

To all our customers

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

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# HD74HC76

## Dual J-K Flip-Flops (with Preset and Clear)



ADE-205-423 (Z)

1st. Edition

Sep. 2000






### Description

Each flip-flop has independent J, K, preset, clear, and clock inputs and Q and  $\bar{Q}$  outputs. This device is edge sensitive to the clock input and change state on the negative going transition of the clock pulse. Clear and preset are independent of the clock and accomplished by a low logic level on the corresponding input.

### Features

- High Speed Operation:  $t_{pd}$  (Clock to Q) = 21 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) = 2  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )

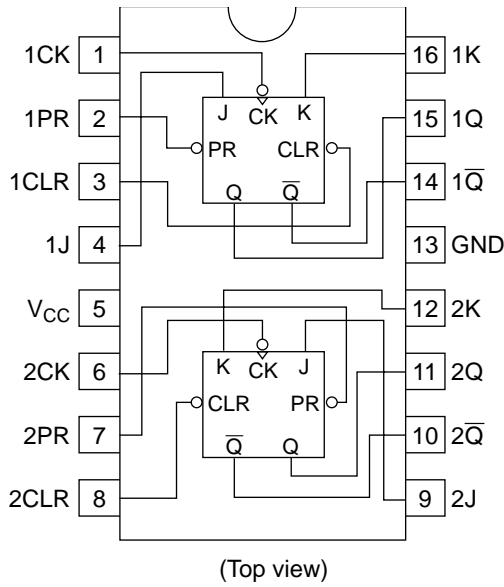
### Function Table

| Inputs |       |   |   |   | Outputs         |                 |
|--------|-------|---|---|---|-----------------|-----------------|
| Preset | Clear | Clock   | J | K | Q               | $\bar{Q}$       |
| L      | H     | X   | X | X | H               | L               |
| H      | L     | X   | X | X | L               | H               |
| L      | L     | X   | X | X | H* <sup>1</sup> | H* <sup>1</sup> |
| H      | H     |  | L | L | No change       |                 |
| H      | H     |  | L | H | L               | H               |
| H      | H     |  | H | L | H               | L               |
| H      | H     |  | H | H | Toggle          |                 |
| H      | H     | L   | X | X | No change       |                 |
| H      | H     | H   | X | X | No change       |                 |
| H      | H     |  | X | X | No change       |                 |

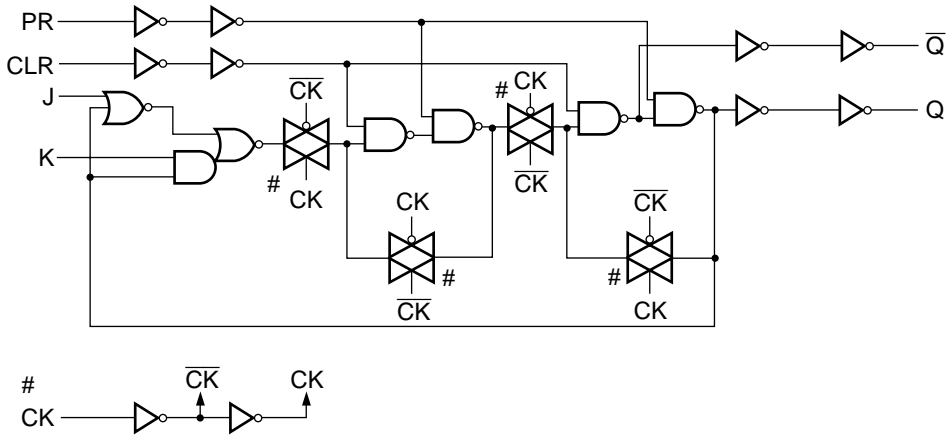
Note: 1. Q and  $\bar{Q}$  will remain HIGH as long as Preset and Clear are Low, but Q and  $\bar{Q}$  are unpredictable, if Preset and Clear go HIGH simultaneously.

# HD74HC76

## Pin Arrangement



## Block Diagram (1/2)



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                 | —         | —    | 2.0               | —    | 20                       | μA              | Vin = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA             |                           |

# HD74HC76

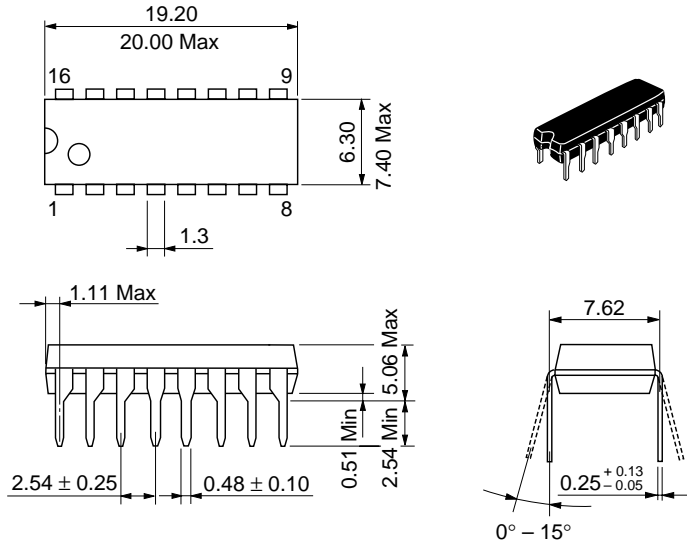
## AC Characteristics ( $C_L = 50$ pF, Input $t_r = t_f = 6$ ns)

