To all our customers

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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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# HD74HC670

## 4-by-4 Register File (with 3-state outputs)

ADE-205-521 (Z)
1st. Edition
Sep. 2000

## Description

The HD74HC670, 16-bit register file is organized as 4 words of 4 bits each and separate on-chip decoding is provided for addressing the four word locations to either write-in or retrieve data.

This permits simultaneous writing into one location and reading from another word location. Four data inputs are available which are used to supply the 4-bit word to be stored. Location of the word is determined by the write-address inputs A and B in conjunction with a write-enable signal. Data applied at the inputs should be in its true form. That is, if a high-level signal is desired from the output, a high-level is applied at the data input for that particular bit location. The latch inputs are arranged so that new data will be accepted only if both internal address gate inputs are high. When this condition exists, data at the D input is transferred to the latch output. When the write-enable input, ($G_W$) is high, the data inputs are inhibited and their levels can cuase no change in the information stored in the internal latches. When the read-enable input, ($G_R$) is high, the data outputs are inhibited and go into the high-impedance state. The individual address lines permit direct acquisition of data stored in any four of the latches. Four individual decoding gates are used to complete the address for reading a word. when the read address is made in conjunction with the read-enable signal, the word appears at the four outputs.

## Features

- High Speed Operation: $t_{pd}$ (Read Select to Q) = 21 ns typ ($C_L$ = 50 pF)
- 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)

## Function Table

| Write Inputs | | | Word | | | |
|---|---|---|---|---|---|---|
| $W_B$ | $W_A$ | $G_W$ | 0 | 1 | 2 | 3 |
| L | L | L | Q = D | $Q_0$ | $Q_0$ | $Q_0$ |
| L | H | L | $Q_0$ | Q = D | $Q_0$ | $Q_0$ |
| H | L | L | $Q_0$ | $Q_0$ | Q = D | $Q_0$ |
| H | H | L | $Q_0$ | $Q_0$ | $Q_0$ | Q = D |
| X | X | H | $Q_0$ | $Q_0$ | $Q_0$ | $Q_0$ |

| Read Inputs | | | Outputs | | | |
|---|---|---|---|---|---|---|
| $R_B$ | $R_A$ | $G_R$ | $Q_1$ | $Q_2$ | $Q_3$ | $Q_4$ |
| L | L | L | $W_0 B_1$ | $W_0 B_2$ | $W_0 B_3$ | $W_0 B_4$ |
| L | H | L | $W_1 B_1$ | $W_1 B_2$ | $W_1 B_3$ | $W_1 B_4$ |
| H | L | L | $W_2 B_1$ | $W_2 B_2$ | $W_2 B_3$ | $W_2 B_4$ |
| H | H | L | $W_3 B_1$ | $W_3 B_2$ | $W_3 B_3$ | $W_3 B_4$ |
| X | X | H | Z | Z | Z | Z |

H : high level

L : low level

X : irrelevant

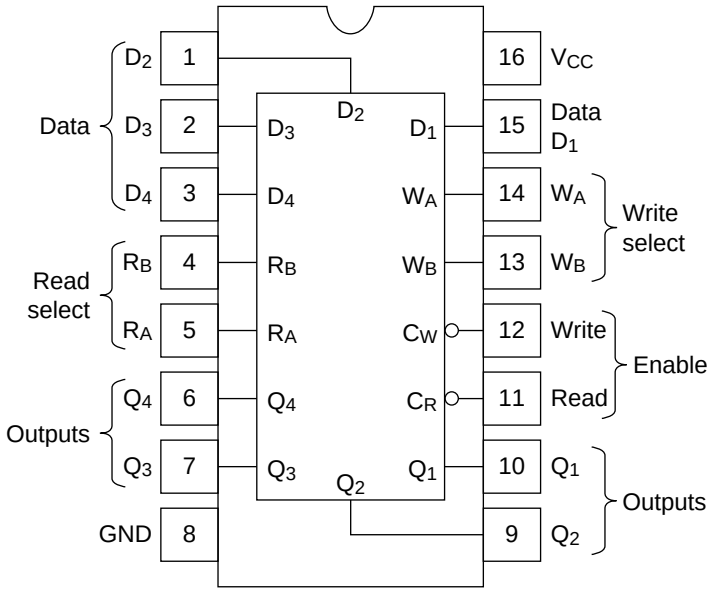
Z : high impedance (off)

(Q = D) : The four selected internal flip-flop outputs will assume the states applied to the four external data inputs.

$Q_0$ : The level of Q before the indicated input conditions were established.

