

# HD74BC374A

## Octal D Type Flip Flops With 3 State Outputs

REJ03D0284-0300Z  
 (Previous ADE-205-010A (Z))  
 Rev.3.00  
 Jul.16.2004

### Description




The HD74BC374A provides high drivability and operation equal to or better than high speed bipolar standard logic IC by using Bi-CMOS process. The device features low power dissipation that is about 1/5 of high speed bipolar logic IC, when the frequency is 10 MHz. The device has eight edge trigger D type flip flop with three state outputs in a 20 pin package. Data at the D inputs meeting set up requirements, are transferred to the Q outputs on positive going transitions of the clock input. When the latch enable goes low, data at the D inputs will be retained at the outputs until latch enable returns high again. When a high logic level is applied to the output control input, all outputs go to a high impedance state, regardless of what signals are present at the other inputs and the state of the storage elements.


### Features

- Input/Output are at high impedance state when power supply is off.
- Built in input pull up circuit can make input pins be open, when not used.
- TTL level input
- Wide operating temperature range  
 Ta = -40 to + 85°C
- Ordering Information

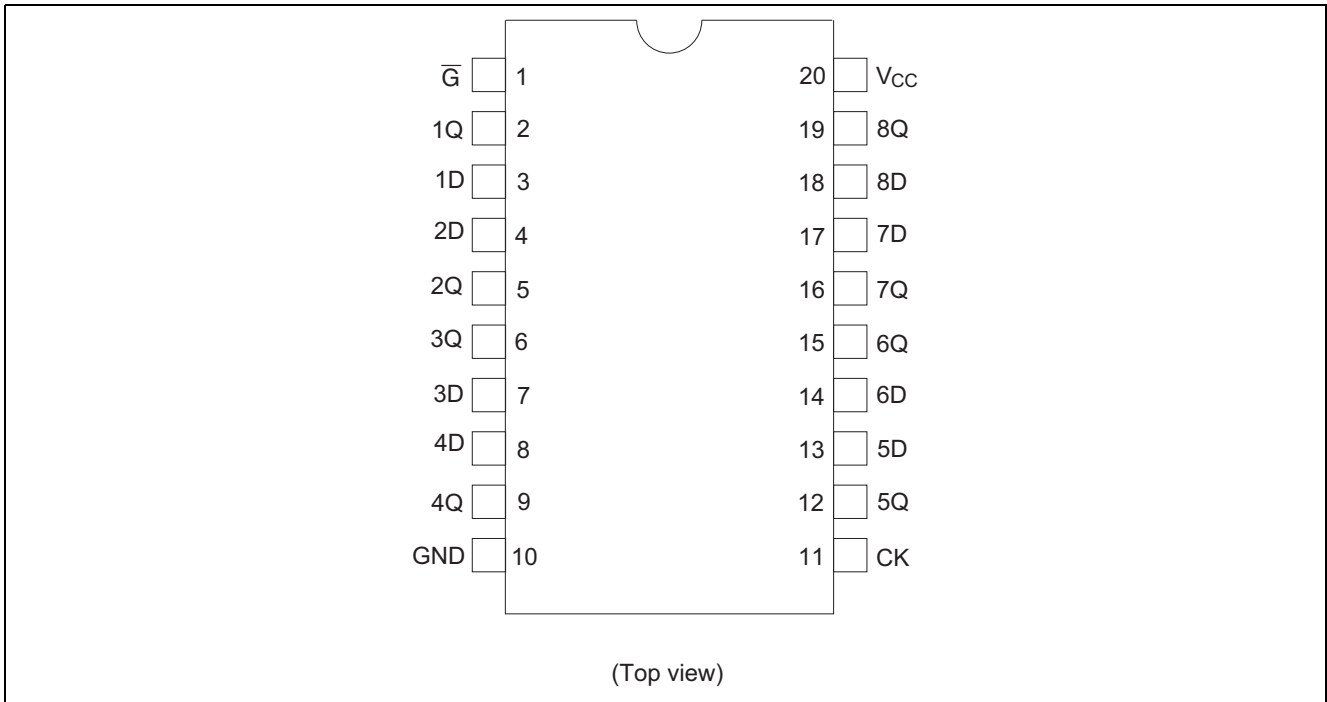
| Part Name      | Package Type       | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------------|--------------|----------------------|--------------------------------|
| HD74BC374AFPEL | SOP-20 pin (JEITA) | FP-20DAV     | FP                   | EL (2,000 pcs/reel)            |

