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# HD74LV240A

Octal Buffers / Drivers with 3-state Outputs

# HITACHI

ADE-205-272 (Z)

1st Edition  
April 1999

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## Description

The HD74LV240A has eight inverter drivers with three-state outputs in a 20-pin package. Four inverters are included in one circuit. Each circuit can be independently controlled by the enable signal 1OE or 2OE, which enables outputs when receiving a low-level signal. Low-voltage operation is suitable for 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  $V_{IH}$  (Max.) =  $5.5\text{ V}$  (@ $V_{CC} = 0\text{ V}$  to  $5.5\text{ V}$ )
- All outputs  $V_O$  (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  $5.5\text{ V}$ )

## Function Table

### Inputs

| OE | A | Output Y |
|----|---|----------|
| L  | H | L        |
| L  | L | H        |
| H  | X | Z        |

Note: H: High level

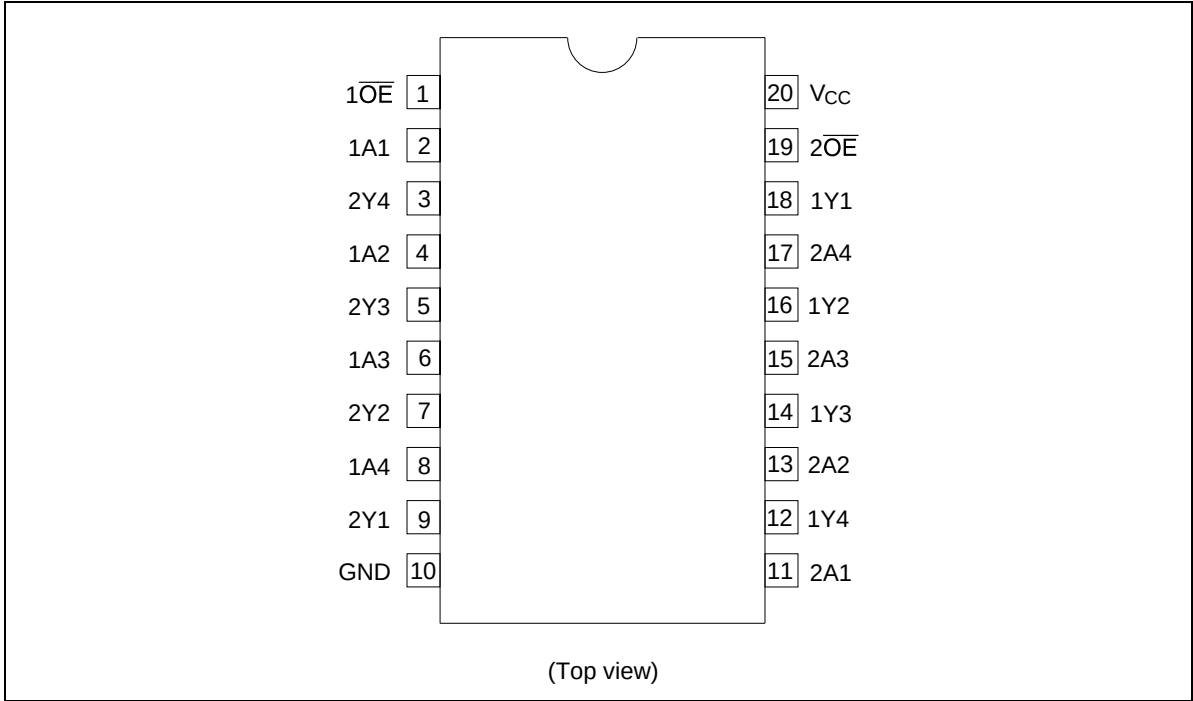
L: Low level

X: Immaterial

Z: High impedance

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## 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>$V_{CC}$ : OFF or Output: Z |
| 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 even 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.

