

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# HD74LVCZ16245A

## 16-bit Bidirectional Transceivers with 3-state Outputs

REJ03D0375-0200  
 (Previous ADE-205-233 (Z))  
 Rev.2.00  
 Aug. 20.2004

### Description

The HD74LVCZ16245A has sixteen two direction buffers, for the fittest at two direction bus lines with three state outputs in a 48 pin package. When (DIR) is high, data flows from the A inputs to the B outputs, and when (DIR) is low, data flows from the B inputs to the A outputs. A and B bus are separated by making enable input ( $\overline{G}$ ) high level.

When  $V_{CC}$  is between 0 and 1.5 V, the device is in the high impedance state during power up or power down.

Low voltage and high-speed operation is suitable at battery drive product (note type personal computer) and low power consumption extends the life of a battery for long time operation.

### Features

- $V_{CC} = 2.7$  to  $5.5$  V
- All inputs  $V_{IH} (\text{Max}) = 5.5$  V (@ $V_{CC} = 0$  to  $5.5$  V)
- All inputs / outputs  $V_{IO} (\text{Max}) = 5.5$  V (@ $V_{CC} = 0$  V or output off state)
- Typical  $V_{OL}$  ground bounce  $< 0.8$  V (@ $V_{CC} = 3.3$  V,  $T_a = 25^\circ\text{C}$ )
- Typical  $V_{OH}$  undershoot  $> 2.0$  V (@ $V_{CC} = 3.3$  V,  $T_a = 25^\circ\text{C}$ )
- High impedance state during power up and power down
- Power off disables outputs, permitting live insertion
- High output current  $\pm 24$  mA (@ $V_{CC} = 3.0$  to  $5.5$  V)
- Ordering Information

| Part Name         | Package Type | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|-------------------|--------------|--------------|----------------------|--------------------------------|
| HD74LVCZ16245ATEL | TSSOP-48 pin | TTP-48DBV    | T                    | EL (1,000 pcs/reel)            |

### Function Table

#### Inputs

| $\overline{G}$ | DIR | Operation       |
|----------------|-----|-----------------|
| L              | L   | B data to A bus |
| L              | H   | A data to B bus |
| H              | X   | Z               |

