



### DESCRIPTION

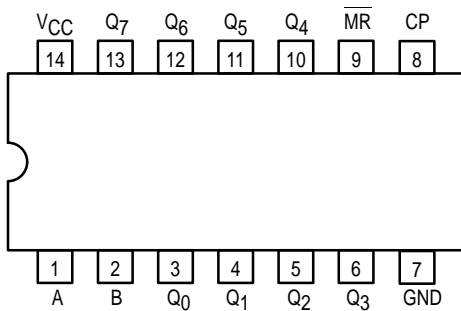
The SN74LS164 is a high speed 8-Bit Serial-In Parallel-Out Shift Register. Serial data is entered through a 2-Input AND gate synchronous with the LOW to HIGH transition of the clock. The device features an asynchronous Master Reset which clears the register setting all outputs LOW independent of the clock.

It utilizes the Schottky diode clamped process to achieve high speeds and is fully compatible with all Motorola TTL products.

### FEATURES

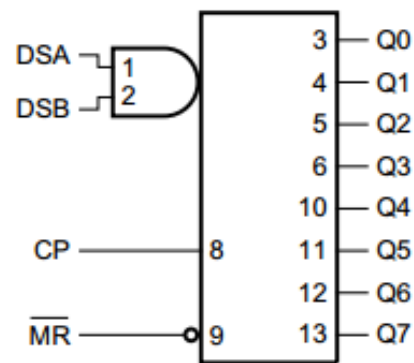
- Typical Shift Frequency of 35 MHz
- Asynchronous Master Reset
- Fully Synchronous Data Transfers
- Gated Serial Data Input
- Input Clamp Diodes Limit High Speed Termination Effects
- ESD > 3500 Volts

### PIN ASSIGNMENT

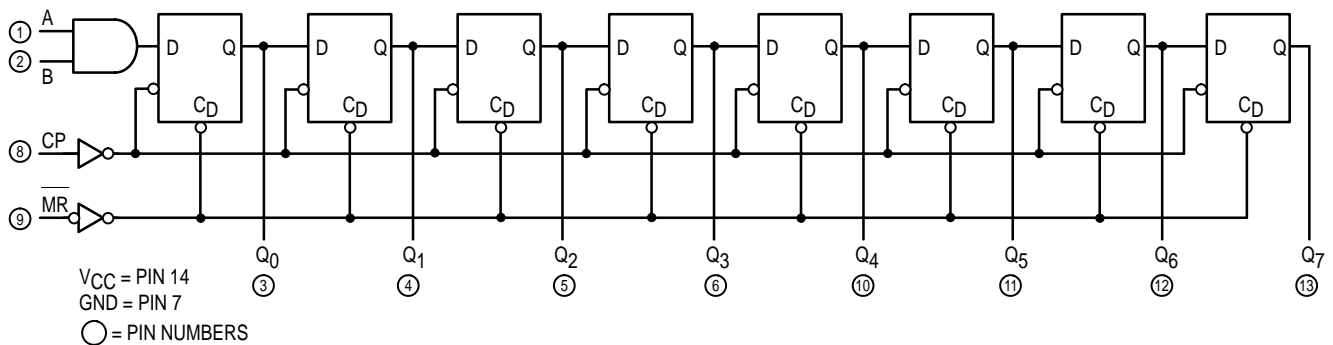


SOP/DIP-14

### LOGIC SYMBOL



### LOGIC DIAGRAM





## FUNCTIONAL DESCRIPTION

| OPERATING MODE | INPUTS                 |     |     | OUTPUTS |       |
|----------------|------------------------|-----|-----|---------|-------|
|                | $\overline{\text{MR}}$ | DSA | DSB | Q0      | Q1~Q7 |
| Reset (Clear)  | L                      | X   | X   | L       | L~L   |
| Shift          | H                      | l   | l   | L       | q0~q6 |
|                | H                      | l   | h   | L       | q0~q6 |
|                | H                      | h   | l   | L       | q0~q6 |
|                | H                      | h   | h   | H       | q0~q6 |

L (l) = LOW Voltage Levels

H (h) = HIGH Voltage Levels

X = Don't Care

q<sub>n</sub> = Lower case letters indicate the state of the referenced input or output one

q<sub>n</sub> = set-up time prior to the LOW to HIGH clock transition.

