

# HD74AC374/HD74ACT374

## Octal D-Type Flip-Flops with 3-State Output

REJ03D0274-0200Z  
(Previous ADE-205-395 (Z))  
Rev.2.00  
Jul.16.2004

### Description

The HD74AC374/HD74ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ( $\overline{OE}$ ) are common to all flip-flops.

### Features

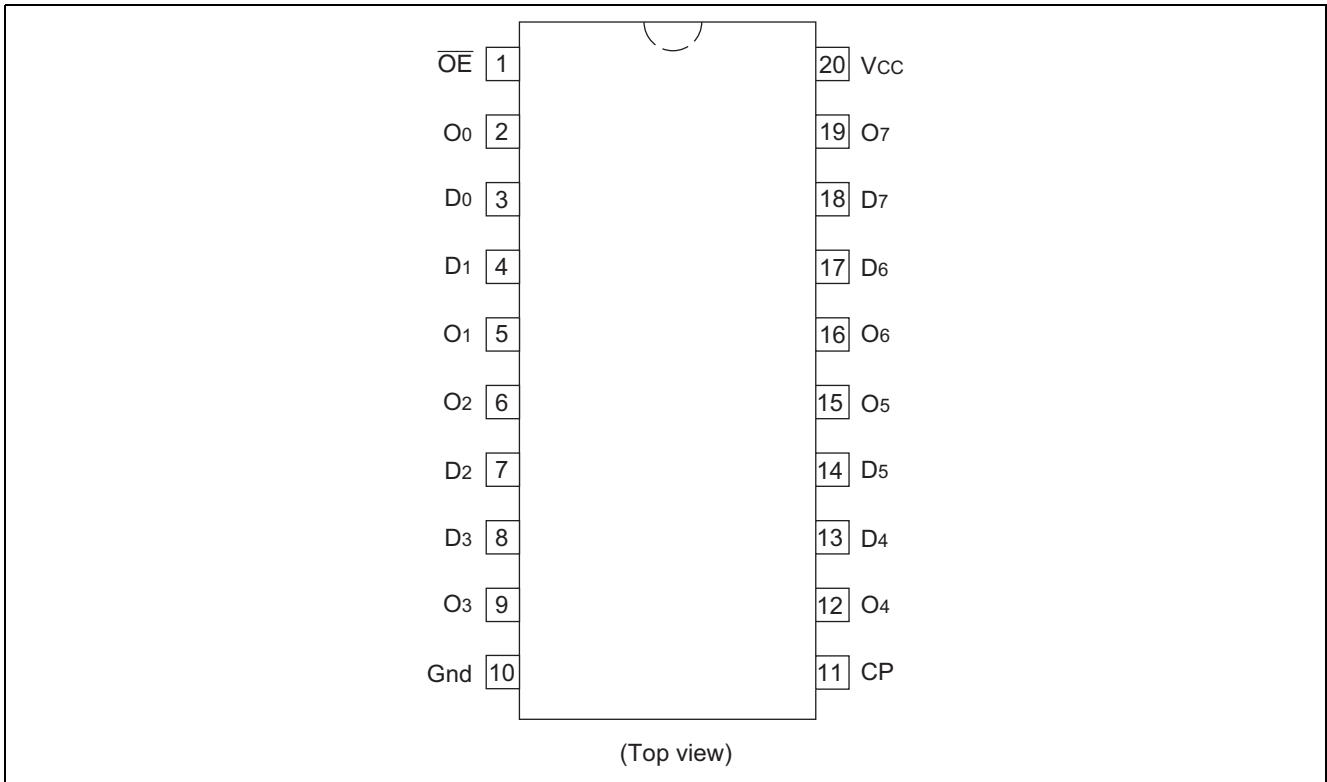
- Buffered Positive Edge-Triggered Clock
- 3-State Outputs for Bus-Oriented Applications
- Outputs Source/Sink 24 mA
- See HD74AC273/HD74ACT273 for Reset Version
- See HD74AC373/HD74ACT373 for Transparent Latch Version
- See HD74AC574/HD74ACT574 for Broadside Pinout Version
- See HD74AC564/HD74ACT564 for Broadside
- Pinout Version with Inverted Outputs
- HD74ACT374 has TTL-Compatible Inputs
- Ordering Information: Ex. HD74AC374

| Part Name     | Package Type       | Package Code   | Package Abbreviation | Taping Abbreviation (Quantity) |
|---------------|--------------------|----------------|----------------------|--------------------------------|
| HD74AC374P    | DIP-20 pin         | DP-20N, -20NEV | P                    | —                              |
| HD74AC374FPEL | SOP-20 pin (JEITA) | FP-20DAV       | FP                   | EL (2,000 pcs/reel)            |
| HD74AC374RPEL | SOP-20 pin (JEDEC) | FP-20DBV       | RP                   | EL (1,000 pcs/reel)            |
| HD74AC374TELL | TSSOP-20 pin       | TTP-20DAV      | T                    | ELL (2,000 pcs/reel)           |