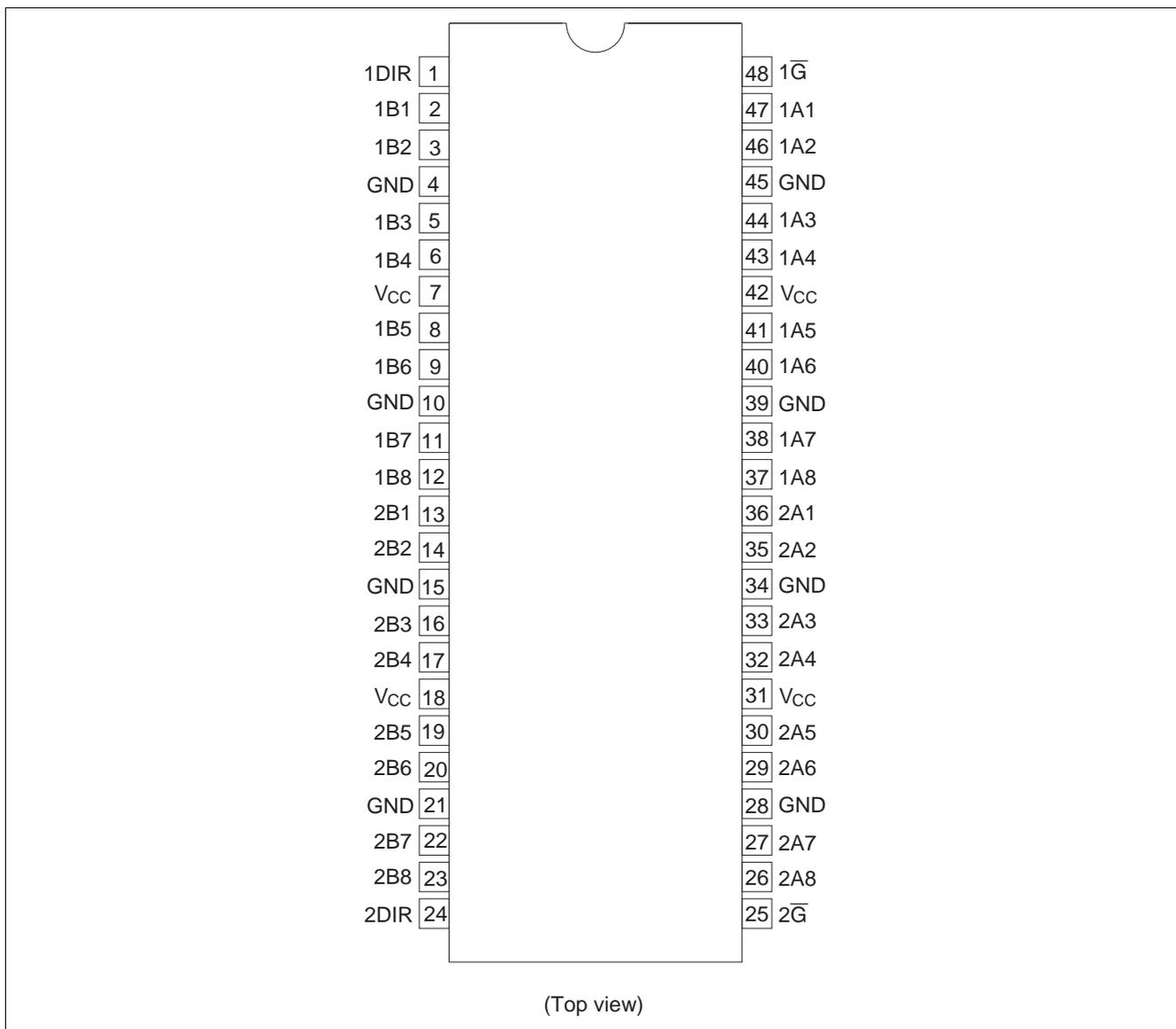
H: High level

L: Low level

X: Immaterial

Z: High impedance

**Pin Arrangement**



**Absolute Maximum Ratings**

| Item                   | Symbol                | Ratings                             | Unit        | Conditions  |
|------------------------|-----------------------|-------------------------------------|-------------|---|
| Supply voltage         | $V_{CC}$              | -0.5 to 7.0                         | V           |   |
| Input voltage          | $V_I$                 | -0.5 to 7.0                         | V           |   |
| Input / output voltage | $V_{I/O}$             | -0.5 to 7.0<br>-0.5 to $V_{CC}+0.5$ | V           | Output "Z" or $V_{CC}$ : OFF<br>Output "H" or "L" |
| Input diode current    | $I_{IK}$              | -50                                 | mA          | $V_I < 0$   |
| Output diode current   | $I_{OK}$              | -50                                 | mA          | $V_O < 0$   |
| Output current         | $I_O$                 | $\pm 50$                            | mA          |   |
| $V_{CC}$ , GND current | $I_{CC}$ or $I_{GND}$ | $\pm 100$                           | mA          |   |
| Storage temperature    | $T_{stg}$             | -65 to 150                          | $^{\circ}C$ |   |

