
HD74LV245A

Octal Bus Transceivers with 3-state Outputs

HITACHI

ADE-205-247 (Z)
1st Edition
March 1999

Description

The HD74LV245A has eight buffers with three-state outputs in a 20-pin package. When DIR is high, data is transferred from the A inputs to the B outputs, and when DIR is low, data is transferred from the B inputs to the A outputs. The A and B buses are separated by making the enable input (\overline{OE}) high level. 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 $V_{IH}(\text{Max.}) = 5.5\text{ V}$ ($@V_{CC} = 0\text{ V to }5.5\text{ V}$)
- 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 $\pm 8\text{ mA}$ ($@V_{CC} = 3.0\text{ V to }3.6\text{ V}$), $\pm 16\text{ mA}$ ($@V_{CC} = 4.5\text{ V to }5.5\text{ V}$)

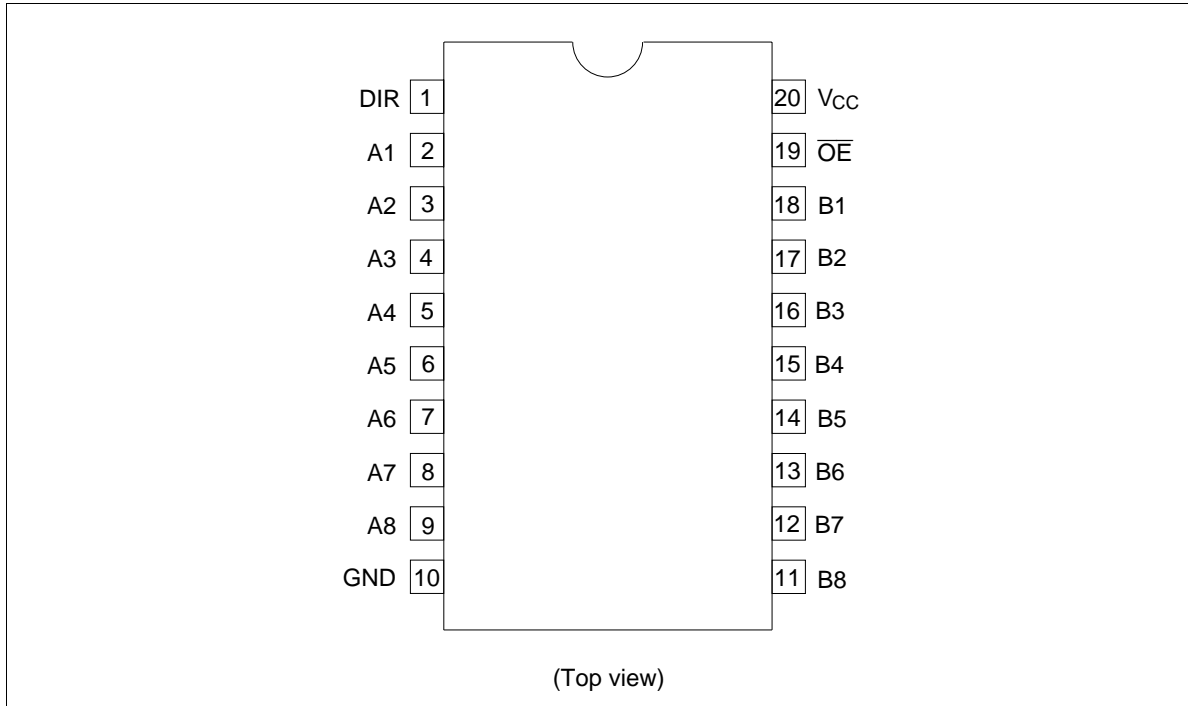
Function Table

| Inputs | | Operation |
|-----------------|-----|-----------------|
| \overline{OE} | DIR | |
| L | L | B data to A bus |
| L | H | A data to B bus |
| H | X | Isolation |

Note: H: High level
L: Low level
X: Immaterial

HD74LV245A

Pin Arrangement



Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit | Conditions |
|--|-----------------------|---------------------------------------|------------------|---|
| Supply voltage range | V_{CC} | -0.5 to 7.0 | V | |
| Input voltage range* ¹ | V_I | -0.5 to 7.0 | V | |
| Output voltage range* ^{1, *2} | V_O | -0.5 to $V_{CC} + 0.5$ -0.5 to 7.0 | V | Output: H or L 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)* ³ | P_T | 835 757 | mW | SOP TSSOP |
| Storage temperature | T_{stg} | -65 to 150 | $^\circ\text{C}$ | |

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 data above are measured by ΔV_{BE} method mounting on glass epoxy board ($40 \times 40 \times 1.6$ mm) with 10% of wiring density.