### Function Table

| G | Inputs  |    | Output    |
|---|---|----|-----------|
|   | CK  | nD | nQ        |
| H | X   | X  | Z         |
| L |  | L  | L         |
| L |  | H  | H         |
| L |  | X  | No change |

H : High level  
 L : Low level  
 X : Immaterial  
 Z : High impedance  
 : Low to high transition

Pin Arrangement



Absolute Maximum Ratings

| Item                     | Symbol         | Rating       | Unit |
|--------------------------|----------------|--------------|------|
| Supply voltage           | $V_{CC}$       | -0.5 to +7.0 | V    |
| Input diode current      | $I_{IK}$       | ±30          | mA   |
| Input voltage            | $V_{IN}$       | -0.5 to +7.5 | V    |
| Output voltage           | $V_{OUT}$      | -0.5 to +7.5 | V    |
| Off state output voltage | $V_{OUT(off)}$ | -0.5 to +5.5 | V    |
| Storage temperature      | $T_{stg}$      | -65 to +150  | °C   |

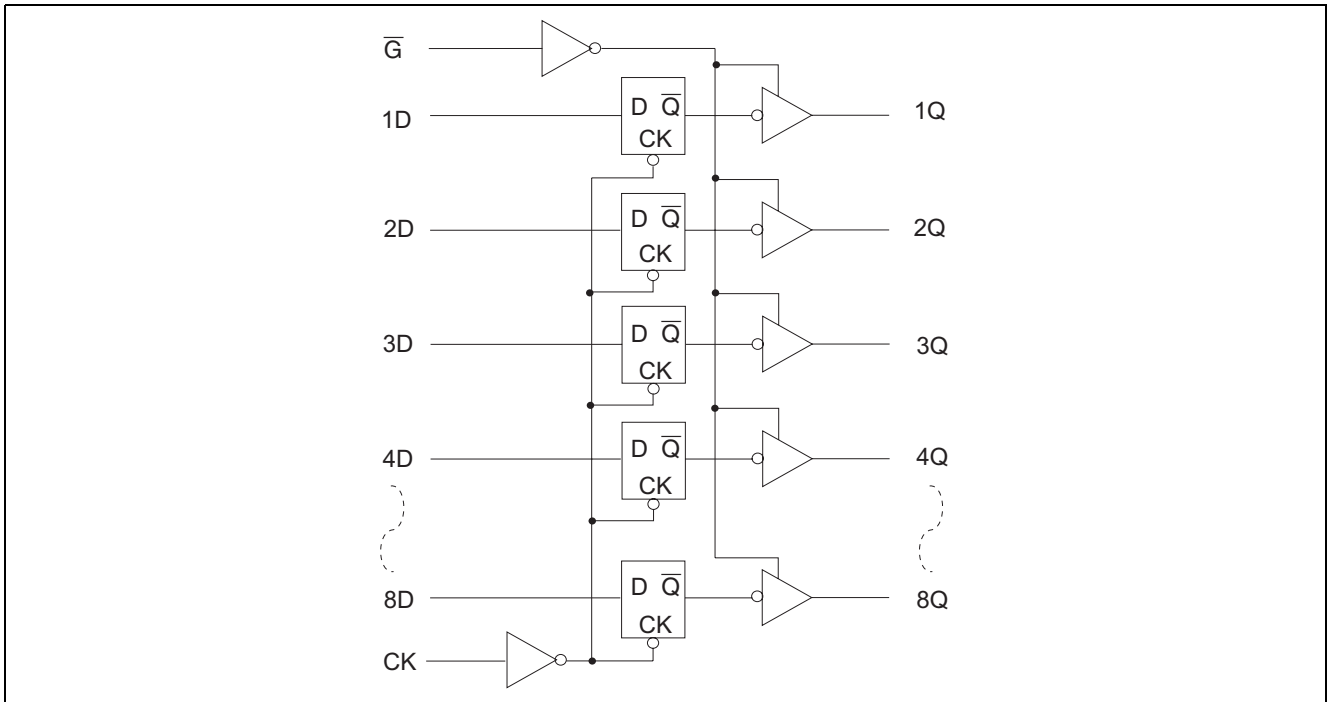
Note: 1. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

