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# HD74LV573A

Octal D-type Transparent Latches with 3-state Outputs

## HITACHI

ADE-205-279A (Z)

2nd Edition  
July 1999

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### Description

The HD74LV573A has eight D-type latches with three-state outputs in a 20-pin package. When the latch enable input is high, the Q outputs will follow the D inputs. 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. Low-voltage and high-speed operation is suitable for the battery-powered products (e.g., notebook computers), and the low-power consumption extends the battery life.

### Features

- $V_{CC} = 2.0\text{ V}$  to  $5.5\text{ V}$  operation
- All inputs  $V_{IH}(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O(\text{Max.}) = 5.5\text{ V}$  ( $@V_{CC} = 0\text{ V}$ )
- Typical  $V_{OL}$  ground bounce  $< 0.8\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot  $> 2.3\text{ V}$  ( $@V_{CC} = 3.3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
- Output current  $\pm 8\text{ mA}$  ( $@V_{CC} = 3.0\text{ V}$  to  $3.6\text{ V}$ ),  $\pm 16\text{ mA}$  ( $@V_{CC} = 4.5\text{ V}$  to  $5.5\text{ V}$ )

# HD74LV573A

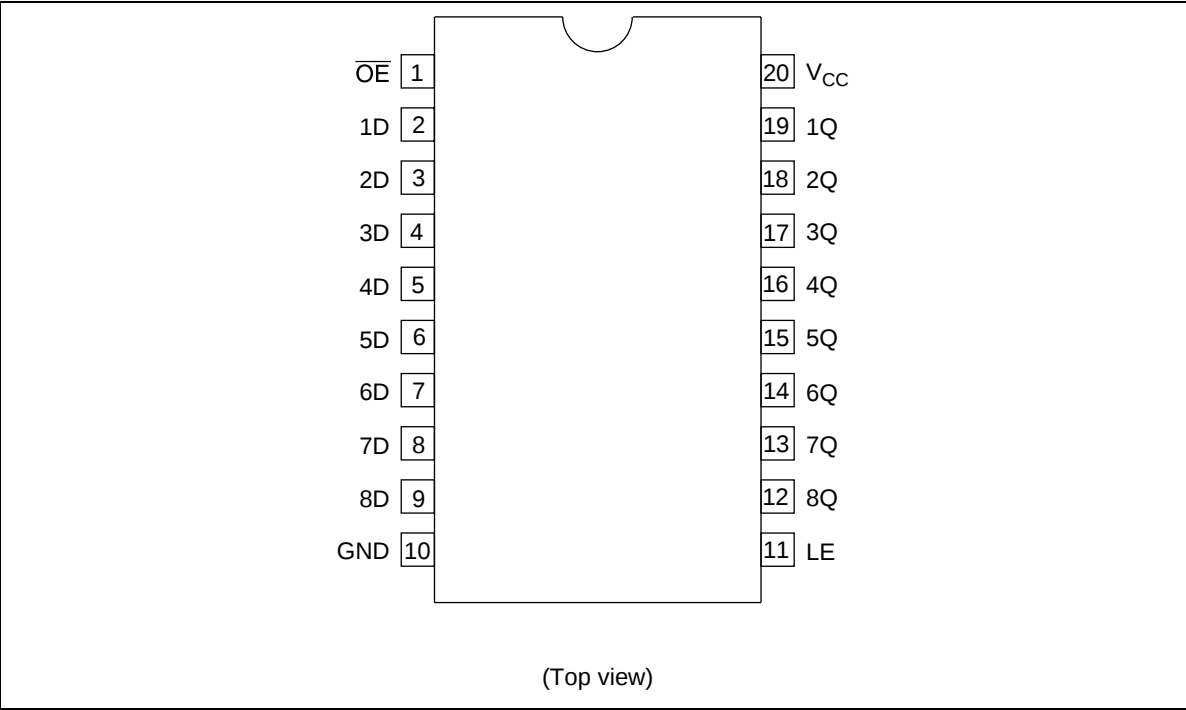
## Function Table

### Inputs

| OE | LE | D | Output Q       |
|----|----|---|----------------|
| L  | H  | H | H              |
| L  | H  | L | L              |
| L  | L  | X | Q <sub>0</sub> |
| H  | X  | X | Z              |