| 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          | —                        | —   | 6                                  | —   | 5    | MHz             |                          |
|                         |           | 4.5          | —                        | —   | 30                                 | —   | 24   |                 |                          |
|                         |           | 6.0          | —                        | —   | 35                                 | —   | 28   |                 |                          |
| Propagation delay time  | $t_{PLH}$ | 2.0          | —                        | —   | 150                                | —   | 190  | ns              | Clock to Q or $\bar{Q}$  |
|                         |           | 4.5          | —                        | 21  | 30                                 | —   | 38   |                 |                          |
|                         |           | 6.0          | —                        | —   | 26                                 | —   | 33   |                 |                          |
|                         | $t_{PHL}$ | 2.0          | —                        | —   | 140                                | —   | 175  | ns              | Clear to Q or $\bar{Q}$  |
|                         |           | 4.5          | —                        | 17  | 28                                 | —   | 35   |                 |                          |
|                         |           | 6.0          | —                        | —   | 24                                 | —   | 30   |                 |                          |
|                         |           | 2.0          | —                        | —   | 140                                | —   | 175  |                 | Preset to Q or $\bar{Q}$ |
|                         |           | 4.5          | —                        | 19  | 28                                 | —   | 35   |                 |                          |
|                         |           | 6.0          | —                        | —   | 24                                 | —   | 30   |                 |                          |
| Pulse width             | $t_w$     | 2.0          | 80                       | —   | —                                  | 100 | —    | ns              | Preset, Clear, Clock     |
|                         |           | 4.5          | 16                       | 6   | —                                  | 20  | —    |                 |                          |
|                         |           | 6.0          | 14                       | —   | —                                  | 17  | —    |                 |                          |
| Setup time              | $t_{su}$  | 2.0          | 100                      | —   | —                                  | 125 | —    | ns              | J or K to Clock          |
|                         |           | 4.5          | 20                       | 4   | —                                  | 25  | —    |                 |                          |
|                         |           | 6.0          | 17                       | —   | —                                  | 21  | —    |                 |                          |
| Hold time               | $t_h$     | 2.0          | 0                        | —   | —                                  | 0   | —    | ns              | Clock to J or K          |
|                         |           | 4.5          | 0                        | -3  | —                                  | 0   | —    |                 |                          |
|                         |           | 6.0          | 0                        | —   | —                                  | 0   | —    |                 |                          |
| Removal time            | $t_{rem}$ | 2.0          | 100                      | —   | —                                  | 125 | —    | ns              | Preset or Clear to Clock |
|                         |           | 4.5          | 20                       | -2  | —                                  | 25  | —    |                 |                          |
|                         |           | 6.0          | 17                       | —   | —                                  | 21  | —    |                 |                          |
| Output rise/fall time   | $t_{TLH}$ | 2.0          | —                        | —   | 75                                 | —   | 95   | ns              |                          |
|                         |           | 4.5          | —                        | 5   | 15                                 | —   | 19   |                 |                          |
|                         | $t_{THL}$ | 6.0          | —                        | —   | 13                                 | —   | 16   |                 |                          |
| Input capacitance       | $C_{in}$  | —            | —                        | 5   | 10                                 | —   | 10   | pF              |                          |

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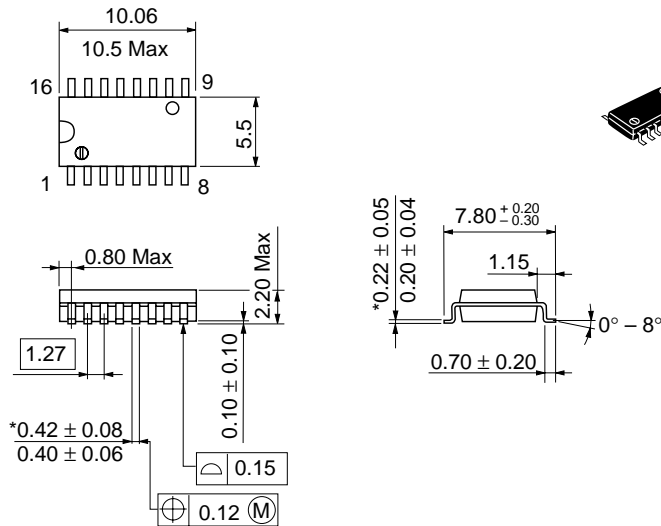
Package Dimensions

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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# 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/>  
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## 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) 585160

Hitachi Asia Ltd.  
Hitachi Tower  
16 Collyer Quay #20-00,  
Singapore 049318  
Tel : <65>-538-6533/538-8577  
Fax : <65>-538-6933/538-3877  
URL : <http://www.hitachi.com.sg>

Hitachi Asia Ltd.  
(Taipei Branch Office)  
4/F, No. 167, Tun Hwa North Road,  
Hung-Kuo Building,  
Taipei (105), Taiwan  
Tel : <886>-(2)-2718-3666  
Fax : <886>-(2)-2718-8180  
Telex : 23222 HAS-TP  
URL : <http://www.hitachi.com.tw>

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  
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