

# HD74HC95

## 4-bit Parallel Access Shift Register

# HITACHI

### Description

This 4-bit register features parallel and serial inputs, parallel outputs, mode control, and two clock inputs. The register has three mode operation:

- Parallel (broadside) load
- Shift right (the direction  $Q_A$  toward  $Q_D$ )
- Shift left (the direction  $Q_D$  toward  $Q_A$ )

Parallel loading is accomplished by applying the four bits of data and taking the mode control input high. The data is loaded into the associated flip-flops and appears at the outputs after the high-to-low transition of the clock-2 input. During loading, the entry of serial data is inhibited. Shift right is accomplished on the high-to-low transition of clock-1 when the mode control is low; shift left is accomplished on the high-to-low transition of clock-2 when the mode control is high by connecting the output of each flip-flop ( $Q_D$  to input C, etc.) and serial data is entered at input D. The clock input may be applied commonly to clock-1 and clock-2 if both modes can be clocked from the same source. Changes at the mode control input should normally be made while both clock inputs are low: however, conditions described in the last three lines of the function table will also ensure that register contents are protected.

### Features

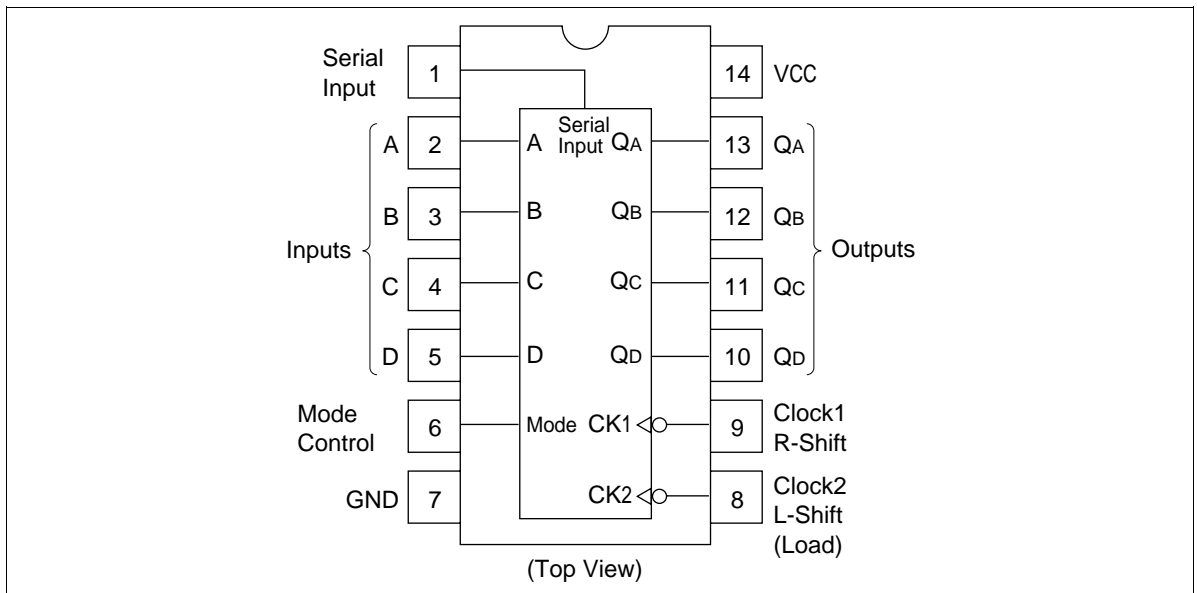
- High Speed Operation:  $t_{pd}$  (Clock to Q) = 17 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )

Function Table

Inputs

| Mode Control | Clocks |       | Serial | Parallel        |                 |                 |   | Outputs         |                 |                 |                 |
|--------------|--------|-------|--------|-----------------|-----------------|-----------------|---|-----------------|-----------------|-----------------|-----------------|
|              | 2 (L)  | 1 (R) |        | A               | B               | C               | D | Q <sub>A</sub>  | Q <sub>B</sub>  | Q <sub>C</sub>  | Q <sub>D</sub>  |
| H            | H      | X     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
| H            |        | X     | X      | a               | b               | c               | d | a               | b               | c               | d               |
| H            |        | X     | X      | Q <sub>B+</sub> | Q <sub>C+</sub> | Q <sub>D+</sub> | d | Q <sub>Bn</sub> | Q <sub>Cn</sub> | Q <sub>Dn</sub> | d               |
| L            | L      | H     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
| L            | X      |       | H      | X               | X               | X               | X | H               | Q <sub>An</sub> | Q <sub>Bn</sub> | Q <sub>Cn</sub> |
| L            | X      |       | L      | X               | X               | X               | X | L               | Q <sub>An</sub> | Q <sub>Bn</sub> | Q <sub>Cn</sub> |
|              | L      | L     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
|              | L      | L     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
|              | L      | H     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
|              | H      | L     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |
|              | H      | H     | X      | X               | X               | X               | X | Q <sub>A0</sub> | Q <sub>B0</sub> | Q <sub>C0</sub> | Q <sub>D0</sub> |