Note: H: High level  
L: Low level  
X: Immaterial  
Z: High impedance  
Q<sub>0</sub>: Output level before the indicated steady state input conditions were established

## Pin Arrangement



**Absolute Maximum Ratings**

| Item                                                                               | Symbol                | Ratings                               | Unit | Conditions                                       |
|------------------------------------------------------------------------------------|-----------------------|---------------------------------------|------|--------------------------------------------------|
| Supply voltage range                                                               | $V_{CC}$              | −0.5 to 7.0                           | V    |                                                  |
| Input voltage range <sup>*1</sup>                                                  | $V_I$                 | −0.5 to 7.0                           | V    |                                                  |
| Output voltage range <sup>*1, 2</sup>                                              | $V_O$                 | −0.5 to $V_{CC} + 0.5$<br>−0.5 to 7.0 | V    | Output: H or L<br>$V_{CC}$ : Z or $V_{CC}$ : OFF |
| Input clamp current                                                                | $I_{IK}$              | −20                                   | mA   | $V_I < 0$                                        |
| Output clamp current                                                               | $I_{OK}$              | ±50                                   | mA   | $V_O < 0$ or $V_O > V_{CC}$                      |
| Continuous output current                                                          | $I_O$                 | ±35                                   | mA   | $V_O = 0$ to $V_{CC}$                            |
| Continuous current through $V_{CC}$ or GND                                         | $I_{CC}$ or $I_{GND}$ | ±70                                   | mA   |                                                  |
| Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air) <sup>*3</sup> | $P_T$                 | 835                                   | mW   | SOP                                              |
|                                                                                    |                       | 757                                   |      | TSSOP                                            |
| Storage temperature                                                                | $T_{stg}$             | −65 to 150                            | °C   |                                                  |

Notes: 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.

1. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.
3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

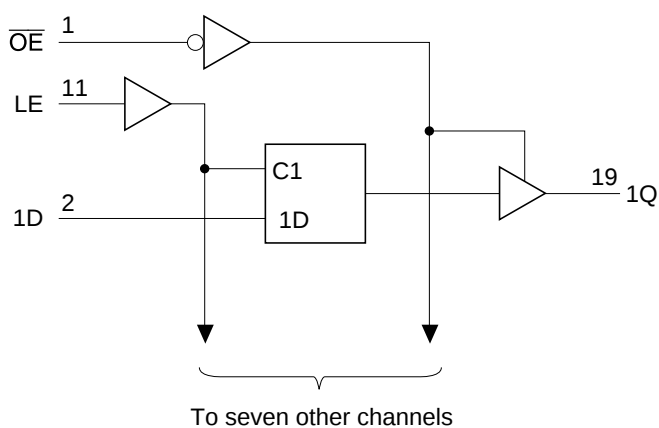
# HD74LV573A

## Recommended Operating Conditions

| Item                               | Symbol              | Min | Max      | Unit        | Conditions                            |
|------------------------------------|---------------------|-----|----------|-------------|---------------------------------------|
| Supply voltage range               | $V_{CC}$            | 2.0 | 5.5      | V           |                                       |
| Input voltage range                | $V_I$               | 0   | 5.5      | V           |                                       |
| Output voltage range               | $V_O$               | 0   | $V_{CC}$ | V           | H or L                                |
|                                    |                     | 0   | 5.5      |             | Output: Z                             |
| Output current                     | $I_{OH}$            | —   | −50      | $\mu A$     | $V_{CC} = 2.0\text{ V}$               |
|                                    |                     | —   | −2       | mA          | $V_{CC} = 2.3\text{ to }2.7\text{ V}$ |
|                                    |                     | —   | −8       |             | $V_{CC} = 3.0\text{ to }3.6\text{ V}$ |
|                                    |                     | —   | −16      |             | $V_{CC} = 4.5\text{ to }5.5\text{ V}$ |
|                                    | $I_{OL}$            | —   | 50       | $\mu A$     | $V_{CC} = 2.0\text{ V}$               |
|                                    |                     | —   | 2        | mA          | $V_{CC} = 2.3\text{ to }2.7\text{ V}$ |
|                                    |                     | —   | 8        |             | $V_{CC} = 3.0\text{ to }3.6\text{ V}$ |
|                                    |                     | —   | 16       |             | $V_{CC} = 4.5\text{ to }5.5\text{ V}$ |
| Input transition rise or fall rate | $\Delta t/\Delta v$ | 0   | 200      | ns/V        | $V_{CC} = 2.3\text{ to }2.7\text{ V}$ |
|                                    |                     | 0   | 100      |             | $V_{CC} = 3.0\text{ to }3.6\text{ V}$ |
|                                    |                     | 0   | 20       |             | $V_{CC} = 4.5\text{ to }5.5\text{ V}$ |
| Operating free-air temperature     | $T_a$               | −40 | 85       | $^{\circ}C$ |                                       |

