# HD74HC299

8-bit Universal Shift/Storage Register (with 3-state outputs)

HITACHI

## Description

The HD74HC299 features multiplexed inputs/outputs to achieve full 8-bit data handling in a single 20-pin package. Due to the large output drive capability and 3-state feature, this device is ideally suited for interfacing with bus lines in a bus oriented system. Two function select inputs and two output control inputs are used to choose the mode of operation as listed in the function table. Synchronous parallel loading is accomplished by taking both function select lines $S_0$ and $S_1$ high. This places the 3-state outputs in a high impedance state, which permits data applied to the input/output lines to be clocked into the register. Reading out of the register can be done while the outputs are enabled in any mode. A direct overriding clear input is provided to clear the register whether the outputs are enabled or disabled.

## Features

- High Speed Operation
- High Output Current: Fanout of 15 LSTTL Loads
- Wide Operating Voltage: $V_{CC}$ = 2 to 6 V
- Low Input Current: 1 µA max
- Low Quiescent Supply Current: $I_{CC}$ (static) = 4 µA max (Ta = 25°C)

Hitachi semiconductor

## Function Table

| | Inputs | | | | | | | | | | | | | | | | Outputs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Function Select | | Output Control | | | Serial | | Inputs/Outputs | | | | | | | | | |
| Mode | Clear | $S_1$ | $S_0$ | $\overline{G}_1$† | $\overline{G}_2$† | Clock | $S_L$ | $S_R$ | $A/Q_A$ | $B/Q_B$ | $C/Q_C$ | $D/Q_D$ | $E/Q_E$ | $F/Q_F$ | $G/Q_G$ | $H/Q_H$ | $Q_A$' | $Q_H$' |
| Clear | L | X | L | L | L | X | X | X | L | L | L | L | L | L | L | L | L | L |
| | L | L | X | L | L | X | X | X | L | L | L | L | L | L | L | L | L | L |
| Hold | H | L | L | L | L | X | X | X | $Q_{A0}$ | $Q_{B0}$ | $Q_{C0}$ | $Q_{D0}$ | $Q_{E0}$ | $Q_{F0}$ | $Q_{G0}$ | $Q_{H0}$ | $Q_{A0}$ | $Q_{H0}$ |
| | H | X | X | L | L | L | X | X | $Q_{A0}$ | $Q_{B0}$ | $Q_{C0}$ | $Q_{D0}$ | $Q_{E0}$ | $Q_{F0}$ | $Q_{G0}$ | $Q_{H0}$ | $Q_{A0}$ | $Q_{H0}$ |
| Shift | H | L | H | L | L | ⎍⎍ | X | H | H | $Q_{An}$ | $Q_{Bn}$ | $Q_{Cn}$ | $Q_{Dn}$ | $Q_{En}$ | $Q_{Fn}$ | $Q_{Gn}$ | H | $Q_{Gn}$ |
| Right | H | L | H | L | L | ⎍⎍ | X | L | L | $Q_{An}$ | $Q_{Bn}$ | $Q_{Cn}$ | $Q_{Dn}$ | $Q_{En}$ | $Q_{Fn}$ | $Q_{Gn}$ | L | $Q_{Gn}$ |
| Shift | H | H | L | L | L | ⎍⎍ | H | X | $Q_{Bn}$ | $Q_{Cn}$ | $Q_{Dn}$ | $Q_{En}$ | $Q_{Fn}$ | $Q_{Gn}$ | $Q_{Hn}$ | H | $Q_{Bn}$ | H |
| Left | H | H | L | L | L | ⎍⎍ | L | X | $Q_{Bn}$ | $Q_{Cn}$ | $Q_{Dn}$ | $Q_{En}$ | $Q_{Fn}$ | $Q_{Gn}$ | $Q_{Hn}$ | L | $Q_{Bn}$ | L |
| Load | H | H | H | X | X | ⎍⎍ | X | X | a | b | c | d | e | f | g | h | a | h |

Notes: 1. a to h; the level of steady-state input at inputs A through H, respectively. These data are loaded into the flip-flop outputs are isolated from the input/output terminals.