Pin Arrangement

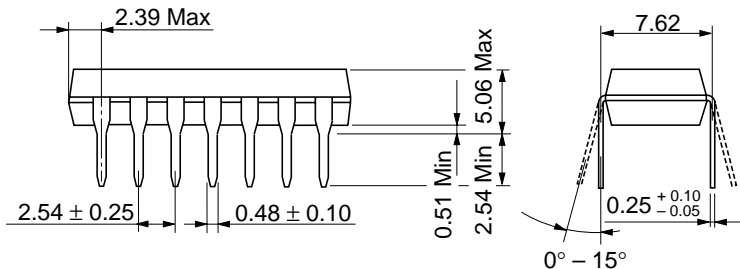
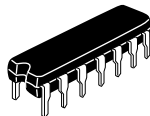
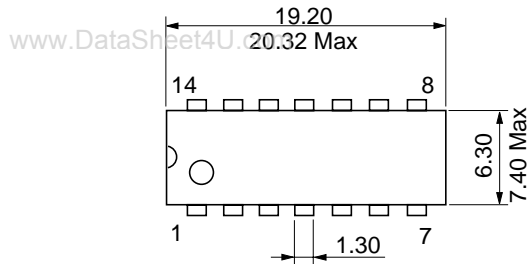


## DC Characteristics

| Item                     | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |      | Ta = -40 to +85°C |      | Unit                     | Test Conditions |   |                           |
|--------------------------|-----------------|---------------------|-----------|------|-------------------|------|--------------------------|-----------------|---|---------------------------|
|                          |                 |                     | Min       | Typ  | Max               | Min  |                          |                 | Max   |                           |
| Input voltage            | V <sub>IH</sub> | 2.0                 | 1.5       | —    | —                 | 1.5  | —                        | V               |   |                           |
|                          |                 | 4.5                 | 3.15      | —    | —                 | 3.15 | —                        |                 |   |                           |
|                          |                 | 6.0                 | 4.2       | —    | —                 | 4.2  | —                        |                 |   |                           |
|                          | V <sub>IL</sub> | 2.0                 | —         | —    | 0.5               | —    | 0.5                      | V               |   |                           |
|                          |                 | 4.5                 | —         | —    | 1.35              | —    | 1.35                     |                 |   |                           |
|                          |                 | 6.0                 | —         | —    | 1.8               | —    | 1.8                      |                 |   |                           |
| Output voltage           | V <sub>OH</sub> | 2.0                 | 1.9       | 2.0  | —                 | 1.9  | —                        | V               | Vin = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -20 μA |                           |
|                          |                 | 4.5                 | 4.4       | 4.5  | —                 | 4.4  | —                        |                 |   |                           |
|                          |                 | 6.0                 | 5.9       | 6.0  | —                 | 5.9  | —                        |                 |   |                           |
|                          |                 | 4.5                 | 4.18      | —    | —                 | 4.13 | —                        |                 |   | I <sub>OH</sub> = -4 mA   |
|                          |                 | 6.0                 | 5.68      | —    | —                 | 5.63 | —                        |                 |   | I <sub>OH</sub> = -5.2 mA |
|                          |                 | 6.0                 | —         | 0.0  | 0.1               | —    | 0.1                      |                 |   | V                         |
|                          | 4.5             | —                   | 0.0       | 0.1  | —                 | 0.1  |                          |                 |   |                           |
|                          | 6.0             | —                   | 0.0       | 0.1  | —                 | 0.1  |                          |                 |   |                           |
|                          | 4.5             | —                   | —         | 0.26 | —                 | 0.33 | I <sub>OL</sub> = 4 mA   |                 |   |                           |
|                          | 6.0             | —                   | —         | 0.26 | —                 | 0.33 | I <sub>OL</sub> = 5.2 mA |                 |   |                           |
| Input current            | I <sub>in</sub> | 6.0                 | —         | —    | ±0.1              | —    | ±1.0                     | μA              | Vin = V <sub>CC</sub> or GND                                      |                           |
| Quiescent supply current | I <sub>CC</sub> | 6.0                 | —         | —    | 4.0               | —    | 40                       | μA              | Vin = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA             |                           |