Recommended Operating Conditions

| Item                   | Symbol     | Min | Typ | Max      | Unit |
|------------------------|------------|-----|-----|----------|------|
| Supply voltage         | $V_{CC}$   | 4.5 | 5.0 | 5.5      | V    |
| Input voltage          | $V_{IN}$   | 0   | —   | $V_{CC}$ | V    |
| Output voltage         | $V_{OUT}$  | 0   | —   | $V_{CC}$ | V    |
| Operating temperature  | $T_{opr}$  | -40 | —   | 85       | °C   |
| Input rise/fall time*1 | $t_r, t_f$ | 0   | —   | 8        | ns/V |

Note: 1. This item guarantees maximum limit when one input switches.  
 Waveform: Refer to test circuit of switching characteristics.

Logic Diagram



**Electrical Characteristics** (Ta = -40°C to +85°C)

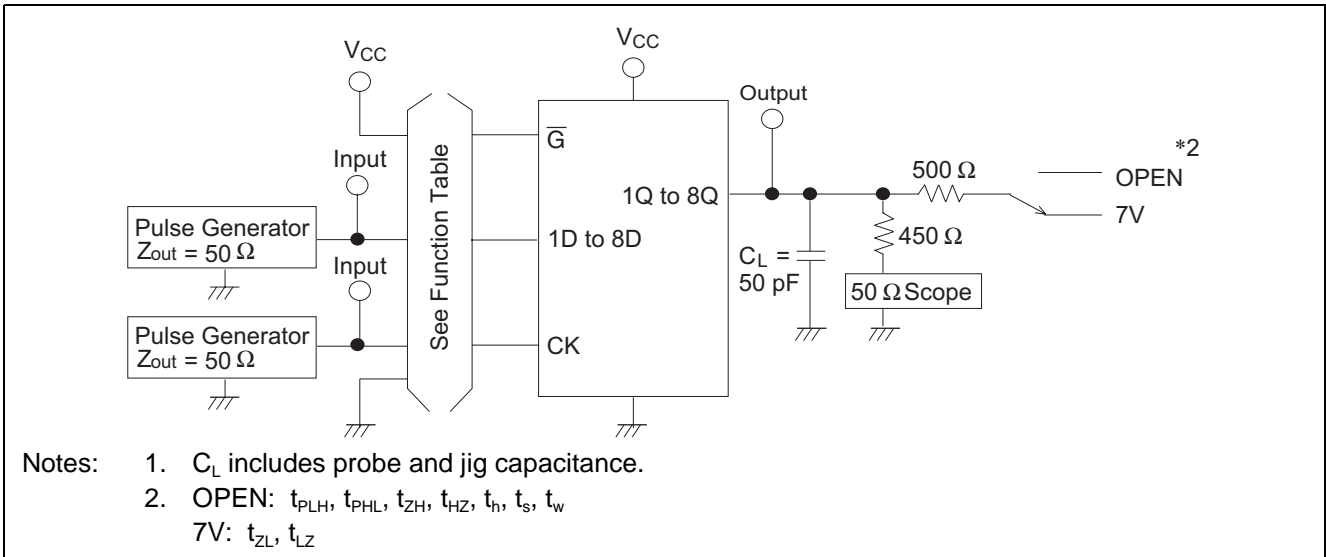
| Item                           | Symbol              | V <sub>CC</sub> (V) | Min  | Max  | Unit | Test Conditions                                   |
|--------------------------------|---------------------|---------------------|------|------|------|---|
| Input voltage                  | V <sub>IH</sub>     |                     | 2.0  | —    | V    |   |
|                                | V <sub>IL</sub>     |                     | —    | 0.8  | V    |   |
| Output voltage                 | V <sub>OH</sub>     | 4.5                 | 2.4  | —    | V    | I <sub>OH</sub> = -3 mA                           |
|                                |                     | 4.5                 | 2.0  | —    | V    | I <sub>OH</sub> = -15 mA                          |
|                                | V <sub>OL</sub>     | 4.5                 | —    | 0.4  | V    | I <sub>OL</sub> = 24 mA                           |
|                                |                     | 4.5                 | —    | 0.5  | V    | I <sub>OL</sub> = 48 mA                           |