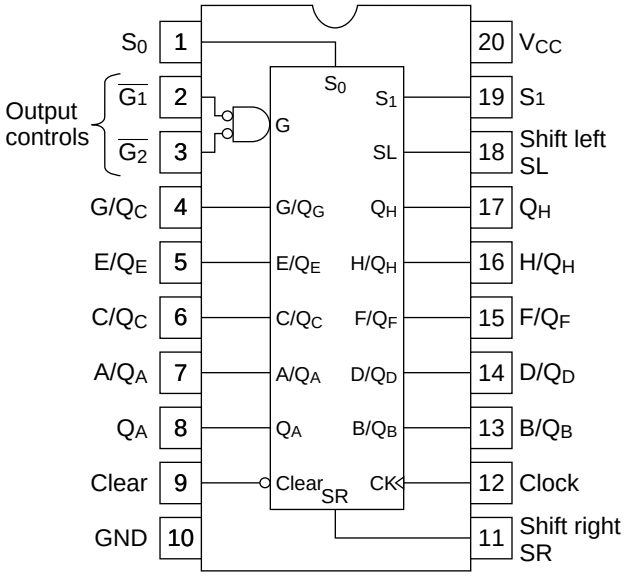
2. $Q_{A0}$ to $Q_{H0}$; the level of $Q_A$ through $Q_H$, respectively, before the indicated steady-state input conditions were established.

3. $Q_{An}$ to $Q_{Hn}$; the level of $Q_A$ through $Q_H$, respectively, before the most-recent ⎍⎍ transition of the clock.

4. † = ; When one or both output controls are high the eight input/output terminals are desabled to the high-impedance state, however, sequential operation or clearing of the register is not affected.

5. When clear is low, outputs of $Q_A$' and $Q_H$' are low, in spite of other inputs.

## Pin Arrangement

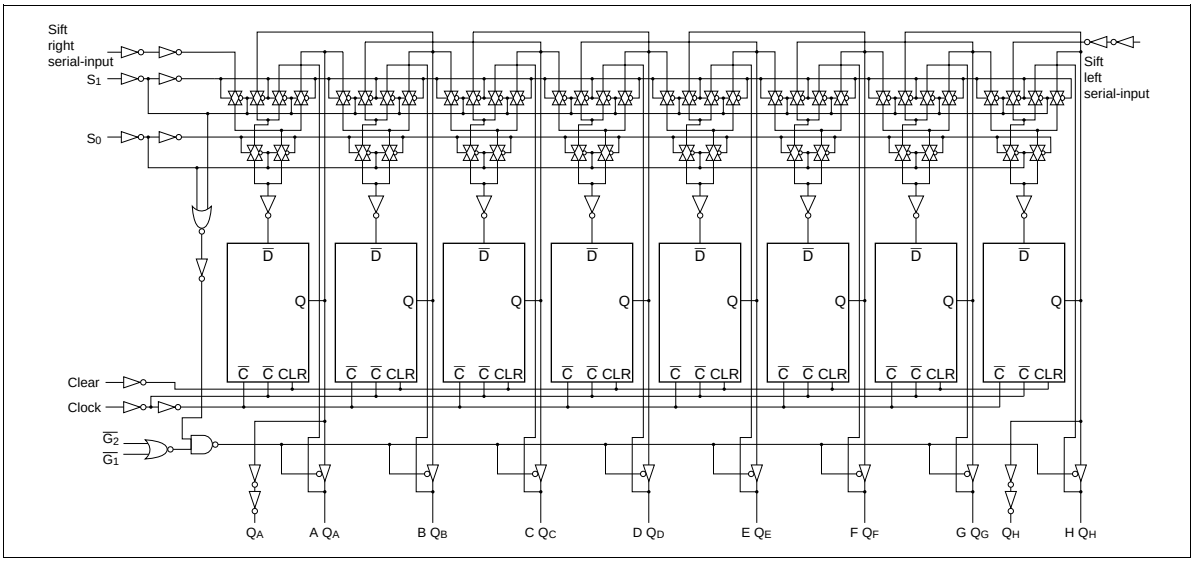



(Top view)

## Absolute Maximum Ratings

| Item | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | –0.5 to +7.0 | V |
| Input voltage | $V_{IN}$ | –0.5 to $V_{CC}$ + 0.5 | V |
| Output voltage | $V_{OUT}$ | –0.5 to $V_{CC}$ + 0.5 | V |
| Output current | $I_{OUT}$ | ±35 | mA |
| DC current drain per $V_{CC}$, GND | $I_{CC}$, $I_{GND}$ | ±75 | mA |
| DC input diode current | $I_{IK}$ | ±20 | mA |
| DC output diode current | $I_{OK}$ | ±20 | mA |
| Power dissipation per package | $P_T$ | 500 | mW |
| Storage temperature | Tstg | –65 to +150 | °C |