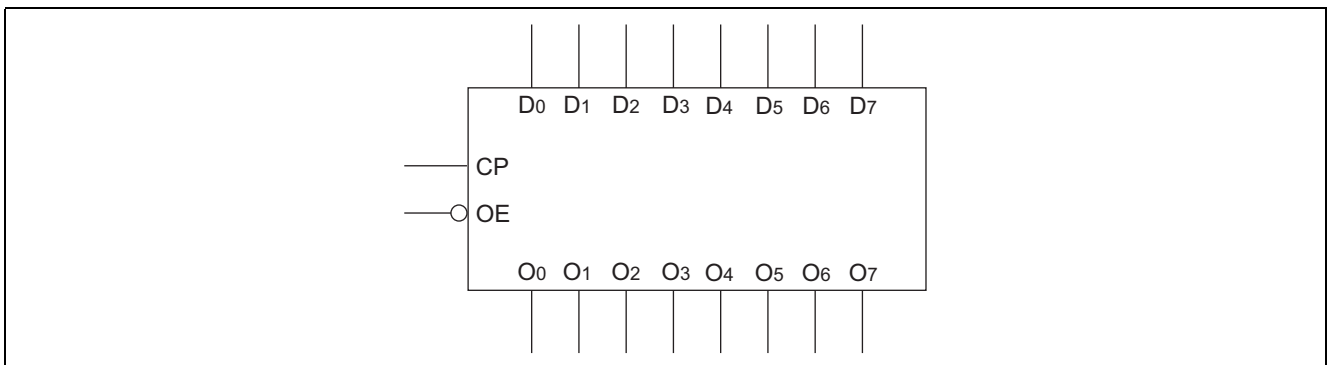
Notes: 1. Please consult the sales office for the above package availability.

2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

## Pin Arrangement



## Logic Symbol





## Pin Names


- D<sub>0</sub> – D<sub>7</sub>      Data Inputs
- CP              Clock Pulse Input
- $\overline{OE}$          3-State Output Enable Input
- O<sub>0</sub> – O<sub>7</sub>       3-State Outputs

## Functional Description

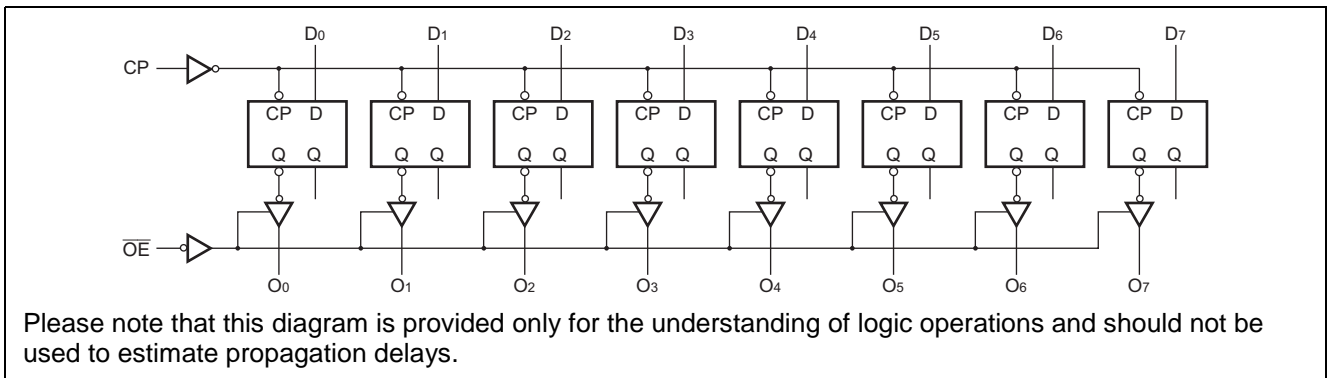
The HD74AC374/HD74ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-state true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the Low-to-High Clock (CP) transition. With the Output Enable ( $\overline{OE}$ ) Low, the contents of the eight flip-flops are available at the outputs. When the  $\overline{OE}$  is High, the outputs go to the high impedance state. Operation of the  $\overline{OE}$  input does not affect the state of the flip-flops.

