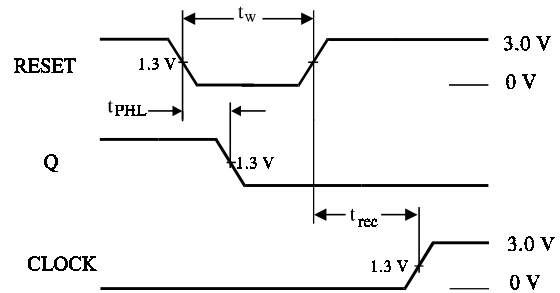


Figure 2. Switching Waveforms

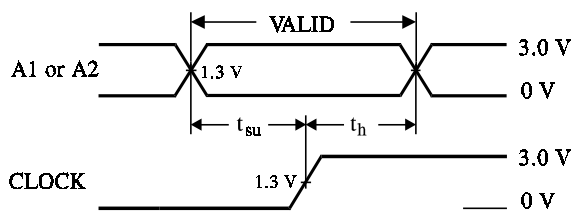
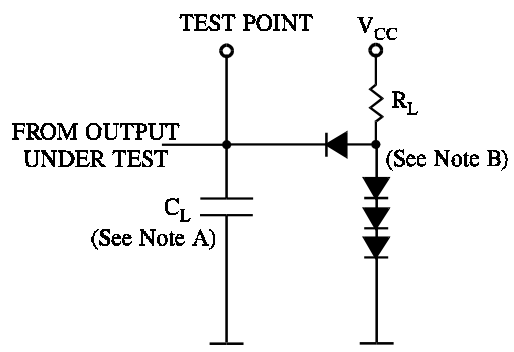


Figure 3. Switching Waveform



NOTES A.  $C_L$  includes probe and jig capacitance.  
 B. All diodes are 1N916 or 1N3064.

Figure 4. Test Circuit

TIMING DIAGRAM