Note: Unused or floating inputs must be held high or low.

## Logic Diagram



## DC Electrical Characteristics

Ta = -40 to 85°C

| Item                     | Symbol           | V <sub>CC</sub> (V)* | Min                   | Typ | Max                   | Unit | Test Conditions                                             |
|--------------------------|------------------|----------------------|-----------------------|-----|-----------------------|------|-------------------------------------------------------------|
| Input voltage            | V <sub>IH</sub>  | 2.0                  | 1.5                   | —   | —                     | V    |                                                             |
|                          |                  | 2.3 to 2.7           | V <sub>CC</sub> × 0.7 | —   | —                     |      |                                                             |
|                          |                  | 3.0 to 3.6           | V <sub>CC</sub> × 0.7 | —   | —                     |      |                                                             |
|                          |                  | 4.5 to 5.5           | V <sub>CC</sub> × 0.7 | —   | —                     |      |                                                             |
|                          | V <sub>IL</sub>  | 2.0                  | —                     | —   | 0.5                   |      |                                                             |
|                          |                  | 2.3 to 2.7           | —                     | —   | V <sub>CC</sub> × 0.3 |      |                                                             |
|                          |                  | 3.0 to 3.6           | —                     | —   | V <sub>CC</sub> × 0.3 |      |                                                             |
|                          |                  | 4.5 to 5.5           | —                     | —   | V <sub>CC</sub> × 0.3 |      |                                                             |
| Output voltage           | V <sub>OH</sub>  | Min to Max           | V <sub>CC</sub> - 0.1 | —   | —                     | V    | I <sub>OH</sub> = -50 µA                                    |
|                          |                  | 2.3                  | 2.0                   | —   | —                     |      | I <sub>OH</sub> = -2 mA                                     |
|                          |                  | 3.0                  | 2.48                  | —   | —                     |      | I <sub>OH</sub> = -8 mA                                     |
|                          |                  | 4.5                  | 3.8                   | —   | —                     |      | I <sub>OH</sub> = -16 mA                                    |
|                          | V <sub>OL</sub>  | Min to Max           | —                     | —   | 0.1                   |      | I <sub>OL</sub> = 50 µA                                     |
|                          |                  | 2.3                  | —                     | —   | 0.4                   |      | I <sub>OL</sub> = 2 mA                                      |
|                          |                  | 3.0                  | —                     | —   | 0.44                  |      | I <sub>OL</sub> = 8 mA                                      |
|                          |                  | 4.5                  | —                     | —   | 0.55                  |      | I <sub>OL</sub> = 16 mA                                     |
| Input current            | I <sub>IN</sub>  | 0 to 5.5             | —                     | —   | ±1                    | µA   | V <sub>I</sub> = 5.5 V or GND                               |
| Off-state output current | I <sub>OZ</sub>  | 5.5                  | —                     | —   | ±5                    | µA   | V <sub>O</sub> = V <sub>CC</sub> or GND                     |
| Quiescent supply current | I <sub>CC</sub>  | 5.5                  | —                     | —   | 20                    | µA   | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 |
| Output leakage current   | I <sub>OFF</sub> | 0                    | —                     | —   | 5                     | µA   | V <sub>I</sub> or V <sub>O</sub> = 0 V to 5.5 V             |
| Input capacitance        | C <sub>IN</sub>  | 3.3                  | —                     | 1.8 | —                     | pF   | V <sub>I</sub> = V <sub>CC</sub> or GND                     |