**Truth Table**

| Inputs |   |                 | Outputs |
|--------|---|-----------------|---------|
| $D_n$  | CP  | $\overline{OE}$ | $O_n$   |
| H      |  | L               | H       |
| L      |  | L               | L       |
| X      | X   | H               | Z       |

H : High Voltage Level  
 L : Low Voltage Level  
 X : Immaterial  
 Z : High Impedance  
 : Low-to-High Transition

**Logic Diagram**



**Absolute Maximum Ratings**

| Item   | Symbol            | Ratings              | Unit        | Condition           |
|--|-------------------|----------------------|-------------|---------------------|
| Supply voltage                               | $V_{CC}$          | -0.5 to 7            | V           |                     |
| DC input diode current                       | $I_{IK}$          | -20                  | mA          | $V_I = -0.5V$       |
|  |                   | 20                   | mA          | $V_I = V_{CC}+0.5V$ |
| DC input voltage                             | $V_I$             | -0.5 to $V_{CC}+0.5$ | V           |                     |
| DC output diode current                      | $I_{OK}$          | -50                  | mA          | $V_O = -0.5V$       |
|  |                   | 50                   | mA          | $V_O = V_{CC}+0.5V$ |
| DC output voltage                            | $V_O$             | -0.5 to $V_{CC}+0.5$ | V           |                     |
| DC output source or sink current             | $I_O$             | $\pm 50$             | mA          |                     |
| DC $V_{CC}$ or ground current per output pin | $I_{CC}, I_{GND}$ | $\pm 50$             | mA          |                     |
| Storage temperature                          | $T_{stg}$         | -65 to +150          | $^{\circ}C$ |                     |

**Recommended Operating Conditions: HD74AC374**

| Item  | Symbol     | Ratings       | Unit        | Condition        |
|---|------------|---------------|-------------|------------------|
| Supply voltage  | $V_{CC}$   | 2 to 6        | V           |                  |
| Input and Output voltage  | $V_I, V_O$ | 0 to $V_{CC}$ | V           |                  |
| Operating temperature   | $T_a$      | -40 to +85    | $^{\circ}C$ |                  |
| Input rise and fall time<br>(except Schmitt inputs)<br>$V_{IN}$ 30% to 70% $V_{CC}$ | tr, tf     | 8             | ns/V        | $V_{CC} = 3.0V$  |
|   |            |               |             | $V_{CC} = 4.5 V$ |
|   |            |               |             | $V_{CC} = 5.5 V$ |