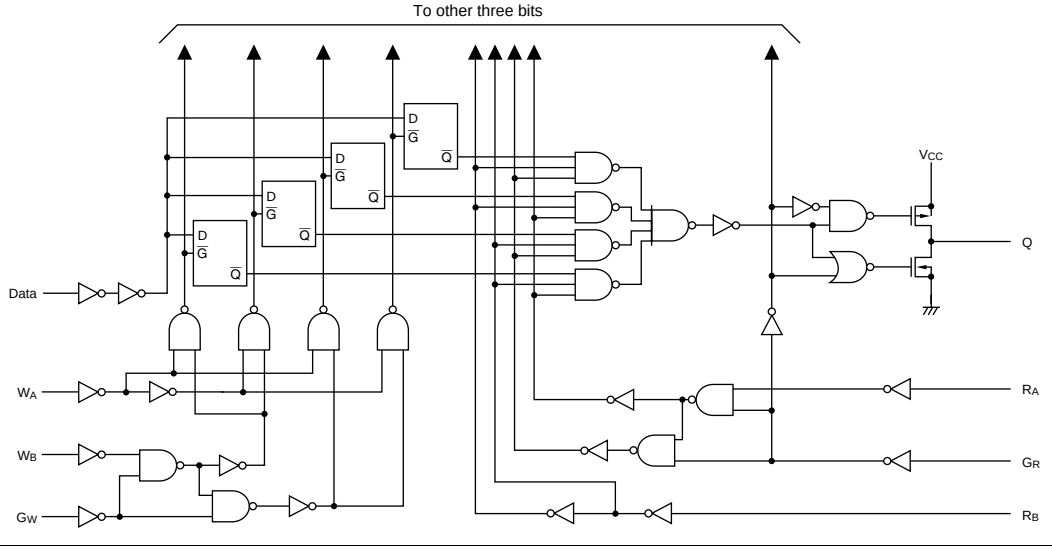
$W_0 B_1$ : The first bit of word 0, etc.

## Pin Arrangement




(Top view)

## Logic 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 | — | | $I_{OH}$ = –6 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | $I_{OH}$ = –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 | | $I_{OL}$ = 6 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | $I_{OL}$ = 7.8 mA |
| Off-state output current | $I_{OZ}$ | 6.0 | — | — | ±0.5 | — | ±5.0 | µA | Vin = $V_{IN}$ 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)

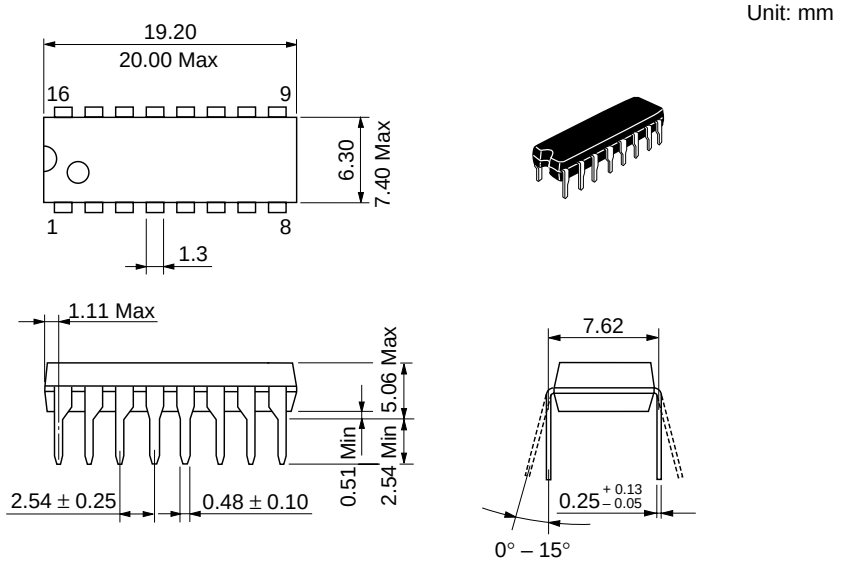
| | | | Ta = 25°C | | | Ta = –40 to +85°C | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Item** | **Symbol** | **$V_{cc}$ (V)** | **Min** | **Typ** | **Max** | **Min** | **Max** | **Unit** | **Test Conditions** |
| Propagation delay time | $t_{PLH}$ | 2.0 | — | — | 160 | — | 200 | ns | Read select to Q |
| | $t_{PHL}$ | 4.5 | — | 21 | 32 | — | 40 | | |
| | | 6.0 | — | — | 27 | — | 34 | | |
| | $t_{PLH}$ | 2.0 | — | — | 200 | — | 250 | ns | Write enable to Q |
| | $t_{PHL}$ | 4.5 | — | 24 | 40 | — | 50 | | |
| | | 6.0 | — | — | 34 | — | 43 | | |
| | $t_{PLH}$ | 2.0 | — | — | 150 | — | 190 | ns | Data to Q |
| | $t_{PHL}$ | 4.5 | — | 18 | 30 | — | 38 | | |
| | | 6.0 | — | — | 26 | — | 33 | | |
| Output enable time | $t_{ZH}$ | 2.0 | — | — | 150 | — | 190 | ns | |
| | $t_{ZL}$ | 4.5 | — | 18 | 30 | — | 38 | | |
| | | 6.0 | — | — | 26 | — | 33 | | |
| Output disable time | $t_{HZ}$ | 2.0 | — | — | 150 | — | 190 | ns | |
| | $t_{LZ}$ | 4.5 | — | 17 | 30 | — | 38 | | |
| | | 6.0 | — | — | 26 | — | 33 | | |
| Pulse width | $t_w$ | 2.0 | 80 | — | — | 100 | — | ns | |
| | | 4.5 | 16 | — | — | 20 | — | | |
| | | 6.0 | 14 | — | — | 17 | — | | |
| Setup time | $t_{su}$ | 2.0 | 60 | — | — | 75 | — | ns | Data to Write enable |
| | | 4.5 | 12 | 4 | — | 15 | — | | |
| | | 6.0 | 10 | — | — | 13 | — | | |
| | $t_{su}$ | 2.0 | 60 | — | — | 75 | — | ns | Write select to Write enable |
| | | 4.5 | 12 | — | — | 15 | — | | |
| | | 6.0 | 10 | — | — | 13 | — | | |
| Hold time | $t_h$ | 2.0 | 50 | — | — | 63 | — | ns | Write enable to Data |
| | | 4.5 | 10 | 6 | — | 13 | — | | |
| | | 6.0 | 9 | — | — | 11 | — | | |
| | | 2.0 | 50 | — | — | 63 | — | ns | Write enable to Write select |
| | | 4.5 | 10 | — | — | 13 | — | | |
| | | 6.0 | 9 | — | — | 11 | — | | |