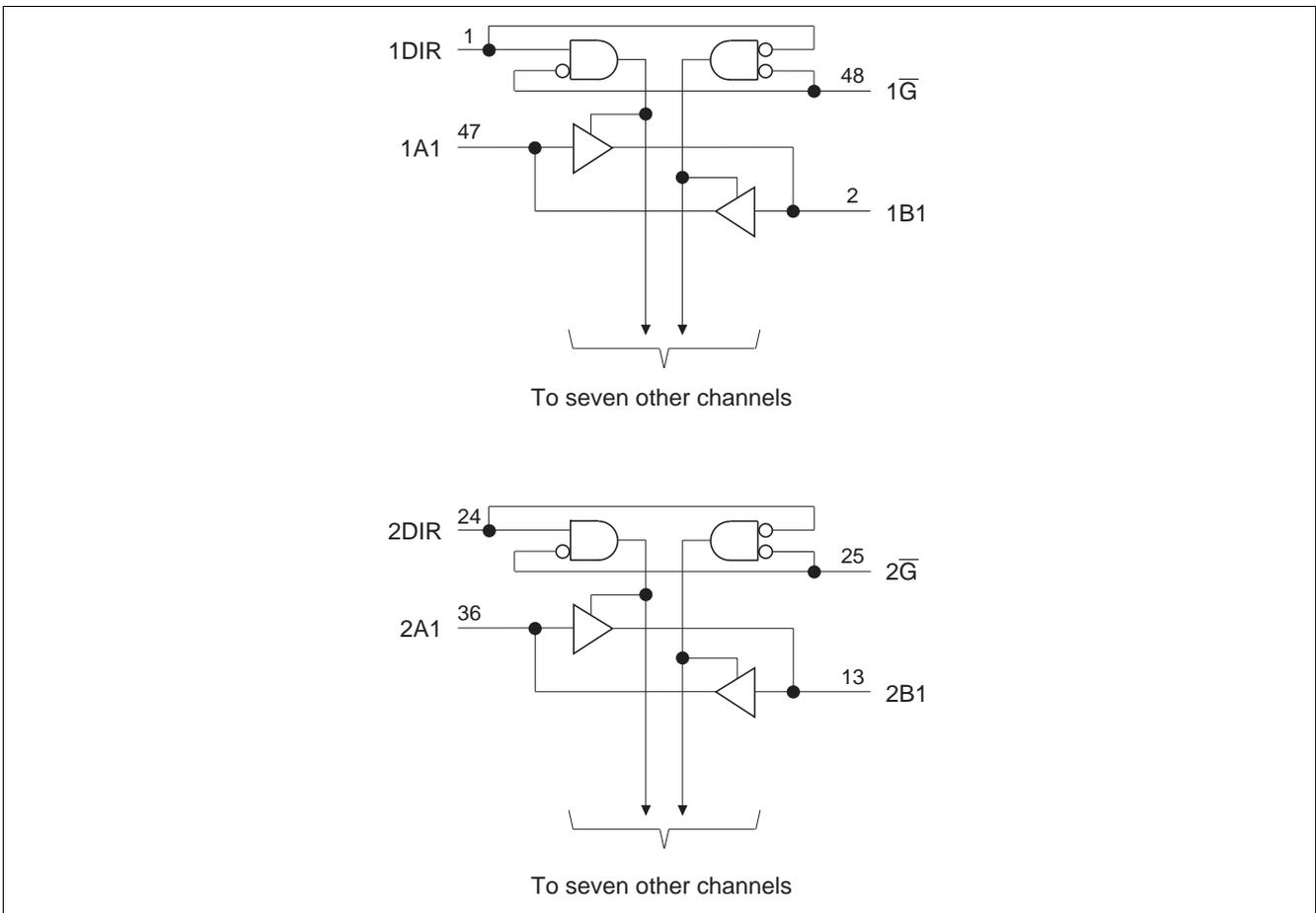
Note: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