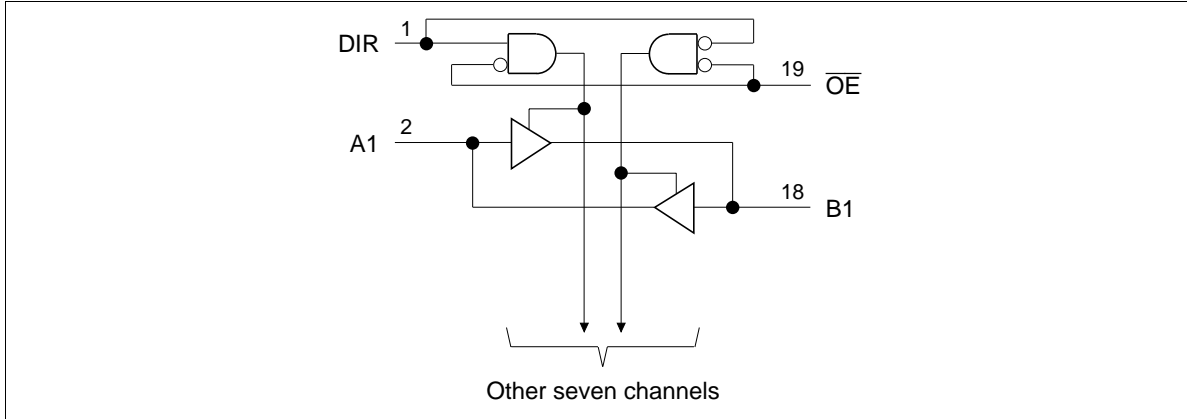
HD74LV245A

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 | Output: H or L |
| | | 0 | 5.5 | | High impedance state |
| Output current | I_{OH} | — | −50 | μA | $V_{CC} = 2.0 \text{ V}$ |
| | | — | −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 | μA | $V_{CC} = 2.0 \text{ V}$ |
| | | — | 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 | $^{\circ}\text{C}$ | |

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

Logic Diagram



HD74LV245A

DC Electrical Characteristics

- $T_a = -40$ to 85°C

| Item | Symbol | V_{CC} (V)*1 | 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 | — | — | ± 1 | μA | $V_{IN} = 5.5 \text{ V or GND}$ |
| Off-state output current | I_{OZ}^{*2} | 5.5 | — | — | ± 5 | μA | $V_O = V_{CC} \text{ or GND}$ |
| Quiescent supply current | I_{CC} | 5.5 | — | — | 20 | μA | $V_{IN} = V_{CC} \text{ or GND, } I_O = 0$ |
| Output leakage current | I_{OFF} | 0 | — | — | 5 | μA | $V_O = 5.5 \text{ V}$ |
| Input capacitance | C_{IN} | 3.3 | — | 3.0 | — | pF | $V_I = V_{CC} \text{ or GND}$ |
| Output capacitance | C_O | 3.3 | — | 5.5 | — | pF | $V_O = V_{CC} \text{ or GND}$ |

Notes: 1. For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

2. For I/O ports, the parameter I_{OZ} includes the input leakage current.

Switching Characteristics

- $V_{CC} = 2.5 \pm 0.2 V$

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|------------------------|-----------|-----------|------|------|------------------|------|------|-----------------|-----------------|-------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 8.3 | 13.0 | 1.0 | 15.0 | ns | $C_L = 15 pF$ | A or B | B or A |
| | t_{PHL} | — | 11.2 | 15.9 | 1.0 | 18.0 | | $C_L = 50 pF$ | | |
| Enable time | t_{ZH} | — | 11.8 | 19.9 | 1.0 | 22.0 | ns | $C_L = 15 pF$ | \overline{OE} | A or B |
| | t_{ZL} | — | 14.1 | 22.7 | 1.0 | 26.0 | | $C_L = 50 pF$ | | |
| Disable time | t_{HZ} | — | 11.8 | 18.1 | 1.0 | 20.0 | ns | $C_L = 15 pF$ | \overline{OE} | A or B |
| | t_{LZ} | — | 17.6 | 23.1 | 1.0 | 25.0 | | $C_L = 50 pF$ | | |