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

HD74LV573A

Switching Characteristics

V<sub>CC</sub> = 2.5 ± 0.2 V

| Item                         | Symbol           | Ta = 25°C |      |      | Ta = -40 to 85°C |      | Unit | Test Conditions        | FROM<br>(Input)  | TO<br>(Output) |
|------------------------------|------------------|-----------|------|------|------------------|------|------|------------------------|------------------|----------------|
|                              |                  | Min       | Typ  | Max  | Min              | Max  |      |                        |                  |                |
| Propagation<br>delay<br>time | t <sub>PLH</sub> | —         | 8.9  | 15.8 | 1.0              | 18.0 | ns   | C <sub>L</sub> = 15 pF | D                | Q              |
|                              | t <sub>PHL</sub> | —         | 8.9  | 15.8 | 1.0              | 18.0 | ns   | C <sub>L</sub> = 15 pF | D                | Q              |
|                              |                  | —         | 9.6  | 16.2 | 1.0              | 19.0 |      |                        | LE               |                |
|                              |                  | —         | 10.9 | 18.7 | 1.0              | 21.0 |      | C <sub>L</sub> = 50 pF | D                |                |
|                              |                  | —         | 11.6 | 19.1 | 1.0              | 23.0 |      |                        | LE               |                |
| Enable<br>time               | t <sub>ZH</sub>  | —         | 9.3  | 16.2 | 1.0              | 19.0 | ns   | C <sub>L</sub> = 15 pF | OE               | Q              |
|                              | t <sub>ZL</sub>  | —         | 11.4 | 19.0 | 1.0              | 22.0 |      | C <sub>L</sub> = 50 pF |                  |                |
| Disable<br>time              | t <sub>HZ</sub>  | —         | 6.7  | 12.6 | 1.0              | 15.0 | ns   | C <sub>L</sub> = 15 pF | OE               | Q              |
|                              | t <sub>LZ</sub>  | —         | 8.6  | 17.3 | 1.0              | 19.0 |      | C <sub>L</sub> = 50 pF |                  |                |
| Setup<br>time                | t <sub>su</sub>  | 5.0       | —    | —    | 5.0              | —    | ns   |                        | Data before LE ↓ |                |
| Hold<br>time                 | t <sub>h</sub>   | 2.0       | —    | —    | 2.0              | —    | ns   |                        | Data after LE ↓  |                |
| Pulse<br>width               | t <sub>w</sub>   | 6.5       | —    | —    | 6.5              | —    | ns   |                        | LE "H"           |                |