**Recommended Operating Conditions**

| Item                   | Symbol     | Ratings           | Unit   | Conditions                            |
|------------------------|------------|-------------------|--------|---------------------------------------|
| Supply voltage         | $V_{CC}$   | 2.7 to 5.5        | V      | At operation                          |
| Input voltage          | $V_I$      | 0 to 5.5          | V      |                                       |
| Input / output voltage | $V_{I/O}$  | 0 to 5.5          | V      | Output "Z" or $V_{CC}$ : OFF          |
|                        |            | 0 to $V_{CC}$     |        | Output "H" or "L"                     |
| Output current         | $I_{OH}$   | -12               | mA     | $V_{CC} = 2.7\text{ V}$               |
|                        |            | -24 <sup>*1</sup> |        | $V_{CC} = 3.0\text{ to }5.5\text{ V}$ |
|                        | $I_{OL}$   | 12                | mA     | $V_{CC} = 2.7\text{ V}$               |
|                        |            | 24 <sup>*1</sup>  |        | $V_{CC} = 3.0\text{ to }5.5\text{ V}$ |
| Input rise / fall time | $t_r, t_f$ | 0 to 6            | ns / V |                                       |
| Operating temperature  | $T_a$      | -40 to +85        | °C     |                                       |

Note: 1. Duty cycle ≤ 50%

**Logic Diagram**



**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>   | 2.7 to 3.6          | 2.0                  | —   | —                    | V    |  |
|                            |                   | 4.5 to 5.5          | V <sub>CC</sub> ×0.7 | —   | —                    |      |  |
|                            | V <sub>IL</sub>   | 2.7 to 3.6          | —                    | —   | 0.8                  | V    |  |
|                            |                   | 4.5 to 5.5          | —                    | —   | V <sub>CC</sub> ×0.3 |      |  |
| Output voltage             | V <sub>OH</sub>   | 2.7 to 5.5          | V <sub>CC</sub> -0.2 | —   | —                    | V    | I <sub>OH</sub> = -100 μA  |
|                            |                   | 2.7                 | 2.2                  | —   | —                    |      | I <sub>OH</sub> = -12 mA   |
|                            |                   | 3.0                 | 2.4                  | —   | —                    |      | I <sub>OH</sub> = -24 mA   |
|                            |                   | 3.0                 | 2.2                  | —   | —                    |      |  |
|                            | V <sub>OL</sub>   | 2.7 to 5.5          | —                    | —   | 0.2                  | V    | I <sub>OL</sub> = 100 μA   |
|                            |                   | 2.7                 | —                    | —   | 0.4                  |      | I <sub>OL</sub> = 12 mA  |
|                            |                   | 3.0                 | —                    | —   | 0.55                 |      | I <sub>OL</sub> = 24 mA  |
|                            |                   | 4.5                 | —                    | —   | 0.55                 |      |  |
| Input current              | I <sub>IN</sub>   | 0 to 5.5            | —                    | —   | ±5                   | μA   | V <sub>IN</sub> = 0 to 5.5 V   |
| Off state output current   | I <sub>OZ</sub>   | 2.7 to 5.5          | —                    | —   | ±5                   | μA   | V <sub>OUT</sub> = 0 to 5.5 V  |
|                            | I <sub>OZPU</sub> | 0 to 1.5            | —                    | —   | ±5                   | μA   | V <sub>OUT</sub> = 0.5 to 5.5 V,<br>Output enable = don't care                                     |
|                            | I <sub>OZPD</sub> | 1.5 to 0            | —                    | —   | ±5                   |      |  |
| Output leak current        | I <sub>OFF</sub>  | 0                   | —                    | —   | ±5                   | μA   | V <sub>IN</sub> or V <sub>O</sub> = 5.5 V  |
| Quiescent supply current   | I <sub>CC</sub>   | 2.7 to 3.6          | —                    | —   | 225                  | μA   | V <sub>IN</sub> = 3.6 to 5.5 V <sup>*1</sup> , I <sub>O</sub> = 0                                  |
|                            |                   | 2.7 to 5.5          | —                    | —   | 350                  |      | V <sub>IN</sub> = V <sub>CC</sub> or GND   |
|                            | ΔI <sub>CC</sub>  | 2.7 to 3.6          | —                    | —   | 500                  | μA   | V <sub>IN</sub> = one input at (V <sub>CC</sub> -0.6) V,<br>other inputs at V <sub>CC</sub> or GND |
| Input capacitance          | C <sub>IN</sub>   | 3.3                 | —                    | 4.1 | —                    | pF   | V <sub>IN</sub> = V <sub>CC</sub> or GND   |
| Input / output capacitance | C <sub>I/O</sub>  | 3.3                 | —                    | 9.2 | —                    | pF   | V <sub>OUT</sub> = V <sub>CC</sub> or GND  |

Note: 1. This applies in the disabled state only.

