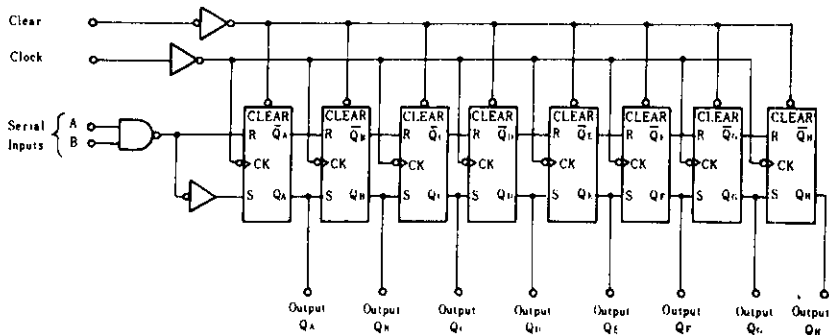


# HD74LS164 8-Bit Parallel-Out Serial-In Shift Registers

This 8-bit shift register features gated serial inputs and an asynchronous clear. 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 on the low-to-high-level transition of the clock input.

## BLOCK DIAGRAM

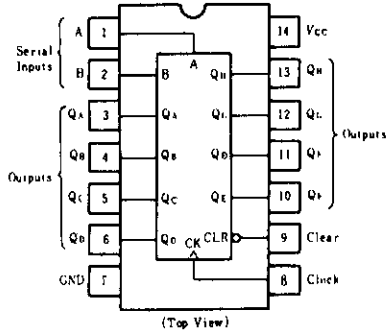


## FUNCTION TABLE

| Inputs |       |   |   | Outputs |             |     |
|--------|-------|---|---|---------|-------------|-----|
| Clear  | Clock | A | B | QA      | QH ..... QH |     |
| L      | X     | X | X | L       | L           | L   |
| H      | L     | X | X | QA0     | QH0         | QH0 |
| H      | ↑     | H | H | H       | QAn         | QGn |
| H      | ↑     | L | X | L       | QAn         | QGn |
| H      | ↑     | X | L | L       | QAn         | QGn |

- Notes) 1. H; high level, L; low level, X; irrelevant  
2. ↑; transition from low to high level  
3. QA0, QB0, QH0; the level of QA, QB, or QH, respectively, before the indicated steady-state input conditions were established.  
4. QAn, QGn; the level of QA or QG before the most-recent ↑ transition of the clock; indicates a one-bit shift.

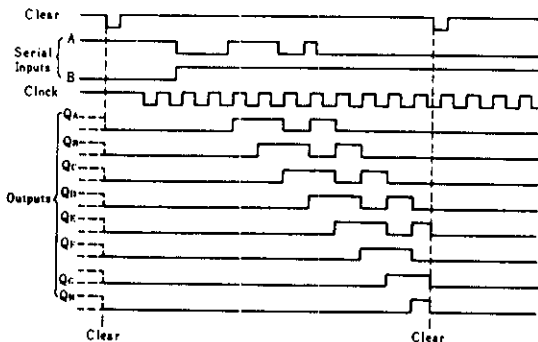
## PIN ARRANGEMENT



## RECOMMENDED OPERATING CONDITIONS

| Item              | Symbol       | min | typ | max | Unit |
|-------------------|--------------|-----|-----|-----|------|
| Clock frequency   | $f_{clock}$  | 0   | —   | 25  | MHz  |
| Clock pulse width | $t_{w(CK)}$  | 20  | —   | —   | ns   |
| Clear pulse width | $t_{w(CLR)}$ | 20  | —   | —   | ns   |
| Data setup time   | $t_{su}$     | 15  | —   | —   | ns   |
| Data hold time    | $t_h$        | 5   | —   | —   | ns   |