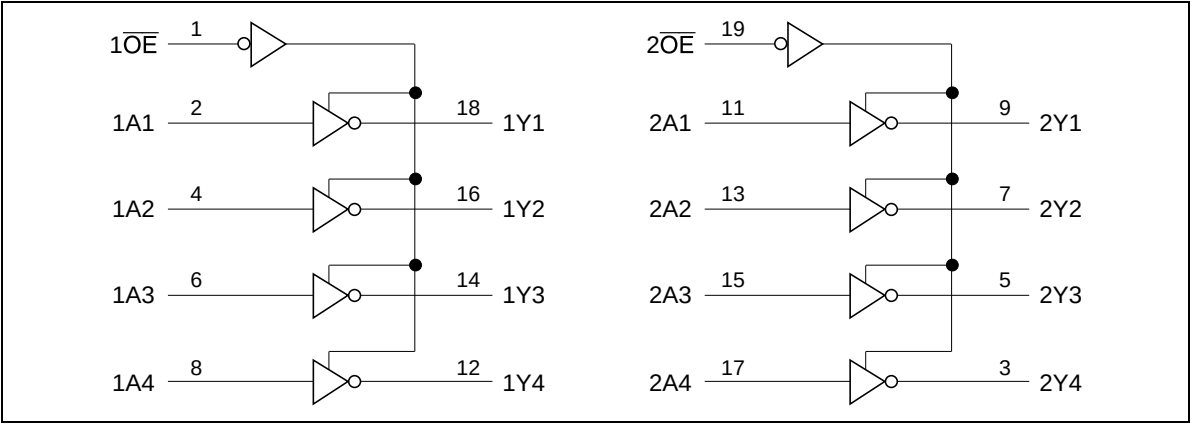
# HD74LV240A

## 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      |         | High impedance state                  |
| 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       |         | $V_{CC} = 3.0\text{ to }3.6\text{ V}$ |
|                                    |                       | —   | −12      |         | $V_{CC} = 4.5\text{ to }5.5\text{ V}$ |
|                                    | $I_{OL}$              | —   | 50       | $\mu A$ | $V_{CC} = 2.0\text{ V}$               |
|                                    |                       | —   | 2        | mA      | $V_{CC} = 2.3\text{ to }2.7\text{ V}$ |
|                                    |                       | —   | 8        |         | $V_{CC} = 3.0\text{ to }3.6\text{ V}$ |
|                                    |                       | —   | 12       |         | $V_{CC} = 4.5\text{ to }5.5\text{ V}$ |
| 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       | °C      |                                       |

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

## Logic Diagram



## DC Electrical Characteristics

$T_a = -40$  to  $85^\circ\text{C}$

| Item                     | Symbol    | $V_{CC}$ (V)* | Min                 | Typ | Max                 | Unit          | Test Conditions                     |
|--------------------------|-----------|---------------|---------------------|-----|---------------------|---------------|-------------------------------------|
| Input voltage            | $V_{IH}$  | 2.0           | 1.5                 | —   | —                   | V             |                                     |
|                          |           | 2.3 to 2.7    | $V_{CC} \times 0.7$ | —   | —                   |               |                                     |
|                          |           | 3.0 to 3.6    | $V_{CC} \times 0.7$ | —   | —                   |               |                                     |
|                          |           | 4.5 to 5.5    | $V_{CC} \times 0.7$ | —   | —                   |               |                                     |
|                          | $V_{IL}$  | 2.0           | —                   | —   | 0.5                 |               |                                     |
|                          |           | 2.3 to 2.7    | —                   | —   | $V_{CC} \times 0.3$ |               |                                     |
|                          |           | 3.0 to 3.6    | —                   | —   | $V_{CC} \times 0.3$ |               |                                     |
|                          |           | 4.5 to 5.5    | —                   | —   | $V_{CC} \times 0.3$ |               |                                     |
| Output voltage           | $V_{OH}$  | Min to Max    | $V_{CC} - 0.1$      | —   | —                   | V             | $I_{OH} = -50\ \mu\text{A}$         |
|                          |           | 2.3           | 2.0                 | —   | —                   |               | $I_{OH} = -2\ \text{mA}$            |
|                          |           | 3.0           | 2.48                | —   | —                   |               | $I_{OH} = -8\ \text{mA}$            |
|                          |           | 4.5           | 3.8                 | —   | —                   |               | $I_{OH} = -16\ \text{mA}$           |
|                          | $V_{OL}$  | Min to Max    | —                   | —   | 0.1                 |               | $I_{OL} = 50\ \mu\text{A}$          |
|                          |           | 2.3           | —                   | —   | 0.4                 |               | $I_{OL} = 2\ \text{mA}$             |
|                          |           | 3.0           | —                   | —   | 0.44                |               | $I_{OL} = 8\ \text{mA}$             |
|                          |           | 4.5           | —                   | —   | 0.55                |               | $I_{OL} = 16\ \text{mA}$            |
| Input current            | $I_{IN}$  | 0 to 5.5      | —                   | —   | $\pm 1$             | $\mu\text{A}$ | $V_{IN} = 5.5\ \text{V}$ or GND     |
| Off-state output current | $I_{OZ}$  | 5.5           | —                   | —   | $\pm 5$             | $\mu\text{A}$ | $V_O = V_{CC}$ or GND               |
| Quiescent supply current | $I_{CC}$  | 5.5           | —                   | —   | 20                  | $\mu\text{A}$ | $V_{IN} = V_{CC}$ or GND, $I_O = 0$ |
| Output leakage current   | $I_{OFF}$ | 0             | —                   | —   | 5                   | $\mu\text{A}$ | $V_O = 5.5\ \text{V}$               |
| Input capacitance        | $C_{IN}$  | 3.3           | —                   | 2.3 | —                   | pF            | $V_I = V_{CC}$ or GND               |