**Switching Characteristics**

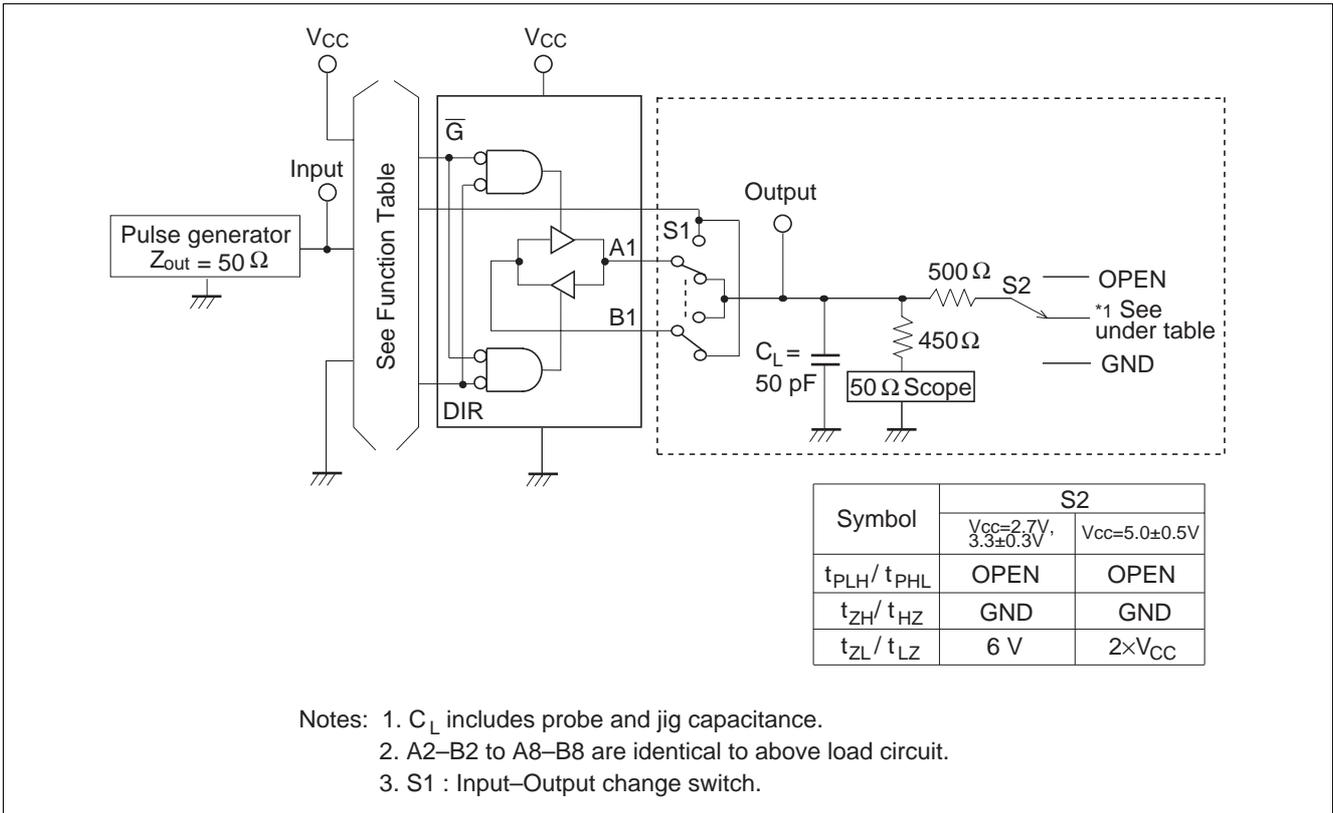
(Ta = -40 to 85°C)

| Item                                  | Symbol            | V <sub>CC</sub> (V) | Min | Typ | Max | Unit | FROM (Input) | TO (Output) |
|---------------------------------------|-------------------|---------------------|-----|-----|-----|------|--------------|-------------|
| Propagation delay time                | t <sub>PLH</sub>  | 2.7                 | —   | —   | 5.2 | ns   | A or B       | B or A      |
|                                       | t <sub>PHL</sub>  | 3.3±0.3             | 1.0 | —   | 4.6 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 4.0 |      |              |             |
| Output enable time                    | t <sub>ZH</sub>   | 2.7                 | —   | —   | 7.3 | ns   | G̅           | A or B      |
|                                       | t <sub>ZL</sub>   | 3.3±0.3             | 1.5 | —   | 6.3 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 5.2 |      |              |             |
| Output disable time                   | t <sub>HZ</sub>   | 2.7                 | —   | —   | 7.5 | ns   | G̅           | A or B      |
|                                       | t <sub>LZ</sub>   | 3.3±0.3             | 1.5 | —   | 6.9 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 6.0 |      |              |             |
| Between output pin skew <sup>*1</sup> | t <sub>OSLH</sub> | 2.7                 | —   | —   | —   | ns   |              |             |
|                                       | t <sub>OSSL</sub> | 3.3±0.3             | —   | —   | 1.0 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 1.0 |      |              |             |

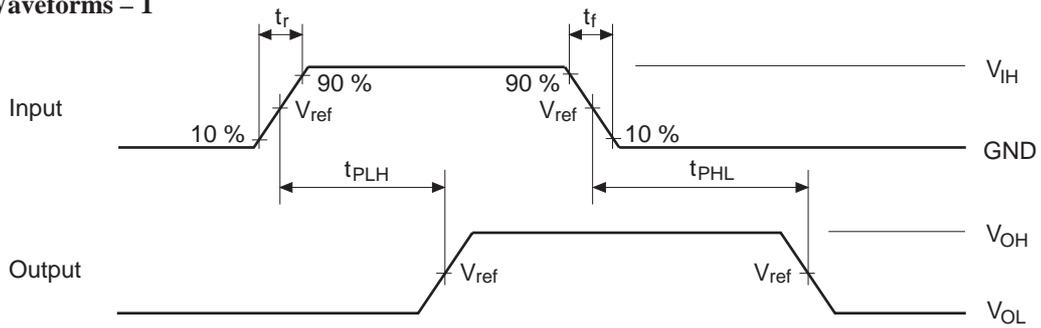
Note: 1. This parameter is characterized but not tested.

$$t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSSL} = |t_{PHLm} - t_{PHLn}|$$