| Input diode voltage            | V <sub>IK</sub>     | 4.5                 | —    | -1.2 | V    | I <sub>IN</sub> = -18 mA                          |
| Input current                  | I <sub>I</sub>      | 5.5                 | —    | 1.0  | μA   | V <sub>IN</sub> = 5.5 V                           |
|                                |                     | 5.5                 | —    | -250 | μA   | V <sub>IN</sub> = 0 V                             |
|                                |                     | 5.5                 | —    | 100  | μA   | V <sub>IN</sub> = 7.0 V                           |
| Short circuit output current*1 | I <sub>OS</sub>     | 5.5                 | -100 | -225 | mA   | V <sub>IN</sub> = 0 or 5.5 V                      |
| Off state output current       | I <sub>OZH</sub>    | 5.5                 | —    | 50   | μA   | V <sub>O</sub> = 2.7 V                            |
|                                | I <sub>OZL</sub>    | 5.5                 | —    | -50  | μA   | V <sub>O</sub> = 0.5 V                            |
| Supply current                 | I <sub>CCL</sub>    | 5.5                 | —    | 29.5 | mA   | V <sub>IN</sub> = 0 or 5.5 V<br>All output is "L" |
|                                | I <sub>CCH</sub>    | 5.5                 | —    | 2.5  | mA   | V <sub>IN</sub> = 0 or 5.5 V<br>All output is "H" |
|                                | I <sub>CCZ</sub>    | 5.5                 | —    | 2.5  | mA   | V <sub>IN</sub> = 0 or 5.5 V<br>All output is "Z" |
|                                | I <sub>CCT</sub> *2 | 5.5                 | —    | 1.5  | mA   | V <sub>IN</sub> = 3.4 or 0.5 V                    |

- Notes : 1. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.  
 2. When input by the TTL level, it shows I<sub>CC</sub> increase at per one input pin.