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

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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 time | t <sub>PLH</sub> | —         | 6.3  | 11.6 | 1.0              | 14.0 | ns   | C <sub>L</sub> = 15 pF | A               | Y              |
|                           | t <sub>PHL</sub> | —         | 8.2  | 14.4 | 1.0              | 17.0 |      | C <sub>L</sub> = 50 pF |                 |                |
| Enable time               | t <sub>ZH</sub>  | —         | 8.5  | 14.6 | 1.0              | 17.0 | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>ZL</sub>  | —         | 10.3 | 17.8 | 1.0              | 21.0 |      | C <sub>L</sub> = 50 pF |                 |                |
| Disable<br>time           | t <sub>HZ</sub>  | —         | 9.7  | 14.1 | 1.0              | 16.0 | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>LZ</sub>  | —         | 14.2 | 19.2 | 1.0              | 21.0 |      | C <sub>L</sub> = 50 pF |                 |                |

V<sub>CC</sub> = 3.3 ± 0.3 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 time | t <sub>PLH</sub> | —         | 4.6  | 7.5  | 1.0              | 9.0  | ns   | C <sub>L</sub> = 15 pF | A               | Y              |
|                           | t <sub>PHL</sub> | —         | 5.9  | 11.0 | 1.0              | 12.5 |      | C <sub>L</sub> = 50 pF |                 |                |
| Enable time               | t <sub>ZH</sub>  | —         | 6.2  | 10.6 | 1.0              | 12.5 | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>ZL</sub>  | —         | 7.5  | 14.1 | 1.0              | 16.0 |      | C <sub>L</sub> = 50 pF |                 |                |
| Disable<br>time           | t <sub>HZ</sub>  | —         | 8.3  | 12.5 | 1.0              | 13.5 | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>LZ</sub>  | —         | 11.8 | 15.0 | 1.0              | 17.0 |      | C <sub>L</sub> = 50 pF |                 |                |

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  |      |                        |                 |                |
| Propagation<br>delay time | t <sub>PLH</sub> | —         | 3.4 | 5.5  | 1.0              | 6.5  | ns   | C <sub>L</sub> = 15 pF | A               | Y              |
|                           | t <sub>PHL</sub> | —         | 4.4 | 7.5  | 1.0              | 8.5  |      | C <sub>L</sub> = 50 pF |                 |                |
| Enable time               | t <sub>ZH</sub>  | —         | 4.6 | 7.3  | 1.0              | 8.5  | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>ZL</sub>  | —         | 5.6 | 9.3  | 1.0              | 10.5 |      | C <sub>L</sub> = 50 pF |                 |                |
| Disable<br>time           | t <sub>HZ</sub>  | —         | 7.4 | 12.2 | 1.0              | 13.5 | ns   | C <sub>L</sub> = 15 pF | OE              | Y              |
|                           | t <sub>LZ</sub>  | —         | 9.7 | 14.2 | 1.0              | 15.5 |      | C <sub>L</sub> = 50 pF |                 |                |

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## Output-skew Characteristics

C<sub>L</sub> = 50 pF

| Item        | Symbol              | V <sub>CC</sub> (V) | Ta = 25°C |     | Ta = -40 to 85°C |     | Unit |
|-------------|---------------------|---------------------|-----------|-----|------------------|-----|------|
|             |                     |                     | Min       | 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<sub>L</sub> = 50 pF

| Item                          | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |      |     | Unit | Test Conditions |
|-------------------------------|-----------------|---------------------|-----------|------|-----|------|-----------------|
|                               |                 |                     | Min       | Typ  | Max |      |                 |
| Power dissipation capacitance | C <sub>PD</sub> | 3.3                 | —         | 14.0 | —   | pF   | f = 10 MHz      |
|                               |                 | 5.0                 | —         | 16.4 | —   |      |                 |