## DC Characteristics: HD74AC374

| Item                     | Symbol                  | V <sub>CC</sub> (V) | Ta = 25°C |       |      | Ta = -40 to +85°C |      | Unit | Condition   |  |                          |
|--------------------------|-------------------------|---------------------|-----------|-------|------|-------------------|------|------|---|--|--------------------------|
|                          |                         |                     | min.      | typ.  | max. | min.              | max. |      |   |  |                          |
| Input Voltage            | V <sub>IH</sub>         | 3.0                 | 2.1       | 1.5   | —    | 2.1               | —    | V    | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V                               |  |                          |
|                          |                         | 4.5                 | 3.15      | 2.25  | —    | 3.15              | —    |      |   |  |                          |
|                          |                         | 5.5                 | 3.85      | 2.75  | —    | 3.85              | —    |      |   |  |                          |
|                          | V <sub>IL</sub>         | 3.0                 | —         | 1.50  | 0.9  | —                 | 0.9  |      | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V                               |  |                          |
|                          |                         | 4.5                 | —         | 2.25  | 1.35 | —                 | 1.35 |      |   |  |                          |
|                          |                         | 5.5                 | —         | 2.75  | 1.65 | —                 | 1.65 |      |   |  |                          |
| Output voltage           | V <sub>OH</sub>         | 3.0                 | 2.9       | 2.99  | —    | 2.9               | —    | V    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OUT</sub> = -50 μA |  |                          |
|                          |                         | 4.5                 | 4.4       | 4.49  | —    | 4.4               | —    |      |   |  |                          |
|                          |                         | 5.5                 | 5.4       | 5.49  | —    | 5.4               | —    |      |   |  |                          |
|                          |                         | 3.0                 | 2.58      | —     | —    | 2.48              | —    |      |   | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>   | I <sub>OH</sub> = -12 mA |
|                          |                         | 4.5                 | 3.94      | —     | —    | 3.80              | —    |      |   |  | I <sub>OH</sub> = -24 mA |
|                          |                         | 5.5                 | 4.94      | —     | —    | 4.80              | —    |      |   |  | I <sub>OH</sub> = -24 mA |
|                          | V <sub>OL</sub>         | 3.0                 | —         | 0.002 | 0.1  | —                 | 0.1  | V    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OUT</sub> = 50 μA  |  |                          |
|                          |                         | 4.5                 | —         | 0.001 | 0.1  | —                 | 0.1  |      |   |  |                          |
|                          |                         | 5.5                 | —         | 0.001 | 0.1  | —                 | 0.1  |      |   |  |                          |
|                          |                         | 3.0                 | —         | —     | 0.32 | —                 | 0.37 |      |   | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>   | I <sub>OL</sub> = 12 mA  |
|                          |                         | 4.5                 | —         | —     | 0.32 | —                 | 0.37 |      |   |  | I <sub>OL</sub> = 24 mA  |
|                          |                         | 5.5                 | —         | —     | 0.32 | —                 | 0.37 |      |   |  | I <sub>OL</sub> = 24 mA  |
|                          | Input leakage current   | I <sub>IN</sub>     | 5.5       | —     | —    | ±0.1              | —    | ±1.0 | μA  | V <sub>IN</sub> = V <sub>CC</sub> or GND   |                          |
|                          | 3 State current         | I <sub>OZ</sub>     | 5.5       | —     | —    | ±0.5              | —    | ±5.0 | μA  | V <sub>IN(OE)</sub> = V <sub>IL</sub> , V <sub>IH</sub><br>V <sub>IN</sub> = V <sub>CC</sub> or GND<br>V <sub>OUT</sub> = V <sub>CC</sub> or GND |                          |
|                          | Dynamic output current* | I <sub>OLD</sub>    | 5.5       | —     | —    | —                 | 86   | —    | mA  | V <sub>OLD</sub> = 1.1 V   |                          |
| I <sub>OHD</sub>         |                         | 5.5                 | —         | —     | —    | -75               | —    | mA   | V <sub>OHD</sub> = 3.85 V   |  |                          |
| Quiescent supply current | I <sub>CC</sub>         | 5.5                 | —         | —     | 8.0  | —                 | 80   | μA   | V <sub>IN</sub> = V <sub>CC</sub> or ground                                       |  |                          |

\*Maximum test duration 2.0 ms, one output loaded at a time.

## Recommended Operating Conditions: HD74ACT374

| Item  | Symbol                          | Ratings              | Unit | Condition  |
|---|---------------------------------|----------------------|------|--|
| Supply voltage  | V <sub>CC</sub>                 | 2 to 6               | V    |  |
| Input and output voltage  | V <sub>I</sub> , V <sub>O</sub> | 0 to V <sub>CC</sub> | V    |  |
| Operating temperature   | Ta                              | -40 to +85           | °C   |  |
| Input rise and fall time<br>(except Schmitt inputs)<br>V <sub>IN</sub> 0.8 to 2.0 V | tr, tf                          | 8                    | ns/V | V <sub>CC</sub> = 4.5V<br>V <sub>CC</sub> = 5.5V |