# Switching Characteristics (cont)

$V_{CC} = 3.3 \pm 0.3 \text{ V}$

| Item                         | Symbol    | Ta = 25°C |     |      | Ta = -40 to 85°C |      | Unit | Test Conditions       | FROM<br>(Input)  | TO<br>(Output) |
|------------------------------|-----------|-----------|-----|------|------------------|------|------|-----------------------|------------------|----------------|
|                              |           | Min       | Typ | Max  | Min              | Max  |      |                       |                  |                |
| Propagation<br>delay<br>time | $t_{PLH}$ | —         | 6.2 | 11.0 | 1.0              | 13.0 | ns   | $C_L = 15 \text{ pF}$ | D                | Q              |
|                              | $t_{PHL}$ | —         | 6.2 | 11.0 | 1.0              | 13.0 | ns   | $C_L = 15 \text{ pF}$ | D                | Q              |
|                              |           | —         | 6.8 | 11.9 | 1.0              | 14.0 |      |                       | LE               |                |
|                              |           | —         | 7.7 | 14.5 | 1.0              | 16.5 |      | $C_L = 50 \text{ pF}$ | D                |                |
|                              |           | —         | 8.2 | 15.4 | 1.0              | 17.5 |      |                       | LE               |                |
| Enable<br>time               | $t_{ZH}$  | —         | 6.6 | 11.5 | 1.0              | 13.5 | ns   | $C_L = 15 \text{ pF}$ | OE               | Q              |
|                              | $t_{ZL}$  | —         | 8.0 | 15.0 | 1.0              | 17.0 |      | $C_L = 50 \text{ pF}$ |                  |                |
| Disable<br>time              | $t_{HZ}$  | —         | 4.9 | 11.0 | 1.0              | 13.0 | ns   | $C_L = 15 \text{ pF}$ | OE               | Q              |
|                              | $t_{LZ}$  | —         | 6.2 | 14.5 | 1.0              | 16.5 |      | $C_L = 50 \text{ pF}$ |                  |                |
| Setup<br>time                | $t_{SU}$  | 3.5       | —   | —    | 3.5              | —    | ns   |                       | Data before LE ↓ |                |
| Hold<br>time                 | $t_H$     | 1.5       | —   | —    | 1.5              | —    | ns   |                       | Data after LE ↓  |                |
| Pulse<br>width               | $t_W$     | 5.0       | —   | —    | 5.0              | —    | ns   |                       | LE "H"           |                |

HD74LV573A

Switching Characteristics (cont)

V<sub>CC</sub> = 5.0 ± 0.5 V

| Item                              | Symbol           | Ta = 25°C |     |     | Ta = -40 to 85°C |      | Unit | Test Conditions        | FROM<br>(Input)  | TO<br>(Output) |
|-----------------------------------|------------------|-----------|-----|-----|------------------|------|------|------------------------|------------------|----------------|
|                                   |                  | Min       | Typ | Max | Min              | Max  |      |                        |                  |                |
| Propa-<br>gation<br>delay<br>time | t <sub>PLH</sub> | —         | 4.3 | 6.8 | 1.0              | 8.0  | ns   | C <sub>L</sub> = 15 pF | D                | Q              |
|                                   | t <sub>PHL</sub> | —         | 4.7 | 7.7 | 1.0              | 9.0  |      |                        | LE               |                |
|                                   |                  | —         | 5.3 | 8.8 | 1.0              | 10.0 |      | C <sub>L</sub> = 50 pF | D                |                |
|                                   |                  | —         | 5.7 | 9.7 | 1.0              | 11.0 |      |                        | LE               |                |
|                                   |                  |           |     |     |                  |      |      |                        |                  |                |
| Enable<br>time                    | t <sub>ZH</sub>  | —         | 4.7 | 7.7 | 1.0              | 9.0  | ns   | C <sub>L</sub> = 15 pF | OE               | Q              |
|                                   | t <sub>ZL</sub>  | —         | 5.7 | 9.7 | 1.0              | 11.0 |      | C <sub>L</sub> = 50 pF |                  |                |
| Disable<br>time                   | t <sub>HZ</sub>  | —         | 3.5 | 7.7 | 1.0              | 9.0  | ns   | C <sub>L</sub> = 15 pF | OE               | Q              |
|                                   | t <sub>LZ</sub>  | —         | 4.2 | 9.7 | 1.0              | 11.0 |      | C <sub>L</sub> = 50 pF |                  |                |
| Setup<br>time                     | t <sub>su</sub>  | 3.5       | —   | —   | 3.5              | —    | ns   |                        | Data before LE ↓ |                |
| Hold<br>time                      | t <sub>h</sub>   | 1.5       | —   | —   | 1.5              | —    | ns   |                        | Data after LE ↓  |                |
| Pulse<br>width                    | t <sub>w</sub>   | 5.0       | —   | —   | 5.0              | —    | ns   |                        | LE "H"           |                |

Output-skew Characteristics

| Item        | Symbol              | V <sub>CC</sub> (V) | Ta = 25°C |     |     | Ta = -40 to 85°C |     | Unit |
|-------------|---------------------|---------------------|-----------|-----|-----|------------------|-----|------|
|             |                     |                     | Min       | Typ | Max | Min              | Max |      |
| Output skew | t <sub>sk (O)</sub> | 2.3 to 2.7          | —         | —   | 2.0 | —                | 2.0 | ns   |
|             |                     | 3.0 to 3.6          | —         | —   | 1.5 | —                | 1.5 |      |
|             |                     | 4.5 to 5.5          | —         | —   | 1.0 | —                | 1.0 |      |

Note: Skew between any outputs of the same package switching in the same direction. This parameter is warranted but not production tested.