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

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|------------------------|-----------|-----------|------|------|------------------|------|------|-----------------|-----------------|-------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 5.9 | 8.4 | 1.0 | 10.0 | ns | $C_L = 15 pF$ | A or B | B or A |
| | t_{PHL} | — | 7.9 | 11.9 | 1.0 | 13.5 | | $C_L = 50 pF$ | | |
| Enable time | t_{ZH} | — | 8.2 | 13.2 | 1.0 | 15.5 | ns | $C_L = 15 pF$ | \overline{OE} | A or B |
| | t_{ZL} | — | 9.9 | 16.7 | 1.0 | 19.0 | | $C_L = 50 pF$ | | |
| Disable time | t_{HZ} | — | 9.6 | 16.5 | 1.0 | 19.5 | ns | $C_L = 15 pF$ | \overline{OE} | A or B |
| | t_{LZ} | — | 13.9 | 19.8 | 1.0 | 22.0 | | $C_L = 50 pF$ | | |

HD74LV245A

Switching Characteristics (cont)

- $V_{CC} = 5.0 \pm 0.5 \text{ V}$

| Item | Symbol | Ta = 25°C | | | Ta = -40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|---------------------------|-----------|-----------|------|------|------------------|------|------|-----------------------|-----------------|----------------|
| | | Min | Typ | Max | Min | Max | | | | |
| Propagation delay time | t_{PLH} | — | 4.3 | 5.5 | 1.0 | 6.5 | ns | $C_L = 15 \text{ pF}$ | A or B | B or A |
| | t_{PHL} | — | 5.6 | 7.5 | 1.0 | 8.5 | | | | |
| Enable time | t_{ZH} | — | 5.7 | 8.5 | 1.0 | 10.0 | ns | $C_L = 15 \text{ pF}$ | \overline{OE} | A or B |
| | t_{ZL} | — | 7.0 | 10.6 | 1.0 | 12.0 | | | | |
| Disable time | t_{HZ} | — | 7.8 | 12.8 | 1.0 | 14.2 | ns | $C_L = 15 \text{ pF}$ | \overline{OE} | A or B |
| | t_{LZ} | — | 10.9 | 14.7 | 1.0 | 16.0 | | | | |

Output-skew Characteristics

- $C_L = 50 \text{ pF}$

| Item | Symbol | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ | | $T_a = -40 \text{ to } 85^\circ\text{C}$ | | Unit |
|-------------|-------------|----------------------|--------------------------|-----|--|-----|------|
| | | | Min | Max | Min | Max | |
| Output skew | $t_{sk(O)}$ | 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 me 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 | — | 20.0 | — | pF | $f = 10 \text{ MHz}$ |
| | | 5.0 | — | 25.0 | — | | |