## GUARANTEED OPERATING RANGES

| Parameter                           | Symbol          | Min  | Typ | Max  | Unit |
|-------------------------------------|-----------------|------|-----|------|------|
| Supply Voltage                      | V <sub>CC</sub> | 4.75 | 5.0 | 5.75 | V    |
| Input Voltage                       | I <sub>OH</sub> |      |     | -0.4 | mA   |
| Storage Temperature                 | I <sub>OL</sub> |      |     | 8    | mA   |
| Operating Ambient Temperature Range | T <sub>A</sub>  | 0    |     | 70   | °C   |



**DC CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ )

| Symbol   | Parameter                 | Test Conditions  | Min. | Typ.  | Max. | Unit          |
|----------|---------------------------|--|------|-------|------|---------------|
| $V_{IH}$ | Input HIGH Voltage        | Guaranteed Input HIGH Voltage for All Inputs   | 2.0  |       |      | V             |
| $V_{IL}$ | Input LOW Voltage         | Guaranteed Input LOW Voltage for All Inputs  |      |       | 0.8  | V             |
| $V_{IK}$ | Input Clamp Diode Voltage | $V_{CC} = \text{MIN}, I_{IN} = 48 \text{ mA}$  |      | -0.65 | -1.5 | V             |
| $V_{OH}$ | Output HIGH Voltage       | $V_{CC} = \text{MIN}, I_{OH} = \text{MAX}, V_{IN} = V_{IH}$<br>or $V_{IL}$ per Truth Table | 2.7  |       | 3.5  | V             |
| $V_{OL}$ | Output LOW Voltage        | $V_{CC} = V_{CC} \text{ MIN},$<br>$V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table            |      | 0.35  | 0.5  | V             |
| $I_{IH}$ | Input HIGH Current        | $V_{CC} = \text{MAX}, V_{IN} = 2.7 \text{ V}$  |      |       | 20   | $\mu\text{A}$ |
|          |                           | $V_{CC} = \text{MAX}, V_{IN} = 7.0 \text{ V}$  |      |       | 100  | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current         | $V_{CC} = \text{MAX}, V_{IN} = 0.4 \text{ V}$  |      |       | -400 | $\mu\text{A}$ |
| $I_{OS}$ | Short Circuit Current     | $V_{CC} = \text{MAX}$  | -20  |       | -100 | mA            |
| $I_{CC}$ | Power Supply Current      | $V_{CC} = \text{MAX}$  |      |       | 27   | mA            |

**AC CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ )

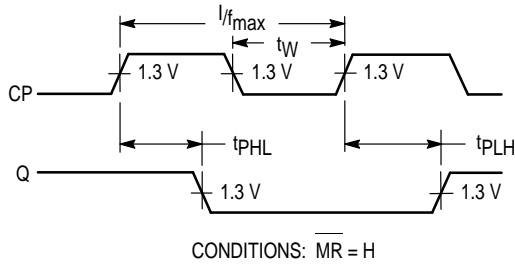
| Symbol    | Parameter                           | Test Conditions                                  | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------------|--|------|------|------|------|
| $f_{MAX}$ | Maximum Clock Frequency             | $V_{CC} = 5.0 \text{ V}$<br>$CL = 15 \text{ pF}$ | 25   | 36   |      | MHz  |
| $t_{PHL}$ | Propagation Delay MR to Output Q    |  |      | 24   | 36   | ns   |
| $t_{IK}$  | Propagation Delay Clock to Output Q |  |      | 17   | 27   | ns   |
| $t_{PHL}$ |                                     |  |      | 21   | 32   | ns   |

**AC SETUP REQUIREMENTS** ( $T_A = 25^\circ\text{C}$ )

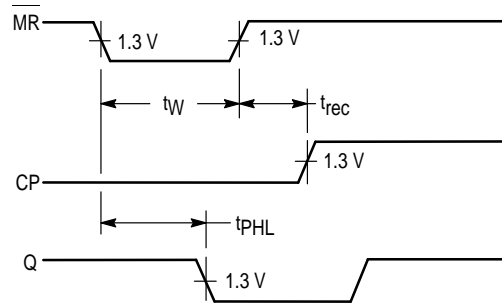
| Symbol    | Parameter                 | Test Conditions          | Min. | Typ. | Max. | Unit |
|-----------|---------------------------|--------------------------|------|------|------|------|
| $t_w$     | CP, MR Pulse Width        | $V_{CC} = 5.0 \text{ V}$ | 25   | 36   |      | ns   |
| $t_s$     | Data Setup Time           |                          |      | 24   | 36   | ns   |
| $t_h$     | Data Hold Time            |                          |      | 17   | 27   | ns   |
| $t_{rec}$ | MR to Clock Recovery Time |                          |      | 21   | 32   | ns   |