**DC Characteristics: HD74ACT374**

| Item                           | Symbol           | V <sub>CC</sub> (V) | Ta = 25°C       |       |      | Ta = -40 to +85°C |      | Unit | Condition   |  |                          |    |  |
|--------------------------------|------------------|---------------------|-----------------|-------|------|-------------------|------|------|---|--|--------------------------|----|--|
|                                |                  |                     | min.            | typ.  | max. | min.              | max. |      |   |  |                          |    |  |
| Input voltage                  | V <sub>IH</sub>  | 4.5                 | 2.0             | 1.5   | —    | 2.0               | —    | V    | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> -0.1 V                                |  |                          |    |  |
|                                |                  | 5.5                 | 2.0             | 1.5   | —    | 2.0               | —    |      |   |  |                          |    |  |
|                                | V <sub>IL</sub>  | 4.5                 | —               | 1.5   | 0.8  | —                 | 0.8  |      | V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> -0.1 V                                |  |                          |    |  |
|                                |                  | 5.5                 | —               | 1.5   | 0.8  | —                 | 0.8  |      |   |  |                          |    |  |
| Output voltage                 | V <sub>OH</sub>  | 4.5                 | 4.4             | 4.49  | —    | 4.4               | —    | V    | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OUT</sub> = -50 μA |  |                          |    |  |
|                                |                  | 5.5                 | 5.4             | 5.49  | —    | 5.4               | —    |      |   |  |                          |    |  |
|                                |                  | 4.5                 | 3.94            | —     | —    | 3.80              | —    |      |   | V <sub>IN</sub> = V <sub>IL</sub> I <sub>OH</sub> = -24 mA |                          |    |  |
|                                |                  | 5.5                 | 4.94            | —     | —    | 4.80              | —    |      |   |  | I <sub>OH</sub> = -24 mA |    |  |
|                                | V <sub>OL</sub>  | 4.5                 | —               | 0.001 | 0.1  | —                 | 0.1  |      | V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub><br>I <sub>OUT</sub> = 50 μA  |  |                          |    |  |
|                                |                  | 5.5                 | —               | 0.001 | 0.1  | —                 | 0.1  |      |   |  |                          |    |  |
|                                |                  | 4.5                 | —               | —     | 0.32 | —                 | 0.37 |      |   | V <sub>IN</sub> = V <sub>IL</sub> I <sub>OL</sub> = 24 mA  |                          |    |  |
|                                |                  | 5.5                 | —               | —     | 0.32 | —                 | 0.37 |      |   |  | I <sub>OL</sub> = 24 mA  |    |  |
|                                |                  | Input current       | I <sub>IN</sub> | 5.5   | —    | —                 | ±0.1 |      |   | —  | ±1.0                     | μA | V <sub>IN</sub> = V <sub>CC</sub> or GND   |
|                                |                  | 3 State current     | I <sub>OZ</sub> | 5.5   | —    | —                 | ±0.5 |      |   | —  | ±5.0                     | μA | V <sub>IN</sub> = V <sub>IL</sub> , V <sub>IH</sub><br>V <sub>OUT</sub> = V <sub>CC</sub> or GND |
| I <sub>CC</sub> /input current | I <sub>CCT</sub> | 5.5                 | —               | 0.6   | —    | —                 | 1.5  | mA   | V <sub>IN</sub> = V <sub>CC</sub> -2.1 V  |  |                          |    |  |
| Dynamic output current*        | I <sub>OLD</sub> | 5.5                 | —               | —     | —    | 86                | —    | mA   | V <sub>OLD</sub> = 1.1 V  |  |                          |    |  |
|                                | I <sub>OHD</sub> | 5.5                 | —               | —     | —    | -75               | —    | mA   | V <sub>OHD</sub> = 3.85 V   |  |                          |    |  |
| Quiescent supply current       | I <sub>CC</sub>  | 5.5                 | —               | —     | 8.0  | —                 | 80   | μA   | V <sub>IN</sub> = V <sub>CC</sub> or ground                                       |  |                          |    |  |

\*Maximum test duration 2.0 ms, one output loaded at a time.