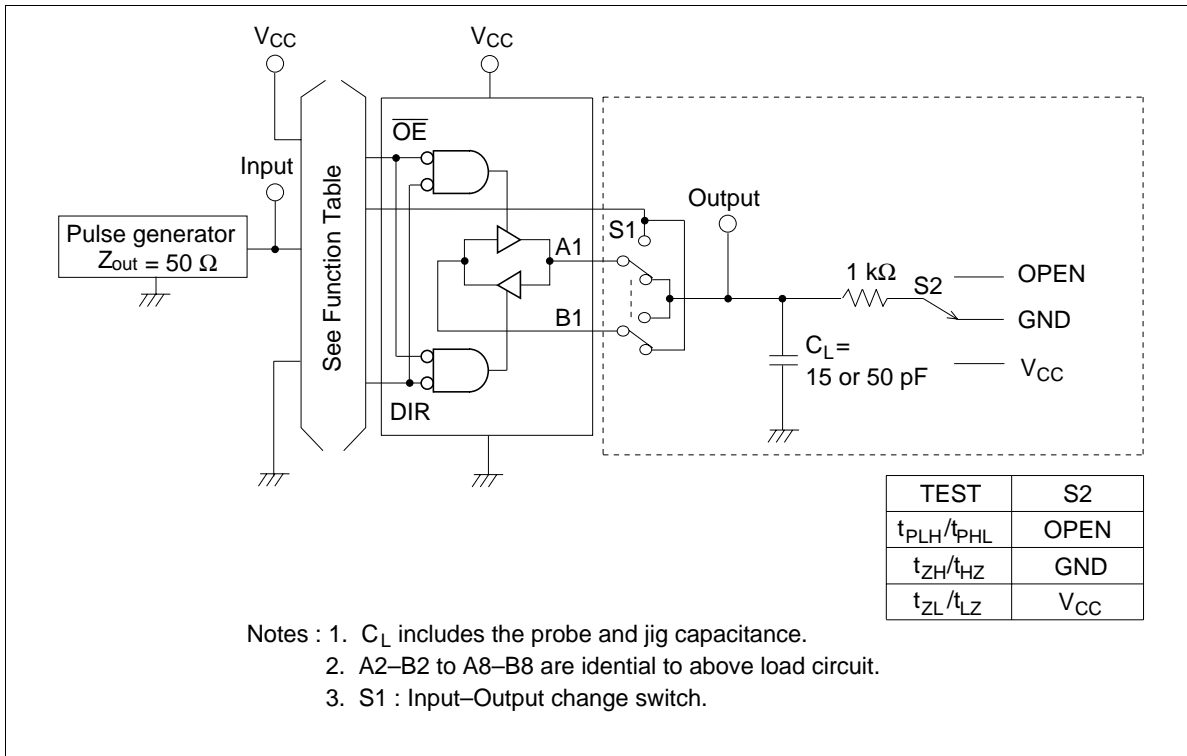
Noise Characteristics

- $C_L = 50 \text{ pF}$

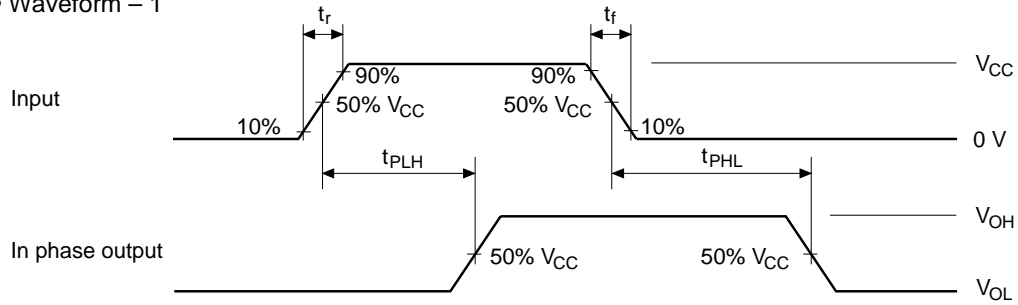
| Item | Symbol | $V_{CC} \text{ (V)}$ | $T_a = 25^\circ\text{C}$ | | | Unit | Test Conditions |
|--|-------------|----------------------|--------------------------|------|------|------|-----------------|
| | | | Min | Typ | Max | | |
| Quiet output, maximum dynamic V_{OL} | $V_{OL(P)}$ | 3.3 | — | 0.5 | 0.8 | V | |
| Quiet output, minimum dynamic V_{OL} | $V_{OL(V)}$ | 3.3 | — | -0.4 | -0.8 | | |
| Quiet output, minimum dynamic V_{OH} | $V_{OH(V)}$ | 3.3 | — | 2.9 | — | V | |
| High-level dynamic input voltage | $V_{IH(D)}$ | 3.3 | 2.31 | — | — | | |
| Low level dynamic input voltage | $V_{IL(D)}$ | 3.3 | — | — | 0.99 | | |