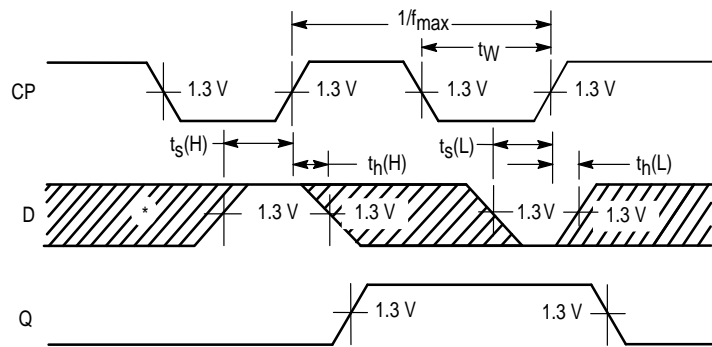
### AC WAVEFORMS



**Clock to Output Delays  
and Clock Pulse Width**



**Master Reset Pulse Width,  
Master Reset to Output Delay and  
Master Reset to Clock Recovery Time**



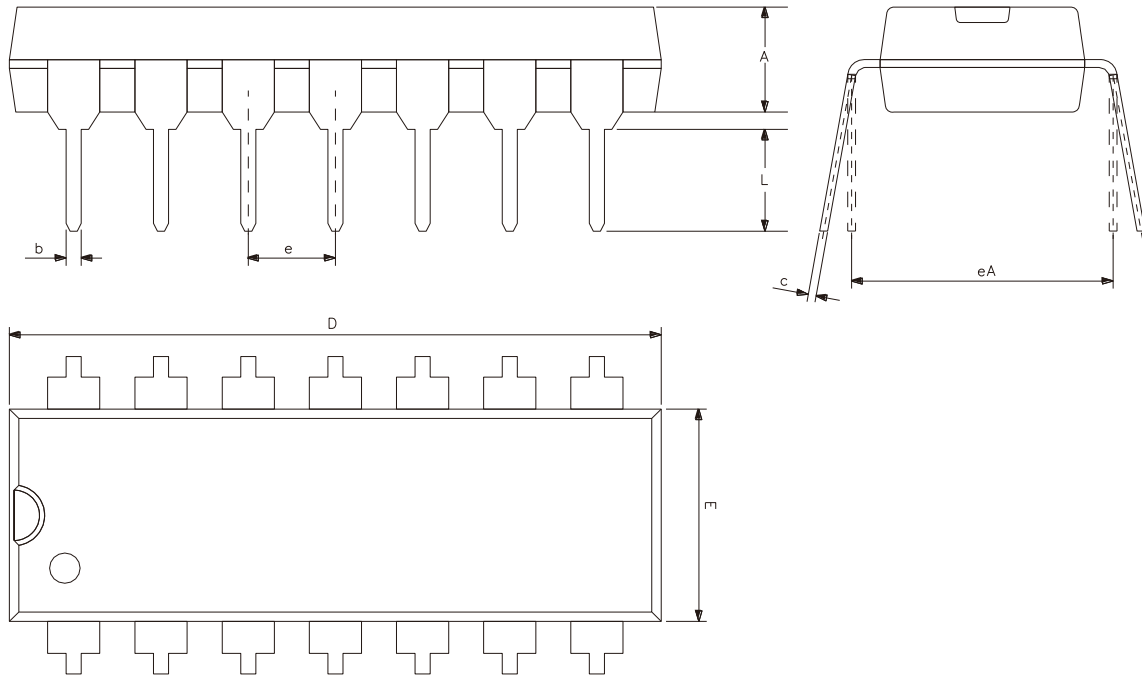
**Data Setup and Hold Times**

### ORDERING GUIDE

| Model       | Package Description | Qty(PCS) |
|-------------|---------------------|----------|
| SN74LS164DR | SOP-14              | 2500     |
| SN74LS164N  | DIP-14              | 25       |