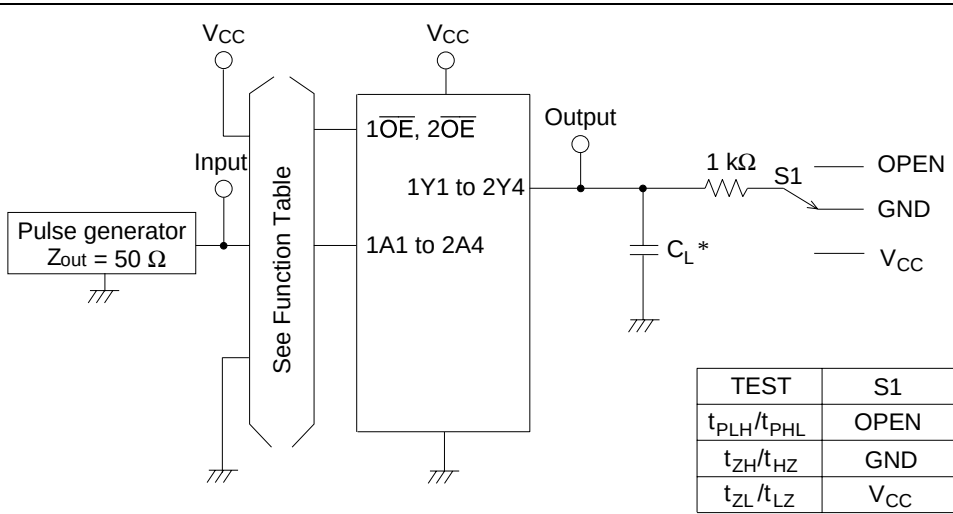
## Noise Characteristics

C<sub>L</sub> = 50 pF

| Item                                          | Symbol              | V <sub>CC</sub> (V) | Ta = 25°C |      |      | Unit | Test Conditions |
|-----------------------------------------------|---------------------|---------------------|-----------|------|------|------|-----------------|
|                                               |                     |                     | Min       | Typ  | Max  |      |                 |
| Quiet output, maximum dynamic V <sub>OL</sub> | V <sub>OL (P)</sub> | 3.3                 | —         | 0.6  | 0.8  | V    |                 |
| Quiet output, minimum dynamic V <sub>OL</sub> | V <sub>OL (V)</sub> | 3.3                 | —         | -0.5 | -0.8 |      |                 |
| Quiet output, minimum dynamic V <sub>OH</sub> | V <sub>OH (V)</sub> | 3.3                 | —         | 2.8  | —    |      |                 |
| High-level dynamic input voltage              | V <sub>IH (D)</sub> | 3.3                 | 2.31      | —    | —    | V    |                 |
| Low-level dynamic inout voltage               | V <sub>IL (D)</sub> | 3.3                 | —         | —    | 0.99 |      |                 |