## TYPICAL CLEAR, SHIFT, AND CLEAR SEQUENCES



# HD74LS164

## ELECTRICAL CHARACTERISTICS ( $T_a = -20 \sim +75^\circ\text{C}$ )

| Item                         | Symbol   | Test Conditions                                                                                      | min | typ* | max | Unit          |
|------------------------------|----------|------------------------------------------------------------------------------------------------------|-----|------|-----|---------------|
| Input voltage                | $V_{IH}$ |                                                                                                      | 2.0 |      | —   | V             |
|                              | $V_{IL}$ |                                                                                                      | —   | —    | 0.8 | V             |
| Output voltage               | $V_{OH}$ | $V_{CC} = 4.75\text{V}$ , $V_{IH} = 2\text{V}$ , $V_{IL} = 0.8\text{V}$ , $I_{OH} = -400\mu\text{A}$ | 2.7 | —    | —   | V             |
|                              | $V_{OL}$ | $V_{CC} = 4.75\text{V}$ , $V_{IH} = 2\text{V}$ , $V_{IL} = 0.8\text{V}$                              | —   | —    | 0.4 | V             |
|                              |          |                                                                                                      |     |      | 0.5 |               |
| Input current                | $I_{IH}$ | $V_{CC} = 5.25\text{V}$ , $V_I = 2.7\text{V}$                                                        | —   | —    | 20  | $\mu\text{A}$ |
|                              | $I_{IL}$ | $V_{CC} = 5.25\text{V}$ , $V_I = 0.4\text{V}$                                                        | —   | —    | 0.4 | mA            |
|                              | $I_I$    | $V_{CC} = 5.25\text{V}$ , $V_I = 7\text{V}$                                                          | —   | —    | 0.1 | mA            |
| Short-circuit output current | $I_{OS}$ | $V_{CC} = 5.25\text{V}$                                                                              | -20 | —    | 100 | mA            |
| Supply current**             | $I_{CC}$ | $V_{CC} = 5.25\text{V}$                                                                              | —   | 16   | 27  | mA            |
| Input clamp voltage          | $V_{IK}$ | $V_{CC} = 4.75\text{V}$ , $I_{IK} = -18\text{mA}$                                                    | —   | —    | 1.5 | V             |

\*  $V_{CC} = 5\text{V}$ ,  $T_a = 25^\circ\text{C}$

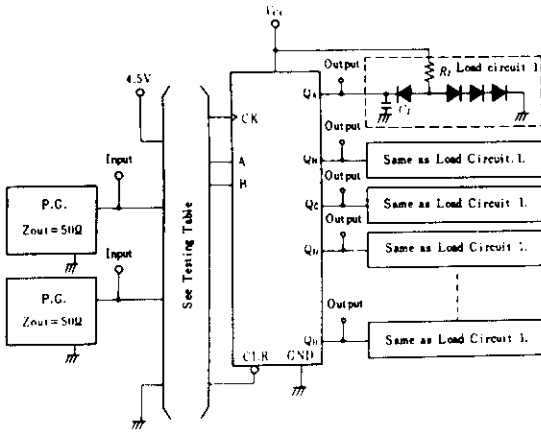
\*\*  $I_{CC}$  is measured with outputs open, serial inputs grounded, the clock input at 2.4V, and a momentary grounded, then 4.5V applied to clear.

## SWITCHING CHARACTERISTICS ( $V_{CC} = 5\text{V}$ , $T_a = 25^\circ\text{C}$ )

| Item                    | Symbol    | Inputs | Outputs | Test Conditions                               | min | typ | max | Unit |
|-------------------------|-----------|--------|---------|-----------------------------------------------|-----|-----|-----|------|
| Maximum clock frequency | $f_{max}$ |        |         |                                               | 25  | 36  | —   | MHz  |
| Propagation delay time  | $t_{PHL}$ | Clear  | Q       | $C_L = 15\text{pF}$ , $R_L = 2\text{k}\Omega$ | —   | 24  | 36  | ns   |
|                         | $t_{PLH}$ | Clock  | Q       |                                               | —   | 17  | 27  | ns   |
|                         | $t_{PHL}$ | Clock  | Q       |                                               | —   | 21  | 32  | ns   |