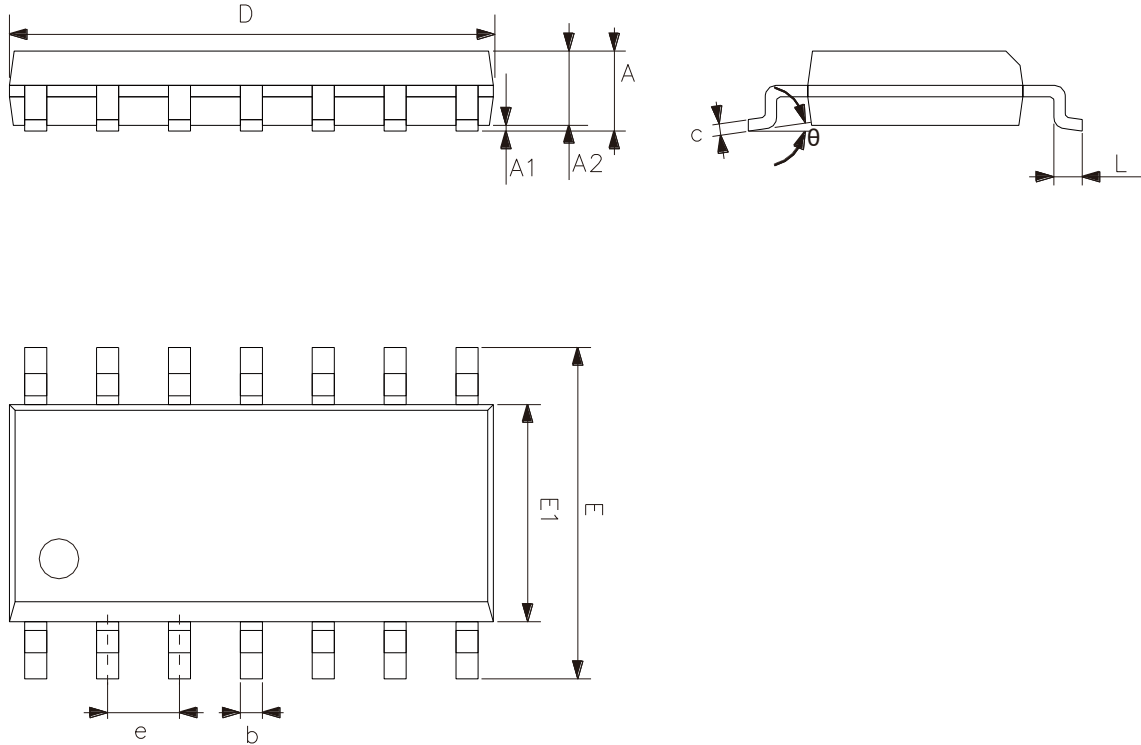
**PACKAGE OUTLINE DIMENSIONS**  
**DIP-14**



| SYMBOL | COMMON DIMENSIONS (mm) |       |
|--------|------------------------|-------|
|        | MIN                    | MAX   |
| A      | 3.05                   | 3.60  |
| b      | 0.33                   | 0.56  |
| c      | 0.20                   | 0.36  |
| D      | 18.80                  | 19.40 |
| E      | 6.20                   | 6.60  |
| e      | 2.54                   |       |
| eA     | 7.62                   | 10.90 |
| L      | 2.92                   | —     |



**PACKAGE OUTLINE DIMENSIONS**  
**SOP-14**



| SYMBOL | COMMON DIMENSIONS (mm) |      |
|--------|------------------------|------|
|        | MIN                    | MAX  |
| A      | 1.50                   | 1.75 |
| A1     | 0.05                   | 0.25 |
| A2     | 1.30                   | —    |
| b      | 0.33                   | 0.50 |
| c      | 0.19                   | 0.25 |
| D      | 8.43                   | 8.76 |
| E      | 5.80                   | 6.25 |
| E1     | 3.75                   | 4.00 |
| e      | 1.27                   |      |
| L      | 0.40                   | 0.89 |
| θ      | 0°                     | 8°   |



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