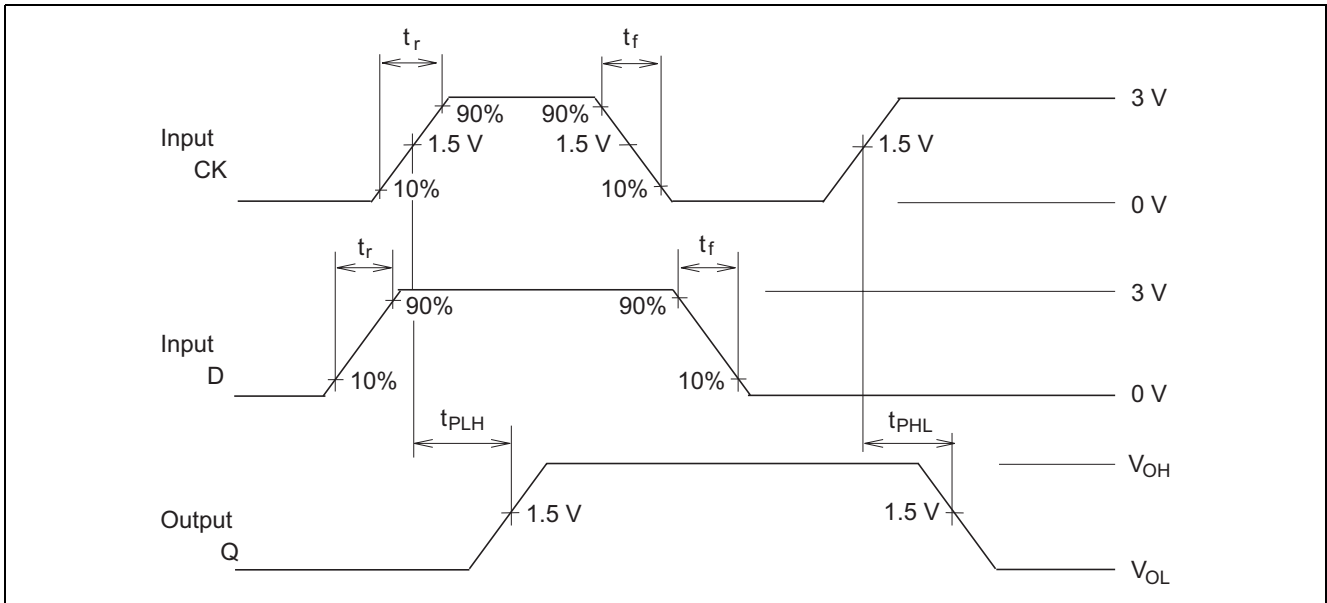
**Switching Test Method** (C<sub>L</sub> = 50 pF)

| Item                             | Symbol             | Ta = 25°C<br>V <sub>CC</sub> = 5.0 V |     | Ta = -40 to 85°C<br>V <sub>CC</sub> = 5.0 V ±10% |      | Unit | Test Conditions  |  |
|----------------------------------|--------------------|--------------------------------------|-----|--|------|------|------------------|--|
|                                  |                    | Min                                  | Max | Min  | Max  |      |                  |  |
| Propagation delay time<br>CK → Q | t <sub>PLH</sub>   | 3.0                                  | 8.0 | 3.0  | 10.0 | ns   | See under figure |  |
|                                  | t <sub>PHL</sub>   | 3.0                                  | 8.0 | 3.0  | 10.0 |      |                  |  |
| Output enable time               | t <sub>ZH</sub>    | 3.0                                  | 9.0 | 3.0  | 11.0 | ns   |                  |  |
|                                  | t <sub>ZL</sub>    | 3.0                                  | 9.0 | 3.0  | 11.0 |      |                  |  |
| Output disable time              | t <sub>HZ</sub>    | 3.0                                  | 8.0 | 3.0  | 10.0 | ns   |                  |  |
|                                  | t <sub>LZ</sub>    | 3.0                                  | 8.0 | 3.0  | 10.0 |      |                  |  |
| Setup time                       | t <sub>s</sub> (H) | 2.0                                  | —   | 2.0  | —    | ns   |                  |  |
|                                  | t <sub>s</sub> (L) | 2.0                                  | —   | 2.0  | —    |      |                  |  |
| Hold time                        | t <sub>h</sub> (H) | 2.0                                  | —   | 2.0  | —    | ns   |                  |  |
|                                  | t <sub>h</sub> (L) | 2.0                                  | —   | 2.0  | —    |      |                  |  |
| Pulse width                      | t <sub>w</sub> (H) | 6.0                                  | —   | 6.0  | —    | ns   |                  |  |
|                                  | t <sub>w</sub> (L) | 6.0                                  | —   | 6.0  | —    |      |                  |  |
| Input capacitance                | C <sub>IN</sub>    | 3.0(Typ)                             |     | —  |      | pF   |                  | V <sub>IN</sub> = V <sub>CC</sub> or GND |
| Output capacitance               | C <sub>O</sub>     | 15.0(Typ)                            |     | —  |      | pF   |                  | V <sub>O</sub> = V <sub>CC</sub> or GND  |