HD74LV245A

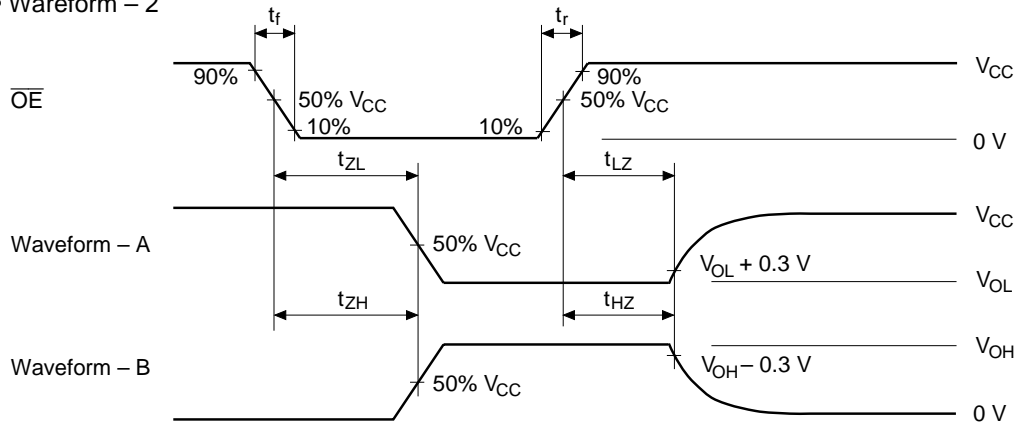
Test Circuit



• Waveform – 1



• Waveform – 2

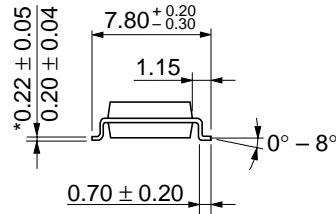
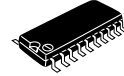
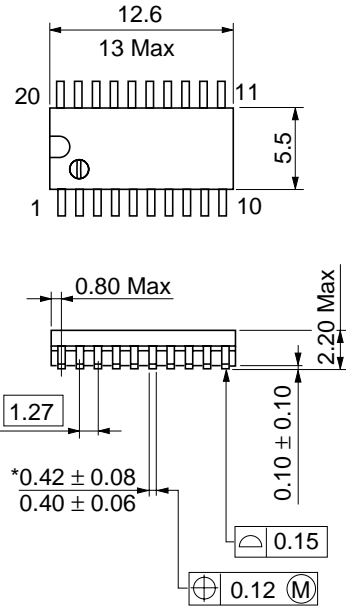


- Notes:
1. Input waveform: $PRR \leq 1 \text{ MHz}$, $Z_o = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$
 2. Waveform-A is for an output with internal conditions such that the output is low except when disabled by the output control.
 3. Waveform-B is for an output with internal conditions 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.

HD74LV245A

Package Dimensions

Unit: mm

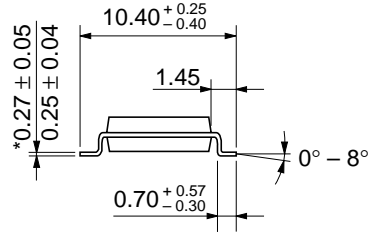
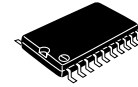
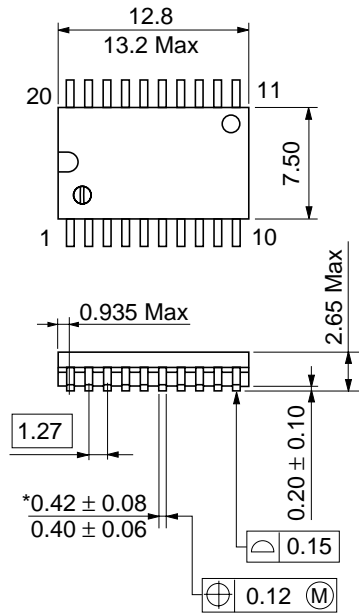


*Dimension including the plating thickness
Base material dimension

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

HD74LV245A

Unit: mm

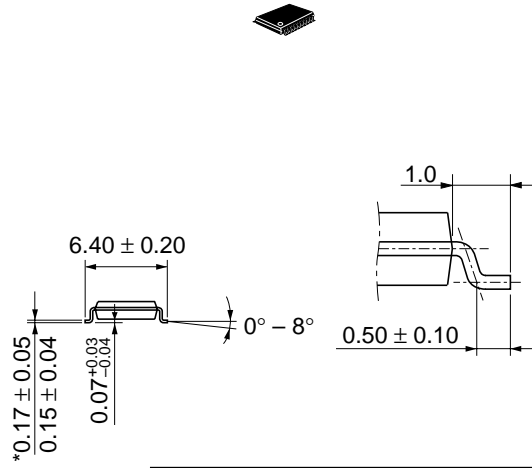
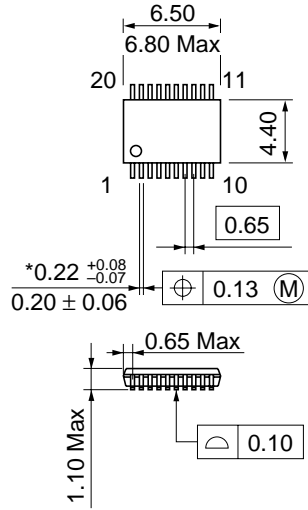


*Dimension including the plating thickness
Base material dimension

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

HD74LV245A

Unit: mm



*Dimension including the plating thickness
Base material dimension

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

HITACHI

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as in aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safe devices, so that the equipment incorporating the Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

Hitachi, Ltd.

Semiconductor & IC Div.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL North America : <http://semiconductor.hitachi.com/>
 Europe : <http://www.hitachi-eu.com/hel/ecg>
 Asia (Singapore) : <http://www.has.hitachi.com.sg/grp3/sicd/index.htm>
 Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
 Asia (HongKong) : <http://www.hitachi.com.hk/eng/bo/grp3/index.htm>
 Japan : <http://www.hitachi.co.jp/Sicd/indx.htm>

For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose, CA 95134
Tel: <1> (408) 433-1990
Fax: <1> (408) 433-0223

Hitachi Europe GmbH
Electronic components Group
Dornacher Straße 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building, No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX

Copyright © Hitachi, Ltd., 1998. All rights reserved. Printed in Japan.

HITACHI



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.