**AC Characteristics: HD74AC374**

| Item                                   | Symbol           | V <sub>CC</sub> (V)*1 | Ta = +25°C<br>C <sub>L</sub> = 50 pF |      |      | Ta = -40°C to +85°C<br>C <sub>L</sub> = 50 pF |      | Unit |
|--|------------------|-----------------------|--------------------------------------|------|------|---|------|------|
|  |                  |                       | Min                                  | Typ  | Max  | Min   | Max  |      |
| Maximum clock frequency                | f <sub>max</sub> | 3.3                   | 60                                   | 110  | —    | 60  | —    | MHz  |
|  |                  | 5.0                   | 100                                  | 155  | —    | 100   | —    |      |
| Propagation delay CP to O <sub>n</sub> | t <sub>PLH</sub> | 3.3                   | 1.0                                  | 11.0 | 13.5 | 1.0   | 15.5 | ns   |
|  |                  | 5.0                   | 1.0                                  | 8.0  | 9.5  | 1.0   | 10.5 |      |
| Propagation delay CP to O <sub>n</sub> | t <sub>PHL</sub> | 3.3                   | 1.0                                  | 10.0 | 12.5 | 1.0   | 14.0 | ns   |
|  |                  | 5.0                   | 1.0                                  | 7.0  | 9.0  | 1.0   | 10.0 |      |
| Output enable time                     | t <sub>ZH</sub>  | 3.3                   | 1.0                                  | 9.5  | 11.5 | 1.0   | 13.0 | ns   |
|  |                  | 5.0                   | 1.0                                  | 7.0  | 8.5  | 1.0   | 9.5  |      |
| Output enable time                     | t <sub>ZL</sub>  | 3.3                   | 1.0                                  | 9.0  | 11.5 | 1.0   | 13.0 | ns   |
|  |                  | 5.0                   | 1.0                                  | 6.5  | 8.5  | 1.0   | 9.5  |      |
| Output disable time                    | t <sub>HZ</sub>  | 3.3                   | 1.0                                  | 10.5 | 12.5 | 1.0   | 14.5 | ns   |
|  |                  | 5.0                   | 1.0                                  | 8.0  | 11.0 | 1.0   | 12.5 |      |
| Output disable time                    | t <sub>LZ</sub>  | 3.3                   | 1.0                                  | 8.0  | 11.5 | 1.0   | 12.5 | ns   |
|  |                  | 5.0                   | 1.0                                  | 6.5  | 8.5  | 1.0   | 10.0 |      |

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V  
Voltage Range 5.0 is 5.0 V ± 0.5 V

**AC Operating Requirements: HD74AC374**

| Item  | Symbol          | V <sub>CC</sub> (V)*1 | Ta = +25°C<br>C <sub>L</sub> = 50 pF |                    | Ta = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF | Unit |
|---|-----------------|-----------------------|--------------------------------------|--------------------|--|------|
|   |                 |                       | Typ                                  | Guaranteed Minimum |  |      |
| Setup time, HIGH or LOW<br>D <sub>n</sub> to CP | t <sub>su</sub> | 3.3                   | 2.0                                  | 5.5                | 6.5  | ns   |
|   |                 |                       | 5.0                                  | 1.0                | 4.0  |      |
| Hold time, HIGH or LOW<br>D <sub>n</sub> to CP  | t <sub>h</sub>  | 3.3                   | -1.0                                 | 1.0                | 1.0  | ns   |
|   |                 |                       | 5.0                                  | -4.0               | 1.5  |      |
| CP pulse width, HIGH or LOW                     | t <sub>w</sub>  | 3.3                   | 4.0                                  | 5.5                | 6.0  | ns   |
|   |                 |                       | 5.0                                  | 2.5                | 4.0  |      |

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V  
Voltage Range 5.0 is 5.0 V ± 0.5 V

**AC Characteristics: HD74ACT374**

| Item                                      | Symbol           | V <sub>CC</sub> (V)*1 | Ta = +25°C<br>C <sub>L</sub> = 50 pF |     |      | Ta = -40°C to +85°C<br>C <sub>L</sub> = 50 pF |      | Unit |
|---|------------------|-----------------------|--------------------------------------|-----|------|---|------|------|
|   |                  |                       | Min                                  | Typ | Max  | Min   | Max  |      |
| Maximum clock frequency                   | f <sub>max</sub> | 5.0                   | 100                                  | 160 | —    | 90  | —    | MHz  |
| Propagation delay<br>CP to O <sub>n</sub> | t <sub>PLH</sub> | 5.0                   | 1.0                                  | 8.5 | 10.0 | 1.0   | 11.5 | ns   |
| Propagation delay<br>CP to O <sub>n</sub> | t <sub>PHL</sub> | 5.0                   | 1.0                                  | 8.0 | 9.5  | 1.0   | 11.0 | ns   |
| Output enable time                        | t <sub>ZH</sub>  | 5.0                   | 1.0                                  | 8.0 | 9.5  | 1.0   | 10.5 | ns   |
| Output enable time                        | t <sub>ZL</sub>  | 5.0                   | 1.0                                  | 8.0 | 9.0  | 1.0   | 10.5 | ns   |
| Output disable time                       | t <sub>HZ</sub>  | 5.0                   | 1.0                                  | 8.5 | 11.5 | 1.0   | 12.5 | ns   |
| Output disable time                       | t <sub>LZ</sub>  | 5.0                   | 1.0                                  | 7.0 | 8.5  | 1.0   | 10.0 | ns   |

Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

**AC Operating Requirements: HD74ACT374**

| Item  | Symbol          | V <sub>CC</sub> (V)*1 | Ta = +25°C<br>C <sub>L</sub> = 50 pF |                    | Ta = -40°C<br>to +85°C<br>C <sub>L</sub> = 50 pF | Unit |
|---|-----------------|-----------------------|--------------------------------------|--------------------|--|------|
|   |                 |                       | Typ                                  | Guaranteed Minimum |  |      |
| Setup time, HIGH or LOW<br>D <sub>n</sub> to CP | t <sub>su</sub> | 5.0                   | 1.0                                  | 7.0                | 5.5  | ns   |
| Hold time, HIGH or LOW<br>D <sub>n</sub> to CP  | t <sub>h</sub>  | 5.0                   | 0.0                                  | 1.5                | 1.5  | ns   |
| CP pulse width, HIGH or LOW                     | t <sub>w</sub>  | 5.0                   | 2.0                                  | 7.0                | 5.0  | ns   |

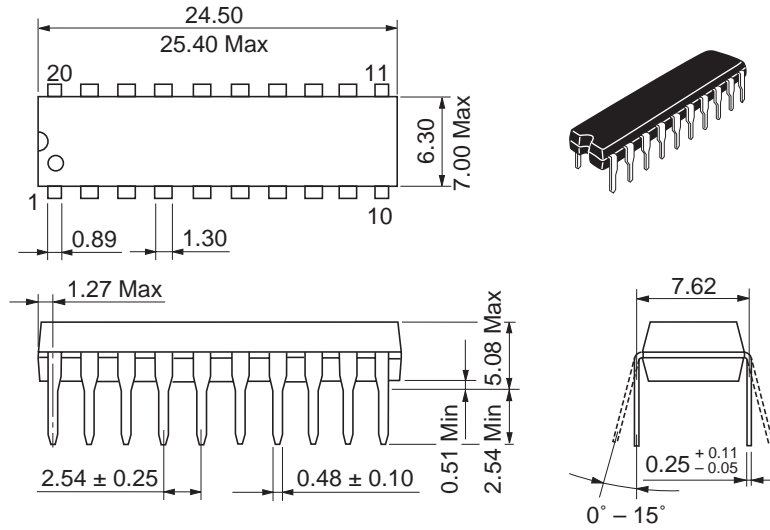
Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

**Capacitance**

| Item                          | Symbol          | Typ  | Unit | Condition               |
|-------------------------------|-----------------|------|------|-------------------------|
| Input capacitance             | C <sub>IN</sub> | 4.5  | pF   | V <sub>CC</sub> = 5.5 V |
| Power dissipation capacitance | C <sub>PD</sub> | 80.0 | pF   | V <sub>CC</sub> = 5.0 V |

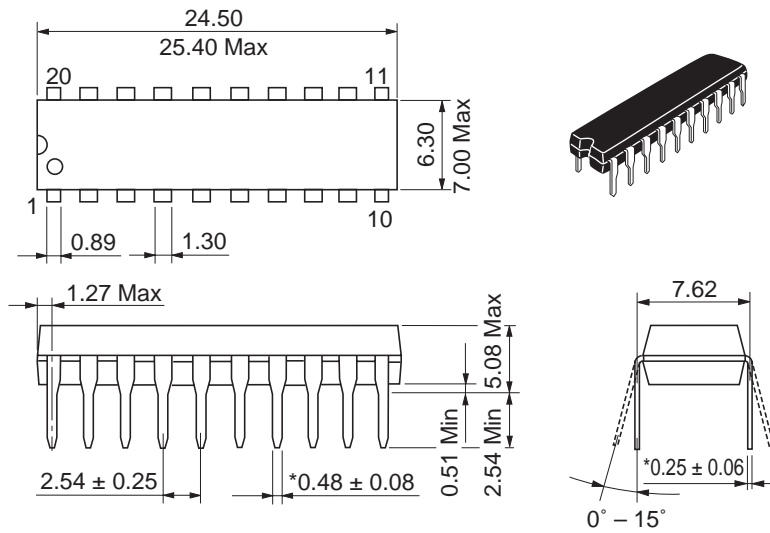
Package Dimensions

As of January, 2003  
Unit: mm



|                        |          |
|------------------------|----------|
| Package Code           | DP-20N   |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 1.26 g   |