## Operating Characteristics

$C_L = 50 \text{ pF}$

| Item                          | Symbol   | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ |     |     | Unit | Test Conditions      |
|-------------------------------|----------|----------------------|--------------------------|-----|-----|------|----------------------|
|                               |          |                      | Min                      | Typ | Max |      |                      |
| Power dissipation capacitance | $C_{PD}$ | 3.3                  | —                        | 16  | —   | pF   | $f = 10 \text{ MHz}$ |
|                               |          | 5.0                  | —                        | 18  | —   |      |                      |

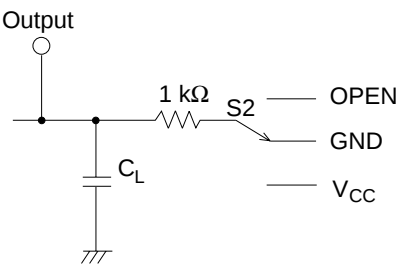
## Noise Characteristics

$C_L = 50 \text{ pF}$

| Item                                   | Symbol      | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ |      |      | Unit | Test Conditions |
|----------------------------------------|-------------|----------------------|--------------------------|------|------|------|-----------------|
|                                        |             |                      | Min                      | Typ  | Max  |      |                 |
| Quiet output, maximum dynamic $V_{OL}$ | $V_{OL(P)}$ | 3.3                  | —                        | 0.6  | 0.8  | V    |                 |
| Quiet output, minimum dynamic $V_{OL}$ | $V_{OL(V)}$ | 3.3                  | —                        | −0.5 | −0.8 |      |                 |
| Quiet output, minimum dynamic $V_{OH}$ | $V_{OH(V)}$ | 3.3                  | —                        | 2.9  | —    |      |                 |
| High-level dynamic input voltage       | $V_{IH(D)}$ | 3.3                  | 2.31                     | —    | —    | V    |                 |
| Low-level dynamic input voltage        | $V_{IL(D)}$ | 3.3                  | —                        | —    | 0.99 |      |                 |