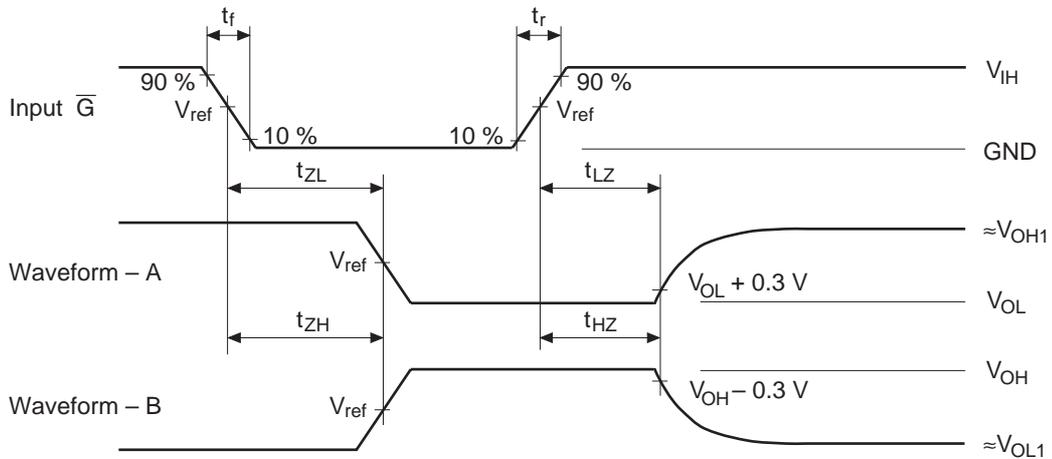
Test Circuit



• Waveforms – 1



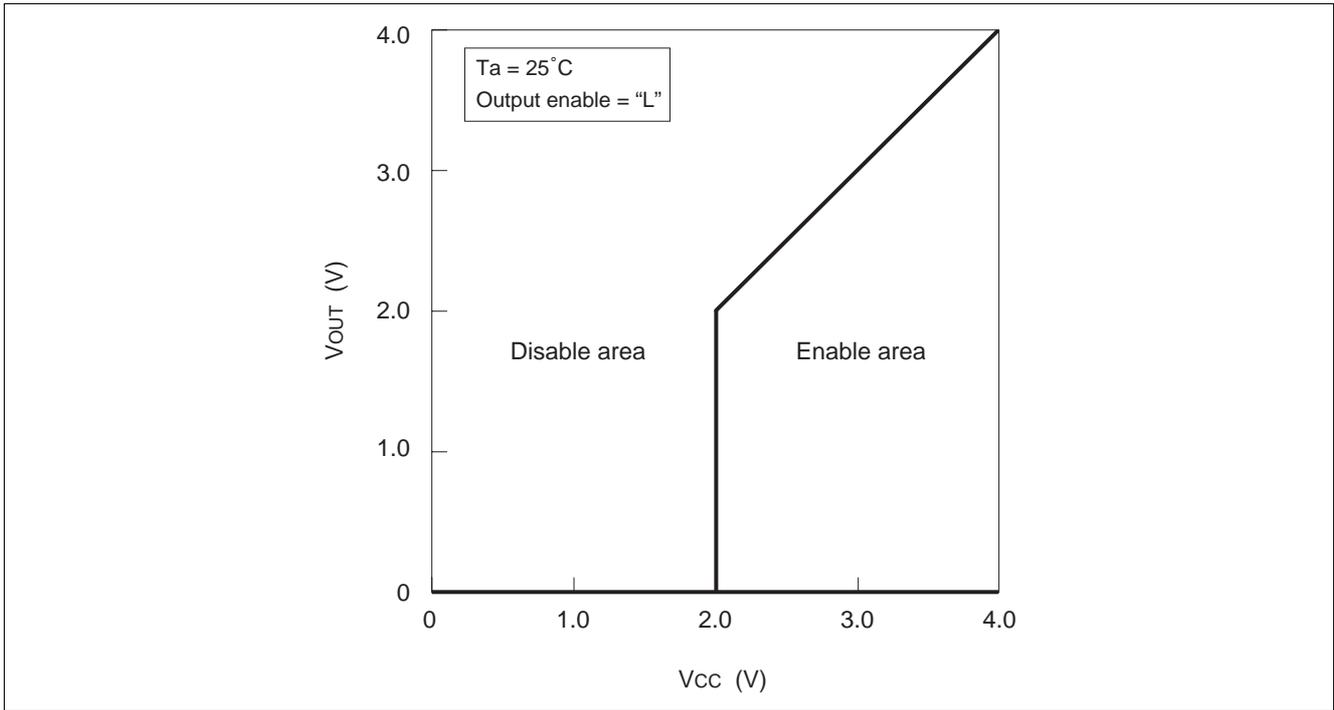
• Waveforms – 2



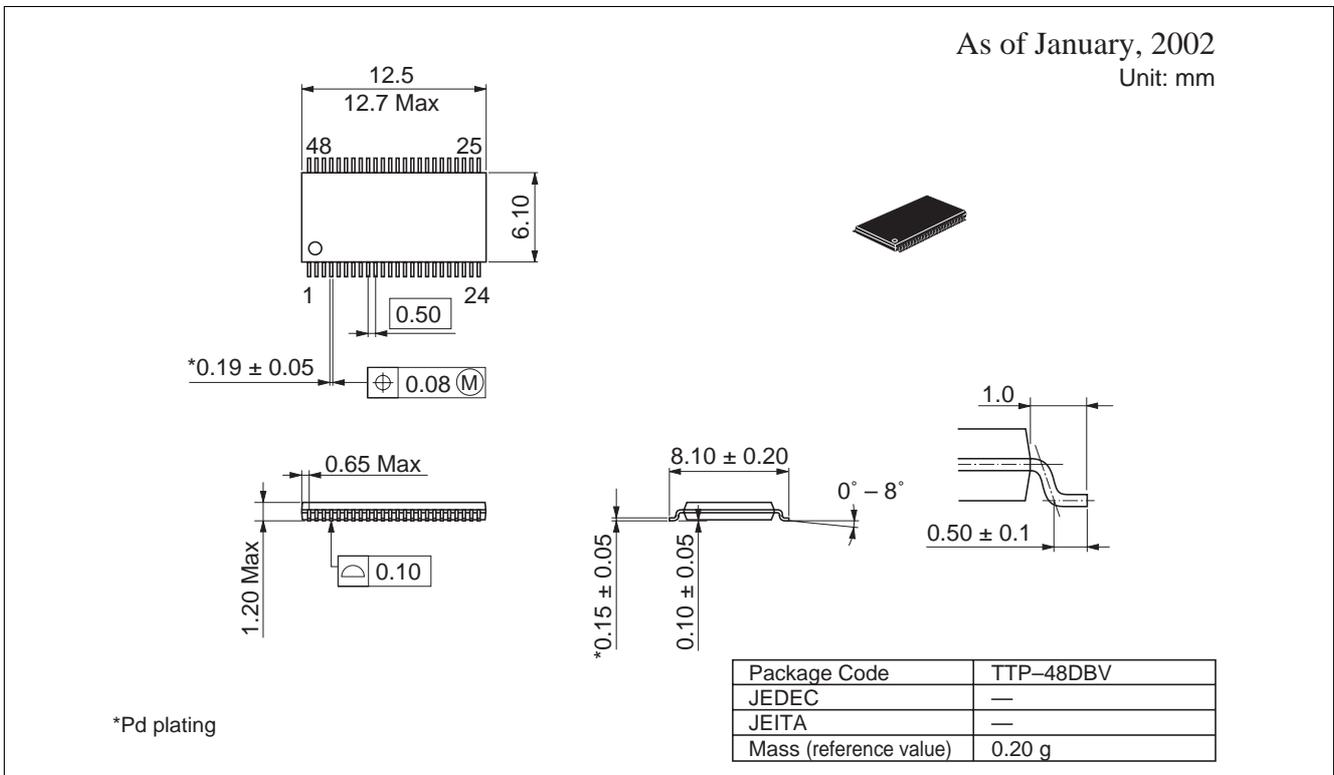
| TEST      | $V_{CC}=2.7V$ ,<br>$3.3\pm 0.3V$ | $V_{CC}=5.0\pm 0.5V$ |
|-----------|----------------------------------|----------------------|
| $V_{IH}$  | 2.7 V                            | $V_{CC}$             |
| $V_{ref}$ | 1.5 V                            | $50\%V_{CC}$         |
| $V_{OH1}$ | 3 V                              | $V_{CC}$             |
| $V_{OL1}$ | GND                              | GND                  |

- Notes: 1. Input waveform : PRR = 10 MHz, duty cycle 50%,  $t_r = 2.5$  ns,  $t_f = 2.5$  ns  
 2. Waveform – A shows input conditions such that the output is “L” level when enabled by the output control.  
 3. Waveform – B shows input conditions such that the output is “H” level when enabled by the output control.

Power up / down Characteristics



Package Dimensions



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