**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** |
| Latch time for new | $t_{latch}$ | 2.5 | 100 | — | — | 125 | — | ns | |
| data | | 4.5 | 20 | — | — | 25 | — | | |
| | | 6.0 | 17 | — | — | 21 | — | | |
| Output rise/fall | $t_{TLH}$ | 2.0 | — | — | 75 | — | 95 | ns | |
| time | $t_{THL}$ | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | Cin | — | — | 5 | 10 | — | 10 | pF | |

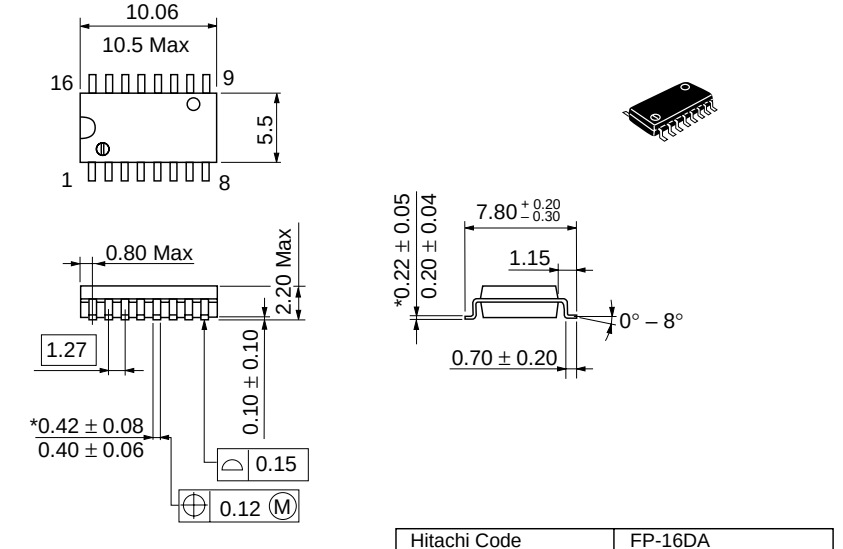
## Package Dimensions

Unit: mm




| | |
|---|---|
| Hitachi Code | DP-16 |
| JEDEC | Conforms |
| EIAJ | Conforms |
| Mass (reference value) | 1.07 g |

Unit: mm




*Dimension including the plating thickness
Base material dimension

| | |
|---|---|
| Hitachi Code | FP-16DA |
| JEDEC | — |
| EIAJ | Conforms |
| Mass (reference value) | 0.24 g |

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