Unit: mm

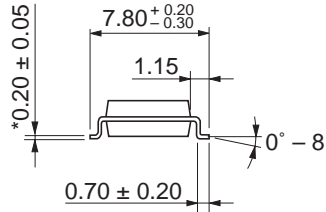
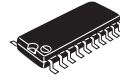
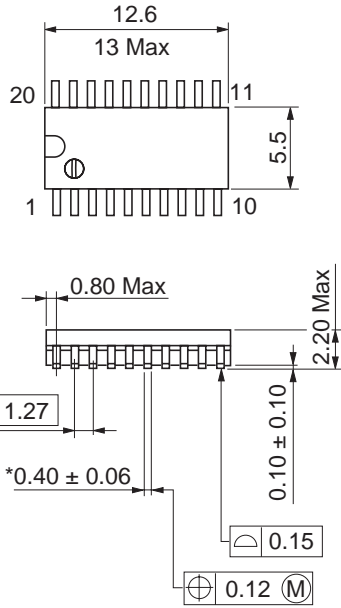


\*Ni/Pd/AU Plating

|                        |          |
|------------------------|----------|
| Package Code           | DP-20NEV |
| JEDEC                  | —        |
| JEITA                  | Conforms |
| Mass (reference value) | 1.26 g   |

As of January, 2003

Unit: mm

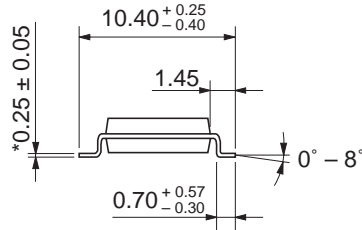
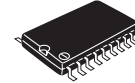
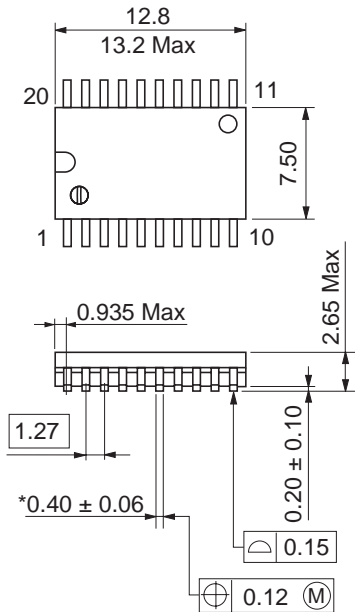


\*Ni/Pd/Au plating

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

As of January, 2003

Unit: mm



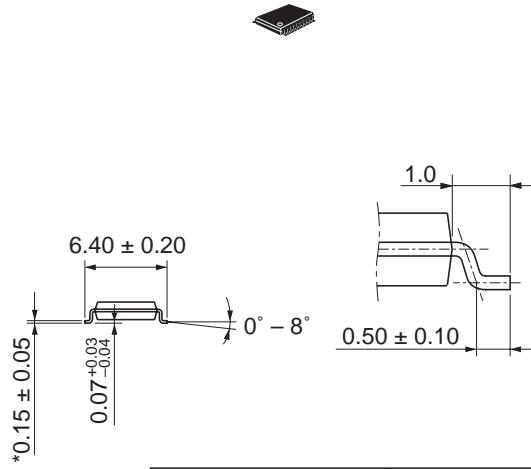
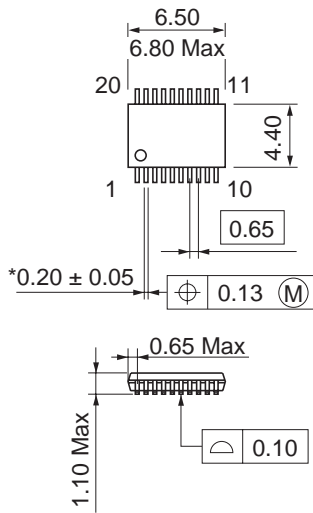
\*Ni/Pd/Au plating

|                        |          |
|------------------------|----------|
| Package Code           | FP-20DBV |
| JEDEC                  | Conforms |
| JEITA                  | —        |
| Mass (reference value) | 0.52 g   |



As of January, 2003

Unit: mm



\*Ni/Pd/Au plating

|                        |           |
|------------------------|-----------|
| Package Code           | TTP-20DAV |
| JEDEC                  | —         |
| JEITA                  | —         |
| Mass (reference value) | 0.07 g    |

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