# HD74LV573A

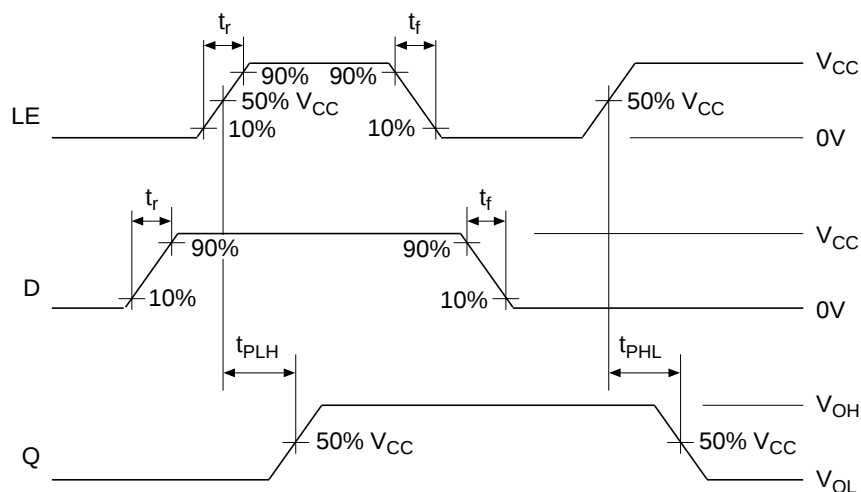
## Test Circuit



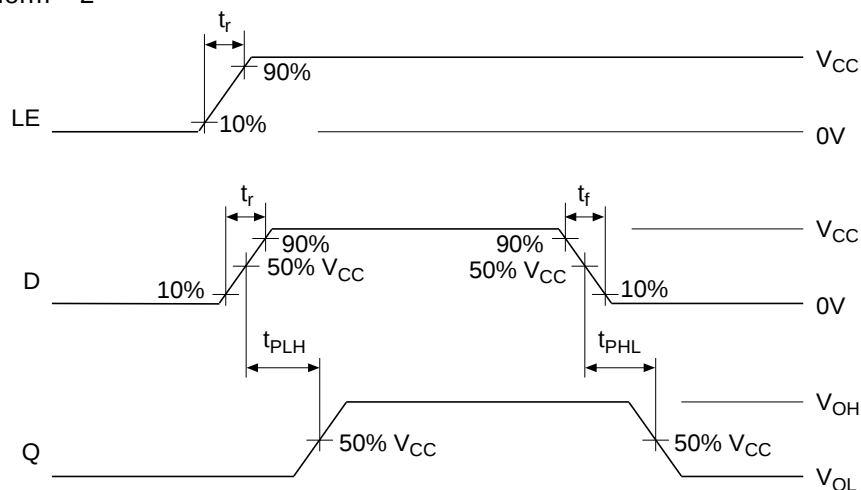
| TEST              | S2       |
|-------------------|----------|
| $t_{PLH}/t_{PHL}$ | OPEN     |
| $t_{ZH}/t_{HZ}$   | GND      |
| $t_{ZL}/t_{LZ}$   | $V_{CC}$ |

Note:  $C_L$  includes the probe and jig capacitance.

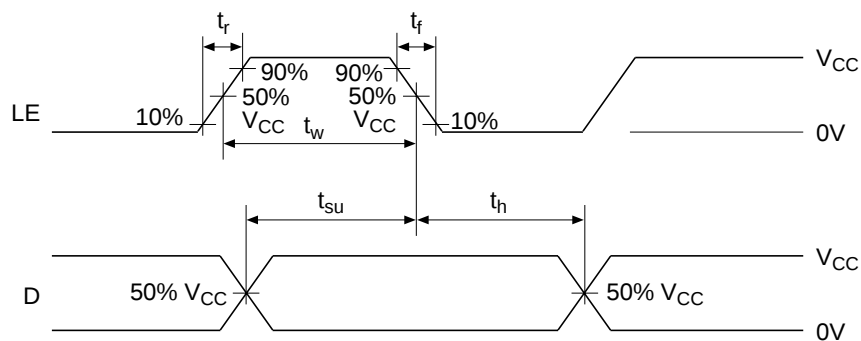
• Waveform – 1



• Waveform – 2

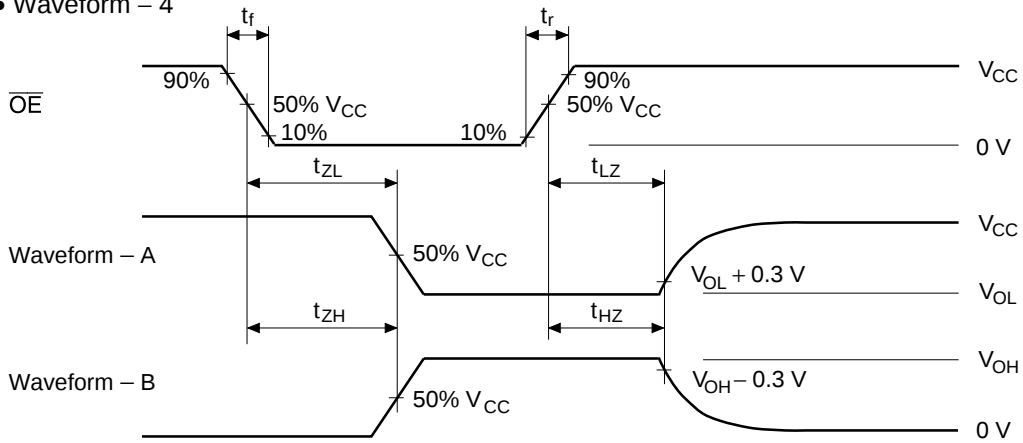


• Waveform – 3



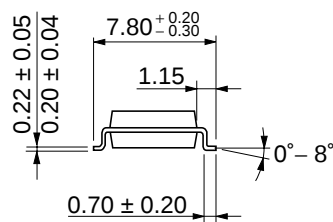
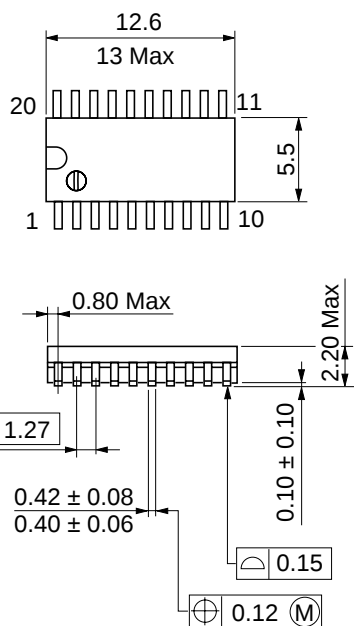
## HD74LV573A

### • Waveform – 4



- Notes:
1. Input waveform:  $PRR \leq 1 \text{ MHz}$ ,  $Z_o = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$
  2. Waveform–A is for an output with internal conditions such that the output is low except when disabled by the output control.
  3. Waveform–B is for an output with internal conditions such that the output is high except when disabled by the output control.
  4. The output is measured one at a time with one transition per measurement.

# Package Dimensions

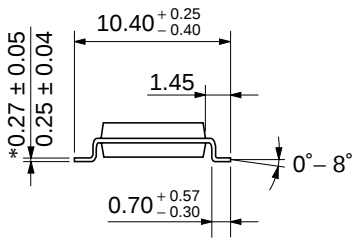
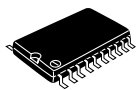
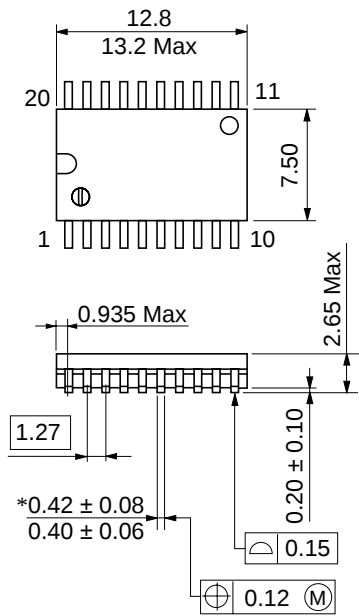


Dimension including the plating thickness  
 Base material dimension

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

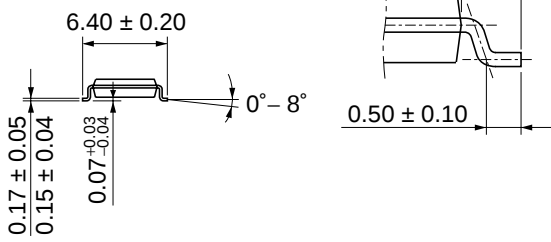
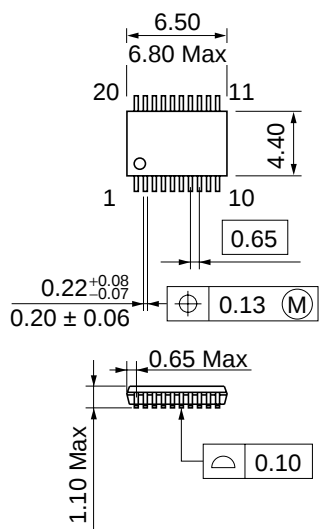
HD74LV573A

Unit: mm



\*Dimension including the plating thickness  
Base material dimension

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



Dimension including the plating thickness  
Base material dimension

|                          |          |
|--------------------------|----------|
| Hitachi Code             | TTP-20DA |
| JEDEC                    | -        |
| EIAJ                     | -        |
| Weight (reference value) | 0.07 g   |

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