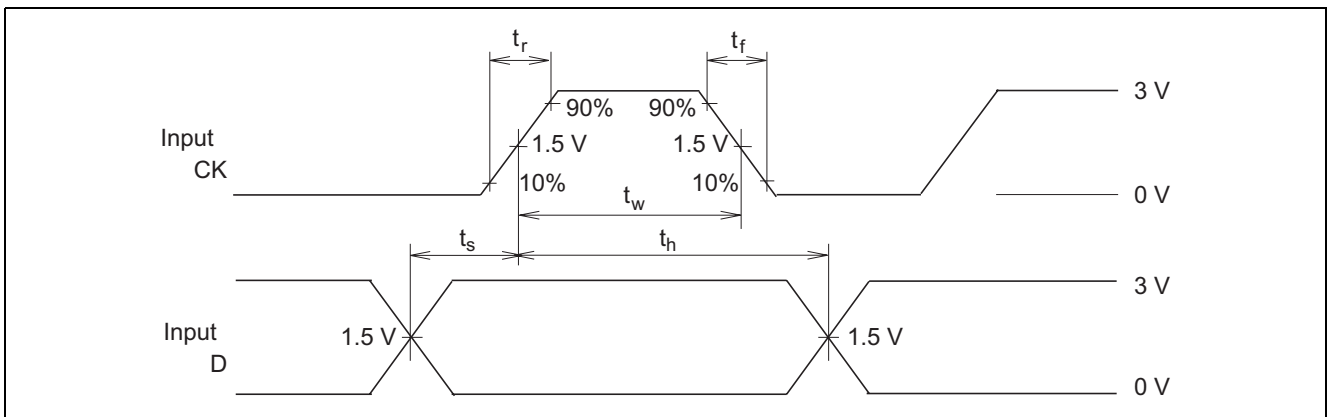
Test Circuit



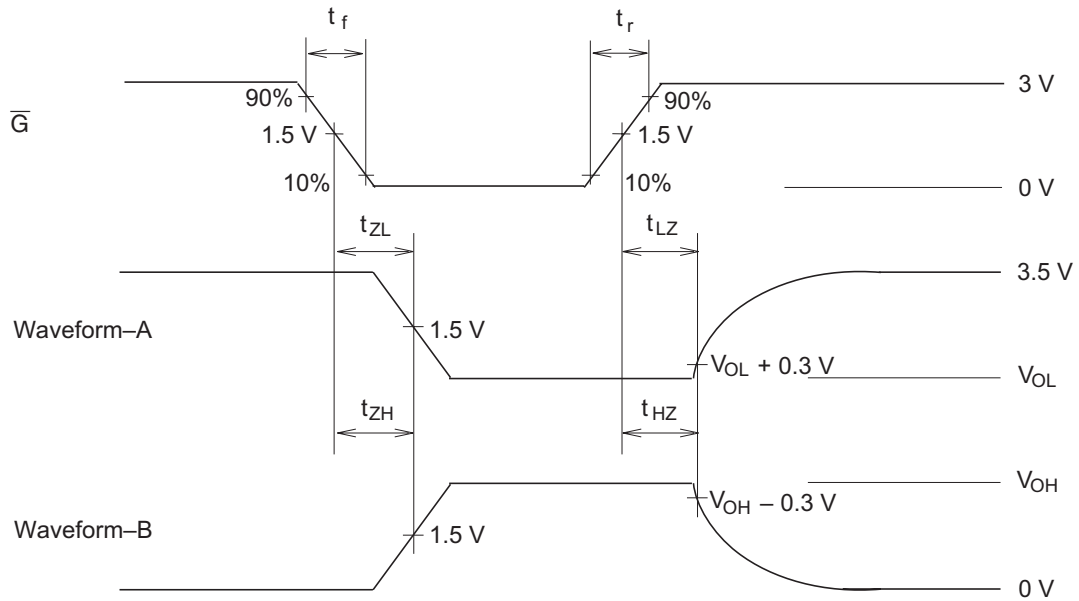
Waveforms-1



Waveforms-2



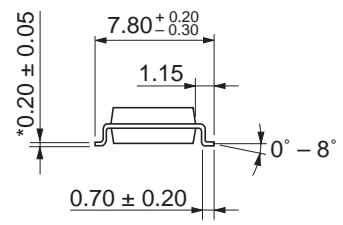
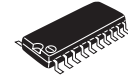
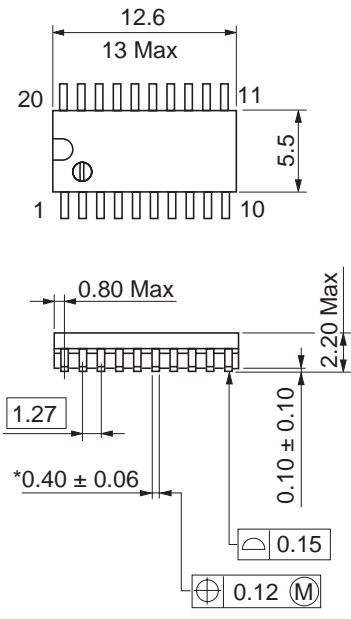
Waveforms-3



- Notes:
1.  $t_r = 2.5 \text{ ns}$ ,  $t_f = 2.5 \text{ ns}$
  2. Input waveform: PRR = 1 MHz, duty cycle 50%
  3. Waveform-A shows input conditions such that the output is "L" level when enable by the output control.
  4. Waveform-B shows input conditions such that the output is "H" level when enable by the output control.

Package Dimensions

As of January, 2003  
Unit: mm



\*Ni/Pd/Au plating

|                        |          |
|------------------------|----------|
| Package Code           | FP-20DAV |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 0.31 g   |



**Renesas Technology Corp.** Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

---

Keep safety first in your circuit designs!

1. Renesas Technology Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corp. product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corp. or a third party.
  2. Renesas Technology Corp. assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
  3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corp. without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor for the latest product information before purchasing a product listed herein.  
The information described here may contain technical inaccuracies or typographical errors.  
Renesas Technology Corp. assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.  
Please also pay attention to information published by Renesas Technology Corp. by various means, including the Renesas Technology Corp. Semiconductor home page (<http://www.renesas.com>).
  4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corp. assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
  5. Renesas Technology Corp. semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corp. or an authorized Renesas Technology Corp. product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
  6. The prior written approval of Renesas Technology Corp. is necessary to reprint or reproduce in whole or in part these materials.
  7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.  
Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
  8. Please contact Renesas Technology Corp. for further details on these materials or the products contained therein.
- 



**RENESAS SALES OFFICES**

<http://www.renesas.com>

**Renesas Technology America, Inc.**

450 Holger Way, San Jose, CA 95134-1368, U.S.A  
Tel: <1> (408) 382-7500 Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited.**

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, United Kingdom  
Tel: <44> (1628) 585 100, Fax: <44> (1628) 585 900

**Renesas Technology Europe GmbH**

Dornacher Str. 3, D-85622 Feldkirchen, Germany  
Tel: <49> (89) 380 70 0, Fax: <49> (89) 929 30 11

**Renesas Technology Hong Kong Ltd.**

7/F., North Tower, World Finance Centre, Harbour City, Canton Road, Hong Kong  
Tel: <852> 2265-6688, Fax: <852> 2375-6836

**Renesas Technology Taiwan Co., Ltd.**

FL 10, #99, Fu-Hsing N. Rd., Taipei, Taiwan  
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

**Renesas Technology (Shanghai) Co., Ltd.**

26/F., Ruijin Building, No.205 Maoming Road (S), Shanghai 200020, China  
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

**Renesas Technology Singapore Pte. Ltd.**

1, Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632  
Tel: <65> 6213-0200, Fax: <65> 6278-8001