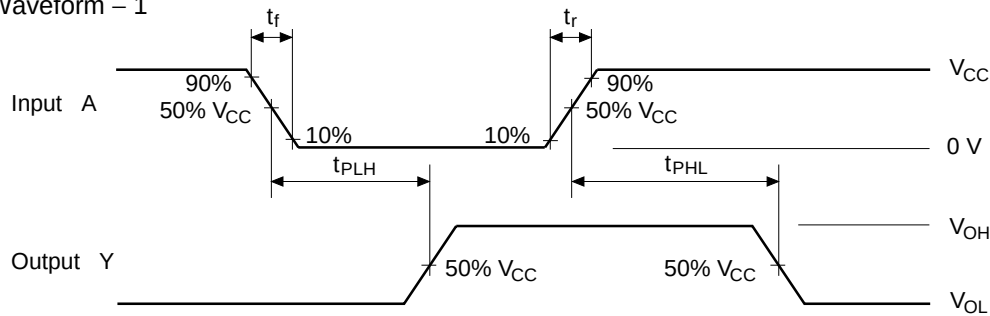
Test Circuit



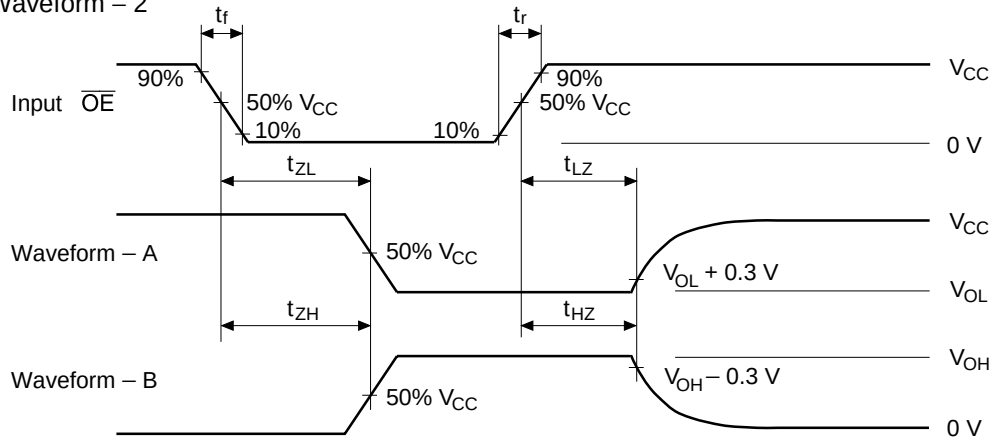
Note:  $C_L$  includes the probe and jig capacitance.

# HD74LV240A

• Waveform – 1



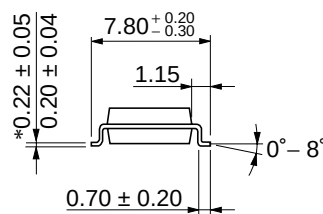
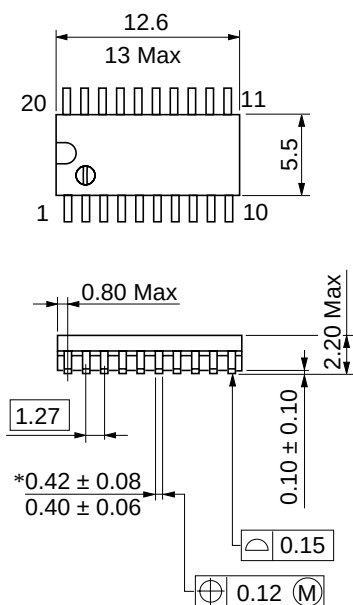
• Waveform – 2



- 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 are measured one at a time with one transition per measurement.

# Package Dimensions

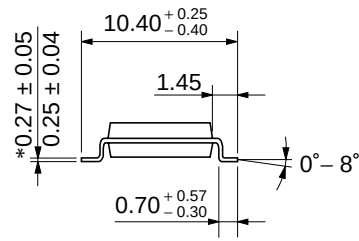
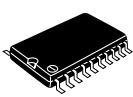
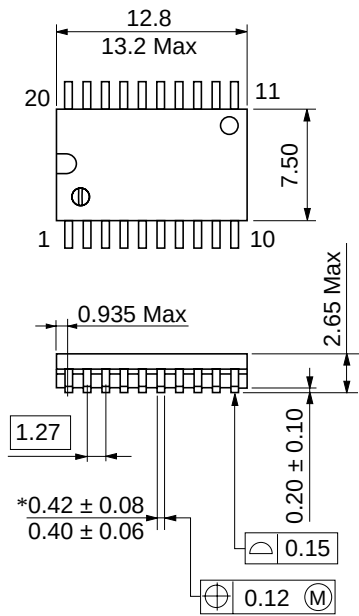
Unit: mm



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

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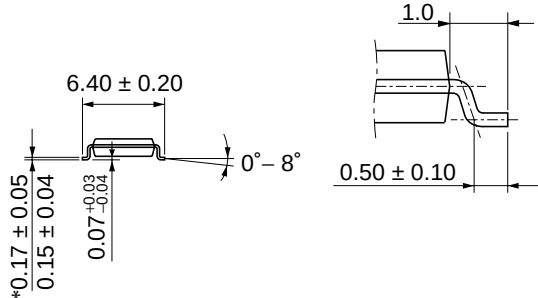
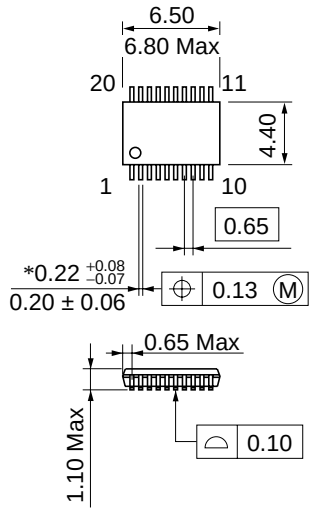
Unit: mm



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

\*Dimension including the plating thickness  
Base material dimension

Unit: mm



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

\*Dimension including the plating thickness  
Base material dimension

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