## Block Diagram



## DC Characteristics

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C Min | Typ | Max | Ta = –40 to +85°C Min | Max | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|
| Input voltage | $V_{IH}$ | 2.0 | 1.5 | — | — | 1.5 | — | V | | |
| | | 4.5 | 3.15 | — | — | 3.15 | — | | | |
| | | 6.0 | 4.2 | — | — | 4.2 | — | | | |
| | $V_{IL}$ | 2.0 | — | — | 0.5 | — | 0.5 | V | | |
| | | 4.5 | — | — | 1.35 | — | 1.35 | | | |
| | | 6.0 | — | — | 1.8 | — | 1.8 | | | |
| Output voltage | $V_{OH}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –20 µA |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | $Q_A$' & $Q_H$' | $I_{OH}$ = –4 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | Outputs | $I_{OH}$ = –5.2 mA |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | A/$Q_A$ thru | $I_{OH}$ = –6 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | H/$Q_H$ Outputs | $I_{OH}$ = –7.8 mA |
| | $V_{OL}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 µA |
| | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | $Q_A$' & $Q_H$' | $I_{OH}$ = 4 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | Outputs | $I_{OH}$ = 5.2 mA |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | A/$Q_A$ thru | $I_{OH}$ = 6 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | H/$Q_H$ Outputs | $I_{OH}$ = 7.8 mA |
| Off-state output current | $I_{OZ}$ | 6.0 | — | — | ±0.5 | — | ±5.0 | µA | Vin = $V_{IH}$ or $V_{IL}$, Vout = $V_{CC}$ or GND | |
| Input current | Iin | 6.0 | — | — | ±0.1 | — | ±1.0 | µA | Vin = $V_{CC}$ or GND | |
| Quiescent supply current | $I_{CC}$ | 6.0 | — | — | 4.0 | — | 40 | µA | Vin = $V_{CC}$ or GND, Iout = 0 µA | |

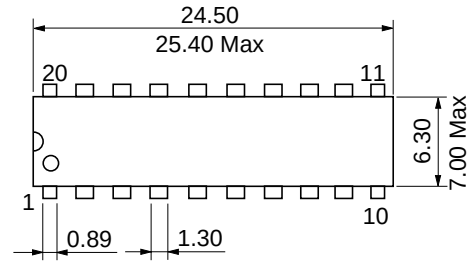
## AC Characteristics ($C_L$ = 50 pF, Input $t_r = t_f$ = 6 ns)

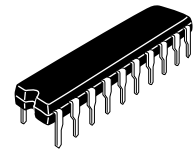
| | | | Ta = 25°C | | | Ta = –40 to +85°C | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Symbol** | **$V_{cc}$ (V)** | **Min** | **Typ** | **Max** | **Min** | **Max** | **Unit** | **Test Conditions** |
| Maximum clock frequency | $f_{max}$ | 2.0 | — | — | 5 | — | 4 | MHz | |
| | | 4.5 | — | — | 25 | — | 20 | | |
| | | 6.0 | — | — | 29 | — | 23 | | |
| Propagation delay time | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 190 | — | 240 | ns | Clock to $Q_A$' or $Q_H$' |
| | | 4.5 | — | — | 38 | — | 48 | | |
| | | 6.0 | — | — | 32 | — | 41 | | |
| | $t_{PHL}$ | 2.0 | — | — | 220 | — | 275 | ns | Clear to $Q_A$' or $Q_H$' |
| | | 4.5 | — | — | 44 | — | 55 | | |
| | | 6.0 | — | — | 37 | — | 47 | | |
| | $t_{PLH}$ $t_{PHL}$ | 2.0 | — | — | 190 | — | 240 | ns | Clock to $Q_A$ – $Q_H$ |
| | | 4.5 | — | — | 38 | — | 48 | | |
| | | 6.0 | — | — | 32 | — | 41 | | |
| | $t_{PHL}$ | 2.0 | — | — | 220 | — | 275 | ns | Clear to $Q_A$ – $Q_H$ |
| | | 4.5 | — | — | 44 | — | 55 | | |
| | | 6.0 | — | — | 37 | — | 47 | | |
| Output enable time | $t_{ZH}$ $t_{ZL}$ | 2.0 | — | — | 160 | — | 200 | ns | |
| | | 4.5 | — | — | 32 | — | 40 | | |
| | | 6.0 | — | — | 27 | — | 34 | | |
| Output disable time | $t_{HZ}$ $t_{LZ}$ | 2.0 | — | — | 160 | — | 200 | ns | |
| | | 4.5 | — | — | 32 | — | 40 | | |
| | | 6.0 | — | — | 27 | — | 34 | | |
| Setup time | $t_{su}$ | 2.0 | 100 | — | — | 125 | — | ns | Select |
| | | 4.5 | 20 | — | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Hold time | $t_h$ | 2.0 | 5 | — | — | 5 | — | ns | Select |
| | | 4.5 | 5 | — | — | 5 | — | | |
| | | 6.0 | 5 | — | — | 5 | — | | |
| Removal time | $t_{rem}$ | 2.0 | 50 | — | — | 65 | — | ns | Clear |
| | | 4.5 | 10 | — | — | 13 | — | | |
| | | 6.0 | 9 | — | — | 11 | — | | |
| Pulse width | $t_w$ | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | — | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |

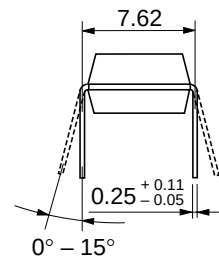
**AC Characteristics** ($C_L$ = 50 pF, Input $t_r$ = $t_f$ = 6 ns) (cont)

| | | | Ta = 25°C | | | Ta = –40 to +85°C | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Symbol** | **$V_{CC}$ (V)** | **Min** | **Typ** | **Max** | **Min** | **Max** | **Unit** | **Test Conditions** |
| Output rise/fall time | $t_{TLH}$ | 2.0 | — | — | 60 | — | 75 | ns | A/$Q_A$ thru H/$Q_H$ outputs |
| | $t_{THL}$ | 4.5 | — | — | 12 | — | 15 | | |
| | | 6.0 | — | — | 10 | — | 13 | | |
| | | 2.0 | — | — | 75 | — | 95 | ns | $Q_A$' & $Q_H$' outputs |
| | | 4.5 | — | — | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | Cin | — | — | 5 | 10 | — | 10 | pF | |

Unit: mm

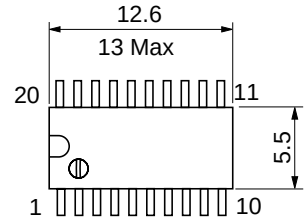


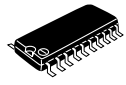



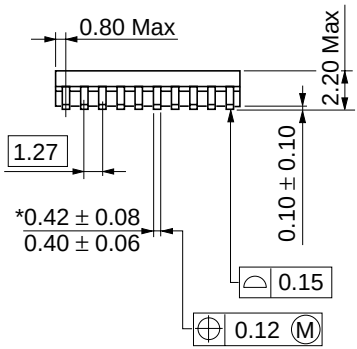


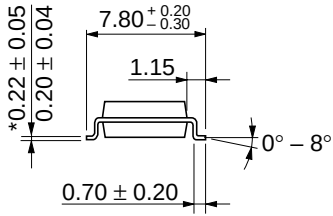

| | |
|---|---|
| Hitachi Code | DP-20N |
| JEDEC | — |
| EIAJ | Conforms |
| Weight (reference value) | 1.26 g |

Unit: mm



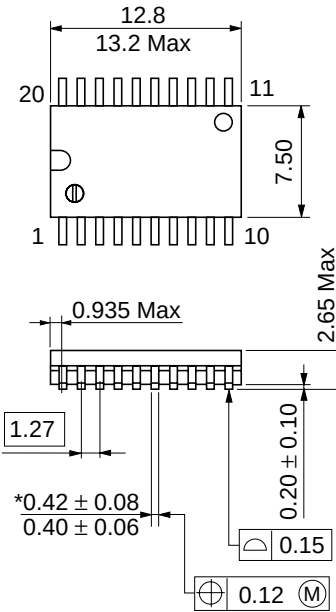


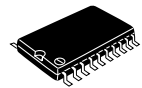



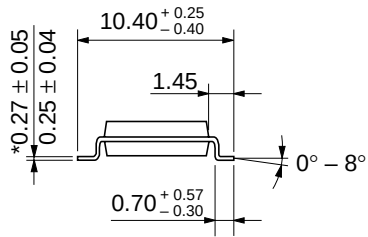

*Dimension including the plating thickness
Base material dimension

| | |
|---|---|
| Hitachi Code | FP-20DA |
| JEDEC | — |
| EIAJ | Conforms |
| Weight (reference value) | 0.31 g |

Unit: mm






*Dimension including the plating thickness
Base material dimension

| | |
|---|---|
| Hitachi Code | FP-20DB |
| JEDEC | Conforms |
| EIAJ | — |
| Weight (reference value) | 0.52 g |

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# HITACHI

**Hitachi, Ltd.**
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
NorthAmerica : http:semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia (Singapore) : http://www.has.hitachi.com.sg/grp3/sicd/index.htm
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Asia (HongKong) : http://www.hitachi.com.hk/eng/bo/grp3/index.htm
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

**For further information write to:**

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX