
HD74ALVCH16334

16-bit Universal Bus Driver with 3-state Outputs

HITACHI

ADE-205-212 (Z)
Preliminary
1st. Edition
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Description

This HD74ALVCH16334 is a 16-bit universal bus driver is designed for 2.3 V to 3.6 V V_{CC} operation.

Data flow from A to Y is controlled by the output enable (\overline{OE}) input. The device operates in the transparent mode when the latch enable (\overline{LE}) input is low. When \overline{LE} is high, the A data is latched if the clock (CLK) input is held at a high or low logic level. If \overline{LE} is high, the A data is stored in the latch/flip flop on the low to high transition of CLK. When \overline{OE} is high, the outputs are in the high impedance state.

To ensure the high impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current sinking capability of the driver.

Active bus hold circuitry is provided to hold unused or floating inputs at a valid logic level.

Features

- $V_{CC} = 2.3 \text{ V to } 3.6 \text{ V}$
- 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 $> 2.0 \text{ V}$ ($@V_{CC} = 3.3 \text{ V, } T_a = 25^\circ\text{C}$)
- High output current $\pm 24 \text{ mA}$ ($@V_{CC} = 3.0 \text{ V}$)
- Bus hold on data inputs eliminates the need for external pullup / pulldown resistors



HD74ALVCH16334

Function Table

| Inputs | | | | Output Y |
|-----------------|-----------------|--------|---|------------|
| \overline{OE} | \overline{LE} | CLK | A | |
| H | X | X | X | Z |
| L | L | X | L | L |
| L | L | X | H | H |
| L | H | ↑ | L | L |
| L | H | ↑ | H | H |
| L | H | L or H | X | Y_0^{-1} |

H : High level

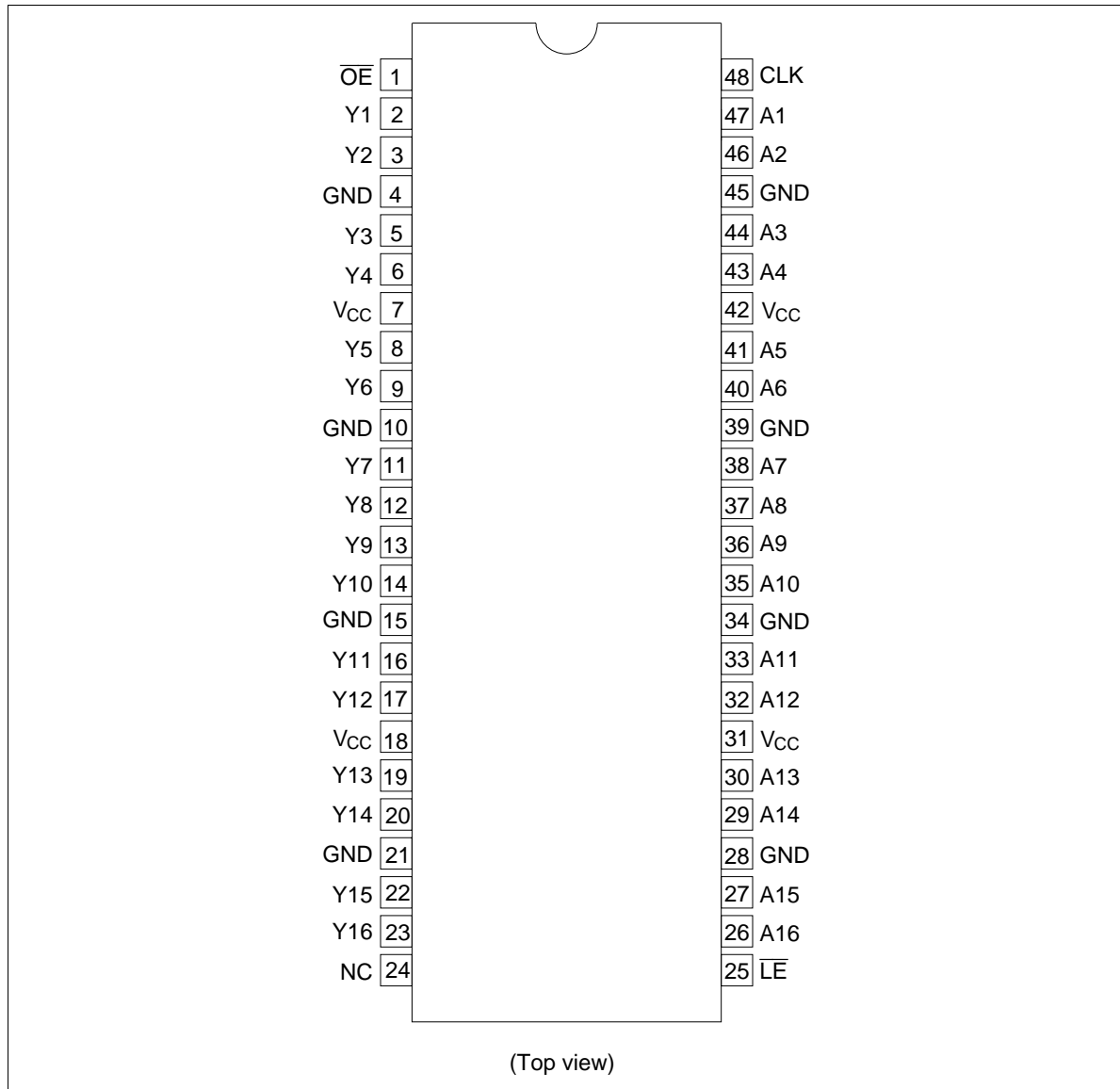
L : Low level

X : Immaterial

Z : High impedance

↑ : Low to high transition

Note: 1. Output level before the indicated steady state input conditions were established.

Pin Arrangement

HD74ALVCH16334

Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Conditions |
|--|-----------------------|------------------------|------------------|-----------------------------|
| Supply voltage | V_{CC} | -0.5 to 4.6 | V | |
| Input voltage ^{*1} | V_I | -0.5 to 4.6 | V | |
| Output voltage ^{*1,2} | V_O | -0.5 to $V_{CC} + 0.5$ | V | |
| Input clamp current | I_{IK} | -50 | mA | $V_I < 0$ |
| Output clamp current | I_{OK} | ± 50 | mA | $V_O < 0$ or $V_O > V_{CC}$ |
| Continuous output current | I_O | ± 50 | mA | $V_O = 0$ to V_{CC} |
| V_{CC} , GND current / pin | I_{CC} or I_{GND} | ± 100 | mA | |
| Maximum power dissipation at $T_a = 55^\circ\text{C}$ (in still air) ^{*3} | P_T | 0.85 | W | TSSOP |
| Storage temperature | T_{stg} | -65 to 150 | $^\circ\text{C}$ | |

Notes: Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

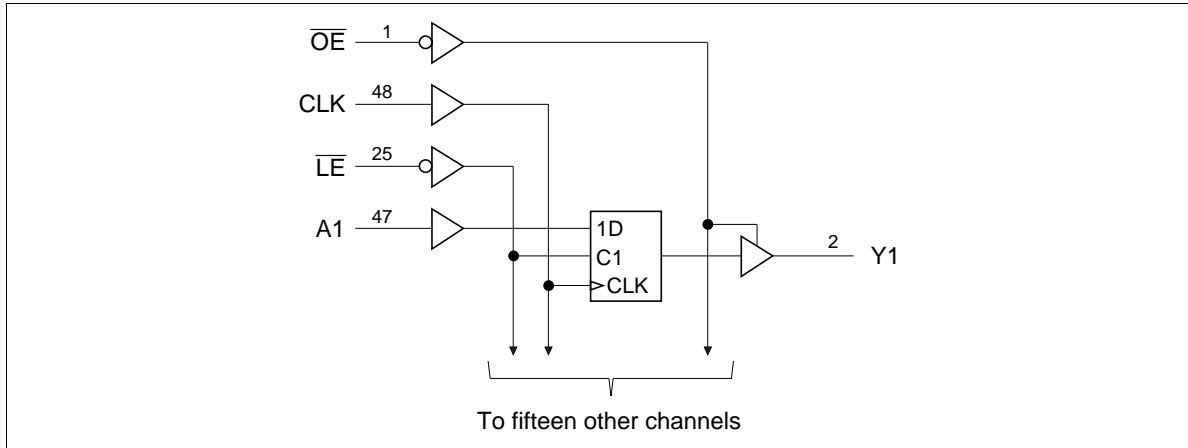
1. The input and output negative voltage ratings may be exceeded if the input and output clamp current ratings are observed.
2. This value is limited to 4.6 V maximum.
3. The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils.

Recommended Operating Conditions

| Item | Symbol | Min | Max | Unit | Conditions |
|------------------------------------|-----------------------|-----|----------|------------------|-------------------------|
| Supply voltage | V_{CC} | 2.3 | 3.6 | V | |
| Input voltage | V_I | 0 | V_{CC} | V | |
| Output voltage | V_O | 0 | V_{CC} | V | |
| High level output current | I_{OH} | — | -12 | mA | $V_{CC} = 2.3\text{ V}$ |
| | | — | -12 | | $V_{CC} = 2.7\text{ V}$ |
| | | — | -24 | | $V_{CC} = 3.0\text{ V}$ |
| Low level output current | I_{OL} | — | 12 | mA | $V_{CC} = 2.3\text{ V}$ |
| | | — | 12 | | $V_{CC} = 2.7\text{ V}$ |
| | | — | 24 | | $V_{CC} = 3.0\text{ V}$ |
| Input transition rise or fall rate | $\Delta t / \Delta v$ | 0 | 10 | ns / V | |
| Operating temperature | T_a | -40 | 85 | $^\circ\text{C}$ | |

Note: Unused control inputs must be held high or low to prevent them from floating.

Logic Diagram



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

| Item | Symbol | V _{CC} (V) | Min | Max | Unit | Test Conditions | | | |
|--------------------------|------------------|---------------------|----------------------|------------------------|------|---|--------------------------|----|--|
| Input voltage | V _{IH} | 2.3 to 2.7 | 1.7 | — | V | | | | |
| | | 2.7 to 3.6 | 2.0 | — | | | | | |
| | V _{IL} | 2.3 to 2.7 | — | 0.7 | | | | | |
| | | 2.7 to 3.6 | — | 0.8 | | | | | |
| Output voltage | V _{OH} | 2.3 to 3.6 | V _{CC} -0.2 | — | V | I _{OH} = -100 μA | | | |
| | | 2.3 | 2.0 | — | | I _{OH} = -6 mA, V _{IH} = 1.7 V | | | |
| | | 2.3 | 1.7 | — | | I _{OH} = -12 mA, V _{IH} = 1.7 V | | | |
| | | 2.7 | 2.2 | — | | I _{OH} = -12 mA, V _{IH} = 2.0 V | | | |
| | | 3.0 | 2.4 | — | | I _{OH} = -12 mA, V _{IH} = 2.0 V | | | |
| | | 3.0 | 2.0 | — | | I _{OH} = -24 mA, V _{IH} = 2.0 V | | | |
| | | V _{OL} | 2.3 to 3.6 | — | | 0.2 | I _{OL} = 100 μA | | |
| | 2.3 | | — | 0.4 | | I _{OL} = 6 mA, V _{IL} = 0.7 V | | | |
| | 2.3 | | — | 0.7 | | I _{OL} = 12 mA, V _{IL} = 0.7 V | | | |
| | 2.7 | | — | 0.4 | | I _{OL} = 12 mA, V _{IL} = 0.8 V | | | |
| | 3.0 | | — | 0.55 | | I _{OL} = 24 mA, V _{IL} = 0.8 V | | | |
| | Input current | | I _{IN} | 3.6 | | — | ±5 | μA | V _{IN} = V _{CC} or GND |
| | | | | I _{IN (hold)} | | 2.3 | 45 | | — |
| | | 2.3 | | | | -45 | — | | V _{IN} = 1.7 V |
| 3.0 | | 75 | | | — | V _{IN} = 0.8 V | | | |
| 3.0 | | -75 | | | — | V _{IN} = 2.0 V | | | |
| 3.6 | | — | | | ±500 | V _{IN} = 0 to 3.6 V ⁻¹ | | | |
| Off state output current | I _{OZ} | 3.6 | — | ±10 | μA | V _{OUT} = V _{CC} or GND | | | |
| Quiescent supply current | I _{CC} | 3.6 | — | 40 | μA | V _{IN} = V _{CC} or GND | | | |
| | ΔI _{CC} | 3.0 to 3.6 | — | 750 | μA | V _{IN} = one input at (V _{CC} -0.6) V, other inputs at V _{CC} or GND | | | |

Note: 1. This is the bus hold maximum dynamic current required to switch the input from one state to another.

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Switching Characteristics (Ta = -40 to 85°C)

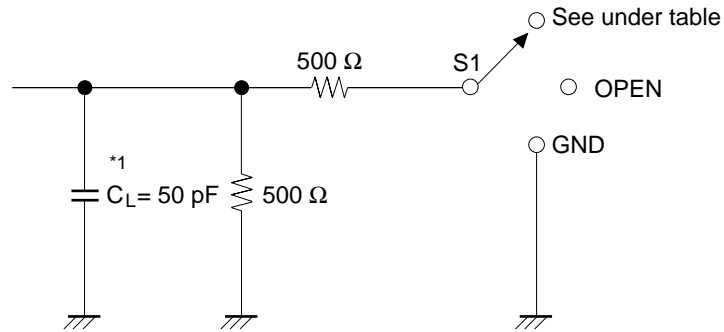
| Item | Symbol | V _{CC} (V) | Min | Typ | Max | Unit | FROM (Input) | TO (Output) |
|-------------------------|------------------|---------------------|-----|-----|-----|------|----------------|-------------|
| Maximum clock frequency | f _{max} | 2.5±0.2 | 150 | — | — | MHz | | |
| | | 2.7 | 150 | — | — | | | |
| | | 3.3±0.3 | 150 | — | — | | | |
| Propagation delay time | t _{PLH} | 2.5±0.2 | 1.0 | — | 3.7 | ns | A | Y |
| | | 2.7 | — | — | 3.6 | | | |
| | | 3.3±0.3 | 1.1 | — | 3.3 | | | |
| | t _{PHL} | 2.5±0.2 | 1.0 | — | 4.8 | | LE | Y |
| | | 2.7 | — | — | 4.4 | | | |
| | | 3.3±0.3 | 1.3 | — | 4.4 | | | |
| | | 2.5±0.2 | 1.0 | — | 4.4 | | CLK | Y |
| | | 2.7 | — | — | 4.1 | | | |
| | | 3.3±0.3 | 1.0 | — | 4.1 | | | |
| Output enable time | t _{ZH} | 2.5±0.2 | 1.0 | — | 5.4 | ns | OE | Y |
| | t _{ZL} | 2.7 | — | — | 4.6 | | | |
| | 3.3±0.3 | 1.1 | — | 4.6 | | | | |
| Output disable time | t _{HZ} | 2.5±0.2 | 1.0 | — | 4.1 | ns | OE | Y |
| | t _{LZ} | 2.7 | — | — | 4.4 | | | |
| | 3.3±0.3 | 1.7 | — | 4.4 | | | | |
| Input capacitance | C _{IN} | 3.3 | — | 5.5 | — | pF | Control inputs | |
| | | 3.3 | — | 6.0 | — | | Data inputs | |
| Output capacitance | C _O | 3.3 | — | 8.0 | — | pF | Outputs | |

HD74ALVCH16334

Switching Characteristics (Ta = -40 to 85°C) (cont)

| Item | Symbol | V _{cc} (V) | Min | Typ | Max | Unit | FROM (Input) |
|-------------|-----------------|---------------------|-----|-----|-----|------|-------------------------------|
| Setup time | t _{su} | 2.5±0.2 | 1.4 | — | — | ns | Data before CLK↑ |
| | | 2.7 | 1.7 | — | — | | |
| | | 3.3±0.3 | 1.5 | — | — | | |
| | | 2.5±0.2 | 1.2 | — | — | | Data before \overline{LE} ↑ |
| | | 2.7 | 1.6 | — | — | | |
| | | 3.3±0.3 | 1.3 | — | — | | |
| | | 2.5±0.2 | 1.4 | — | — | | Data before \overline{LE} ↑ |
| | | 2.7 | 1.5 | — | — | | |
| | | 3.3±0.3 | 1.2 | — | — | | |
| Hold time | t _h | 2.5±0.2 | 0.9 | — | — | ns | Data after CLK↑ |
| | | 2.7 | 0.8 | — | — | | |
| | | 3.3±0.3 | 0.9 | — | — | | |
| | | 2.5±0.2 | 1.2 | — | — | | Data after \overline{LE} ↑ |
| | | 2.7 | 1.1 | — | — | | |
| | | 3.3±0.3 | 1.1 | — | — | | |
| Pulse width | t _w | 2.5±0.2 | 3.3 | — | — | ns | \overline{LE} "L" |
| | | 2.7 | 3.3 | — | — | | |
| | | 3.3±0.3 | 3.3 | — | — | | |
| | | 2.5±0.2 | 3.3 | — | — | | CLK "H" or "L" |
| | | 2.7 | 3.3 | — | — | | |
| | | 3.3±0.3 | 3.3 | — | — | | |

Test Circuit



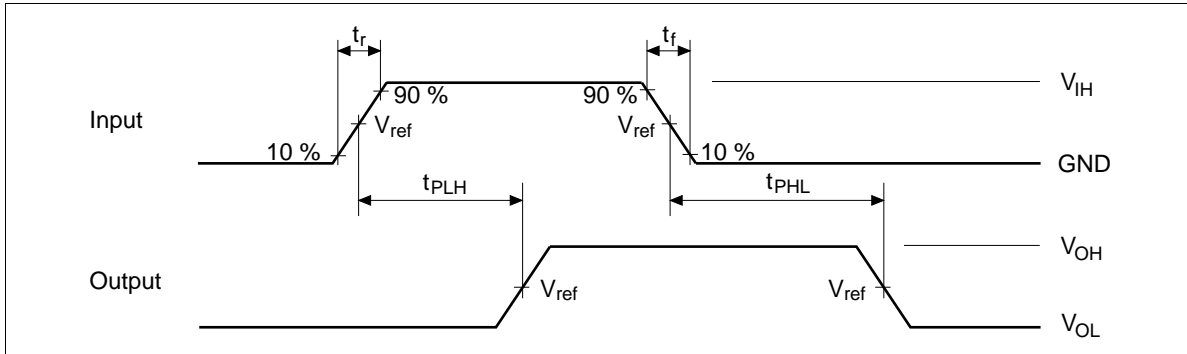
Load Circuit for Outputs

| Symbol | V _{CC} =2.5±0.2V | V _{CC} =2.7V, 3.3±0.3V |
|---|---------------------------|------------------------------------|
| t _{PLH} /t _{PHL} | OPEN | OPEN |
| t _{su} /t _h /t _w | | |
| t _{ZH} /t _{HZ} | GND | GND |
| t _{ZL} /t _{LZ} | 2 × V _{CC} | 6.0 V |

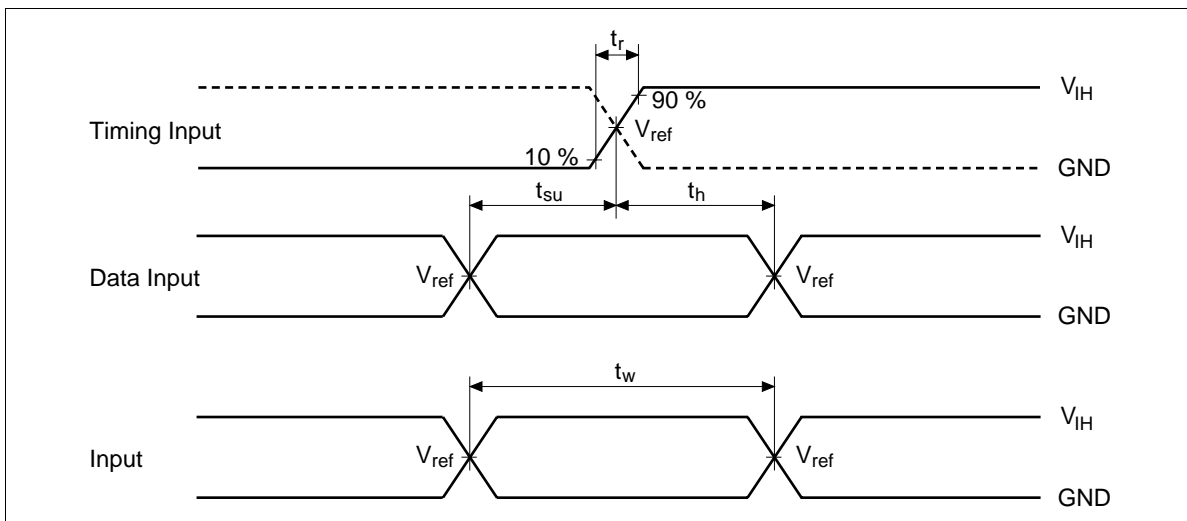
Note: 1. C_L includes probe and jig capacitance.

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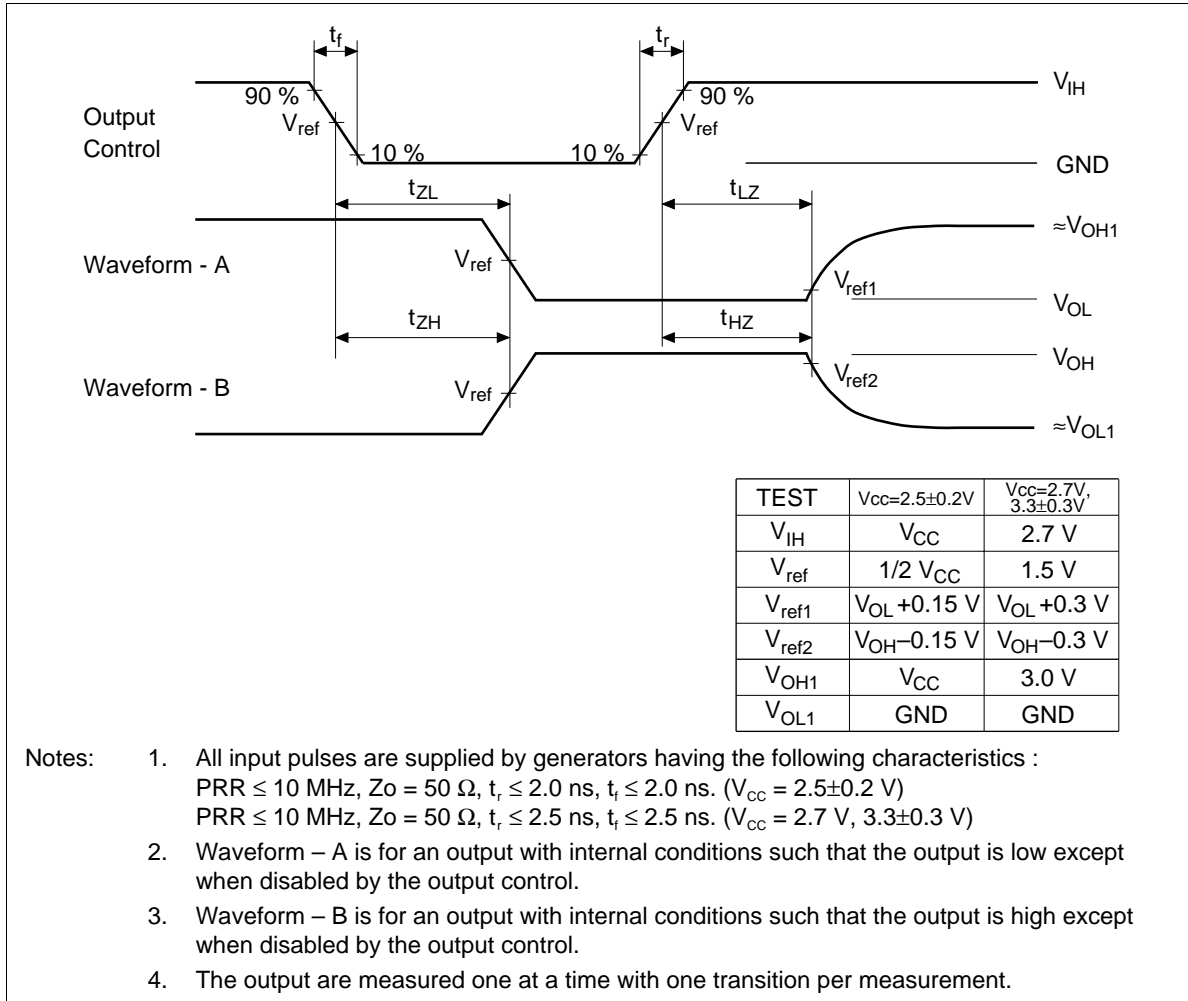
Waveforms – 1