## TESTING METHOD

### 1) Test Circuit

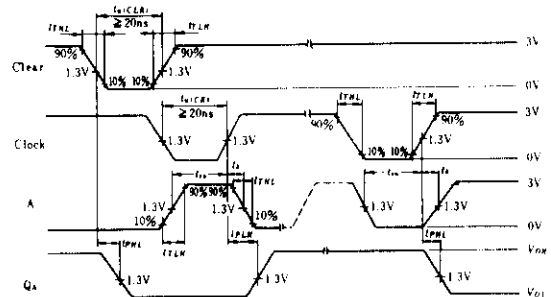


- Notes) 1. Input pulse:  $t_{TLH} \leq 15\text{ns}$ ,  $t_{THL} \leq 6\text{ns}$ ,  $PRR = 1\text{MHz}$ ,  
(Clock, Clear),  $PRR = 500\text{kHz}$  (A or B)  
2.  $C_L$  includes probe and jig capacitance.  
3. All diodes are 1S2074 ④

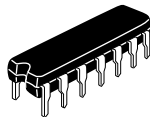
### 2) Testing Table

| Item      | From input to output | Inputs |    |    |      | Outputs        |                |                |                |                |                |                |                |
|-----------|----------------------|--------|----|----|------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
|           |                      | CLR    | CK | A  | B    | Q <sub>A</sub> | Q <sub>H</sub> | Q <sub>C</sub> | Q <sub>D</sub> | Q <sub>E</sub> | Q <sub>F</sub> | Q <sub>G</sub> | Q <sub>H</sub> |
| $f_{max}$ |                      | 4.5V   | IN | IN | 4.5V | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            |
| $t_{PLH}$ | Clear → Q            | IN     | IN | IN | 4.5V | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            |
| $t_{PHL}$ | CK → Q               | 4.5V   | IN | IN | 4.5V | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            | OUT            |

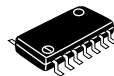
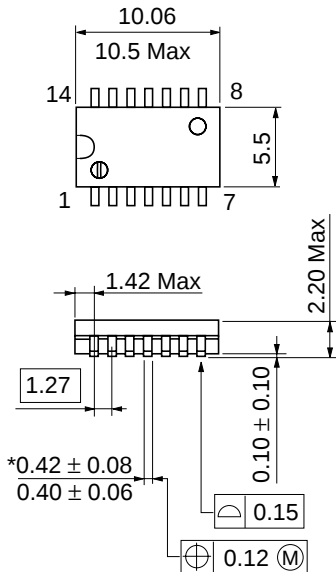
### Waveform



Notes)  $Q_A$  output is illustrated. Relationship of serial input A and B data to other Q outputs is illustrated in the timing chart.

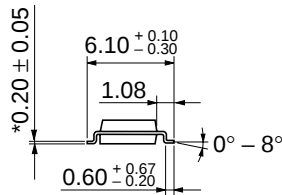
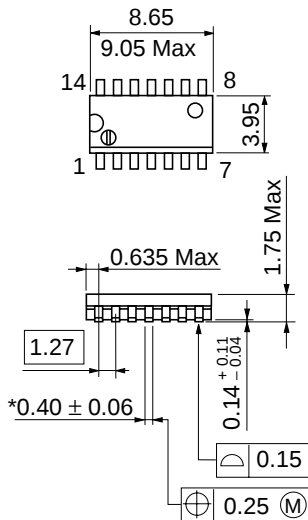


|                          |          |
|--------------------------|----------|
| Hitachi Code             | DP-14    |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.97 g   |



\*Dimension including the plating thickness  
Base material dimension

|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DA  |
| JEDEC                    | —        |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.23 g   |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | FP-14DN  |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.13 g   |

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