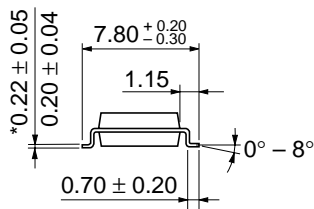
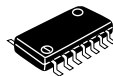
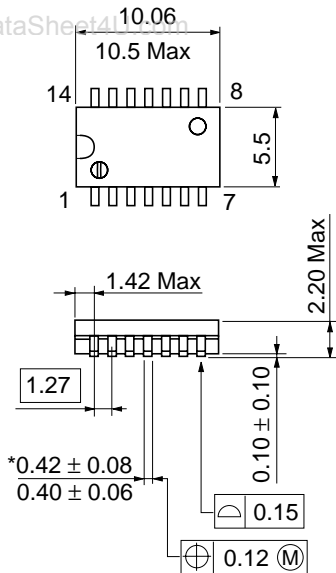
## AC Characteristics ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

| Item                    | Symbol    | $V_{CC}$ (V) | $T_a = 25^\circ\text{C}$ |     | $T_a = -40$ to $+85^\circ\text{C}$ |     | Unit | Test Conditions |       |
|-------------------------|-----------|--------------|--------------------------|-----|------------------------------------|-----|------|-----------------|-------|
|                         |           |              | Min                      | Typ | Max                                | Min |      |                 | Max   |
| Maximum clock frequency | $f_{max}$ | 2.0          | —                        | —   | 4                                  | —   | 3    | MHz             |       |
|                         |           | 4.5          | —                        | —   | 20                                 | —   | 16   |                 |       |
|                         |           | 6.0          | —                        | —   | 24                                 | —   | 19   |                 |       |
| Propagation delay time  | $t_{PLH}$ | 2.0          | —                        | —   | 145                                | —   | 180  | ns              |       |
|                         |           | 4.5          | —                        | 17  | 29                                 | —   | 36   |                 |       |
|                         |           | 6.0          | —                        | —   | 25                                 | —   | 31   |                 |       |
|                         | $t_{PHL}$ | 2.0          | —                        | —   | 170                                | —   | 215  | ns              |       |
|                         |           | 4.5          | —                        | 17  | 34                                 | —   | 43   |                 |       |
|                         |           | 6.0          | —                        | —   | 29                                 | —   | 37   |                 |       |
| Pulse width             | $t_w$     | 2.0          | 80                       | —   | —                                  | 100 | —    | ns              | Clock |
|                         |           | 4.5          | 16                       | 6   | —                                  | 20  | —    |                 |       |
|                         |           | 6.0          | 14                       | —   | —                                  | 17  | —    |                 |       |
| Setup time              | $t_{su}$  | 2.0          | 100                      | —   | —                                  | 125 | —    | ns              |       |
|                         |           | 4.5          | 20                       | 2   | —                                  | 25  | —    |                 |       |
|                         |           | 6.0          | 17                       | —   | —                                  | 21  | —    |                 |       |
| Hold time               | $t_h$     | 2.0          | 10                       | —   | —                                  | 10  | —    | ns              |       |
|                         |           | 4.5          | 10                       | -1  | —                                  | 10  | —    |                 |       |
|                         |           | 6.0          | 10                       | —   | —                                  | 10  | —    |                 |       |
| Output rise/fall time   | $t_{TLH}$ | 2.0          | —                        | —   | 75                                 | —   | 95   | ns              |       |
|                         | $t_{THL}$ | 4.5          | —                        | 5   | 15                                 | —   | 19   |                 |       |
|                         |           | 6.0          | —                        | —   | 13                                 | —   | 16   |                 |       |
| Input capacitance       | $C_{in}$  | —            | —                        | 5   | 10                                 | —   | 10   | pF              |       |



|                          |          |
|--------------------------|----------|
| Hitachi Code             | D144     |
| JEDEC                    | Conforms |
| EIAJ                     | Conforms |
| Weight (reference value) | 0.97 g   |

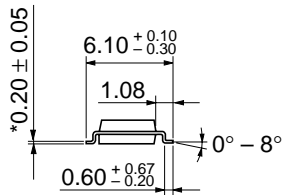
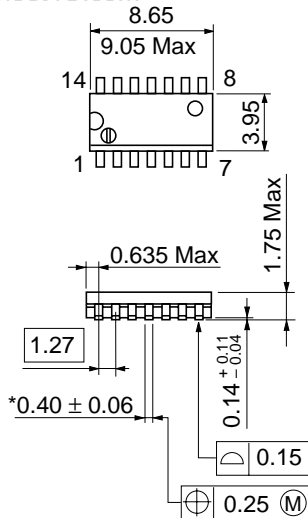
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\*Dimension including the plating thickness  
Base material dimension

|                          |                     |
|--------------------------|---------------------|
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| JEDEC                    | —                   |
| EIAJ                     | Conforms            |
| Weight (reference value) | 0.23 g              |

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

\*Pd plating

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