Waveforms – 2



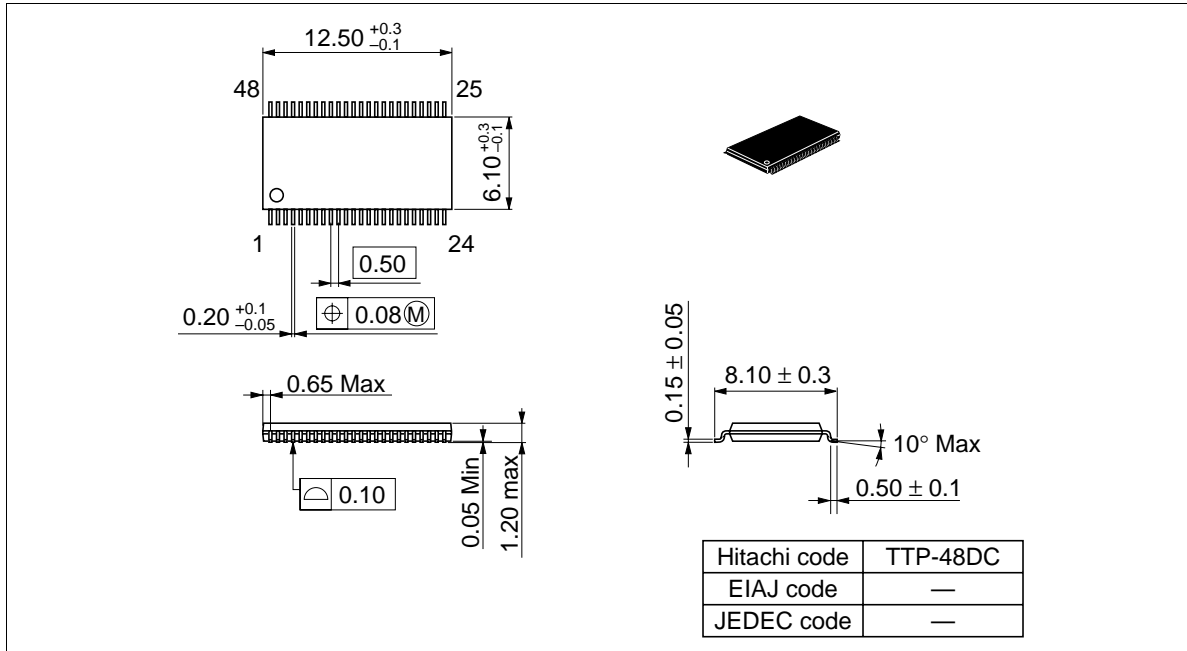
Waveforms – 3



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Package Dimensions

Unit : mm



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