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

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# HD74LVCZ16244A

## 16-bit Buffers / Line Drivers with 3-state Outputs

REJ03D0374-0200  
(Previous ADE-205-232 (Z))  
Rev.2.00  
Aug. 19, 2004

### Description

The HD74LVCZ16244A has sixteen line drivers with three state outputs in a 48 pin package. This device is a non inverting buffer and has four active low enables ( $\overline{1G}$  to  $\overline{4G}$ ). Each enable independently controls four buffers.

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  $V_{IH}$  (Max) = 5.5 V (@ $V_{CC} = 0$  to 5.5 V)
- All outputs  $V_O$  (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) |
|-------------------|--------------|--------------|----------------------|--------------------------------|
| HD74LVCZ16244ATEL | TSSOP-48 pin | TTP-48DBV    | T                    | EL (1,000 pcs/reel)            |

### Function Table

#### Inputs

| $\overline{G}$ | A | Output Y |
|----------------|---|----------|
| H              | X | Z        |
| L              | H | H        |
| L              | L | L        |

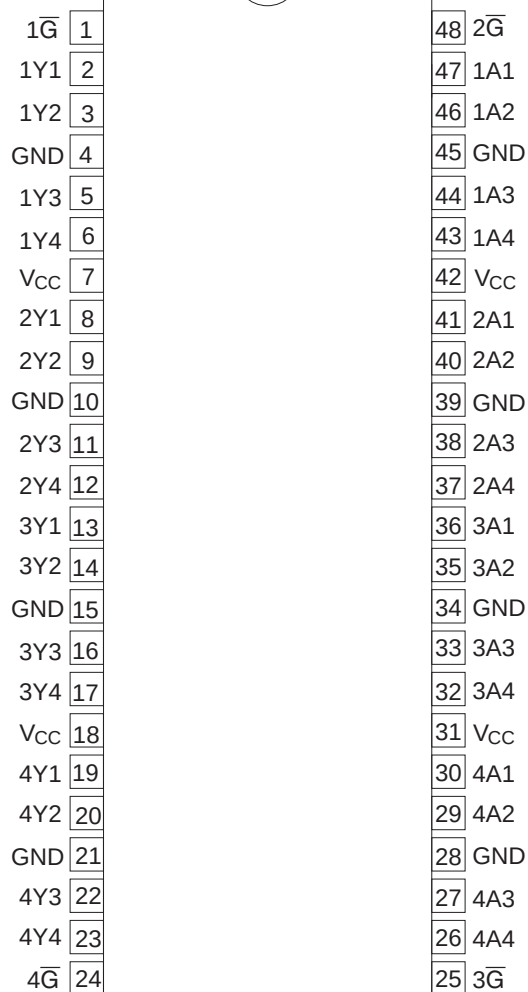
H: High level

L: Low level

X: Immaterial

Z: High impedance

## Pin Arrangement



(Top view)

## 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    |                                                   |
| Output voltage         | $V_O$                 | -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    | Tstg                  | -65 to 150                          | °C   |                                                   |

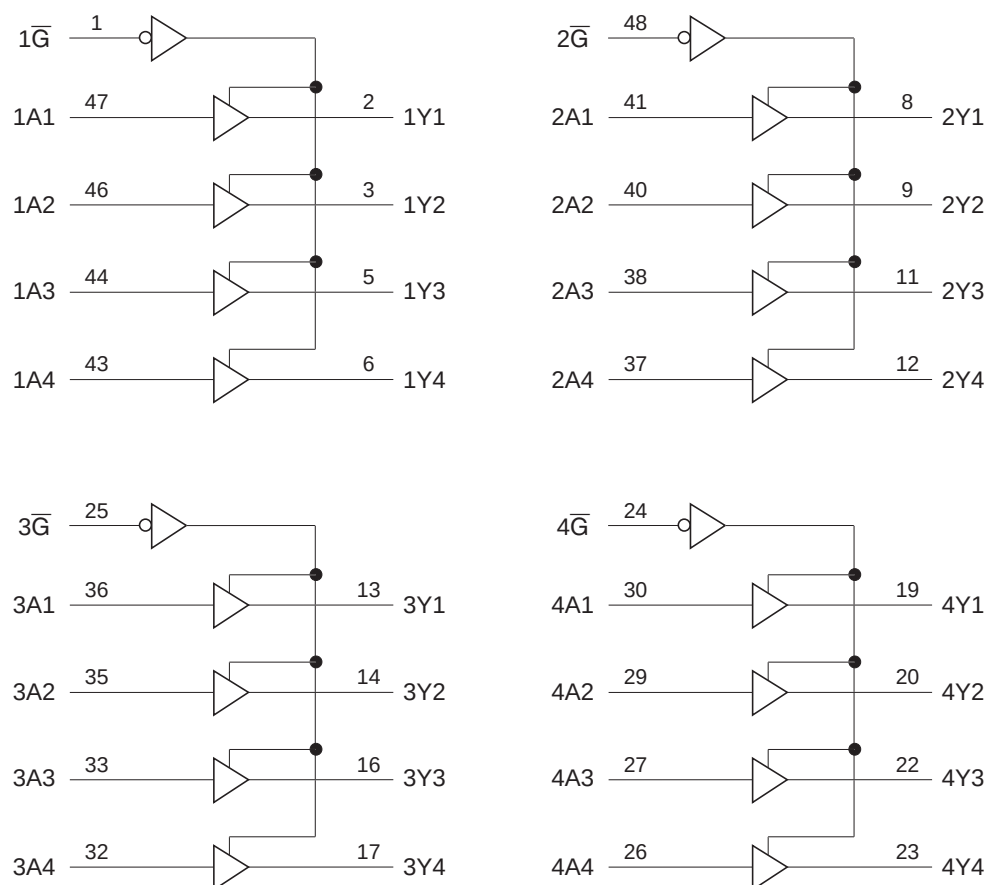
Note: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

## 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      |                                                   |
| Output voltage         | $V_O$      | 0 to 5.5<br>0 to $V_{CC}$ | V      | Output "Z" or $V_{CC}$ : OFF<br>Output "H" or "L" |
| Output current         | $I_{OH}$   | -12                       | mA     | $V_{CC} = 2.7$ V                                  |
|                        |            | -24 <sup>*1</sup>         |        | $V_{CC} = 3.0$ to 5.5 V                           |
|                        | $I_{OL}$   | 12                        | mA     | $V_{CC} = 2.7$ V                                  |
|                        |            | 24 <sup>*1</sup>          |        | $V_{CC} = 3.0$ to 5.5 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  $\leq 50\%$

## 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                  | —   | —                    |      |                                                                                                 |
|                          |                   | 3.0                 | 2.2                  | —   | —                    |      | I <sub>OH</sub> = -24 mA                                                                        |
|                          |                   | 4.5                 | 3.8                  | —   | —                    |      |                                                                                                 |
|                          | 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                   |      | V <sub>OUT</sub> = 0.5 to 5.5 V,                                                                |
|                          | I <sub>OZPD</sub> | 1.5 to 0            | —                    | —   | ±5                   |      | Output enable = don't care                                                                      |
| 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, 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                                                        |
| Output capacitance       | C <sub>O</sub>    | 3.3                 | —                    | 8.1 | —                    | pF   | V <sub>OUT</sub> = V <sub>CC</sub> or GND                                                       |

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

## Switching Characteristics

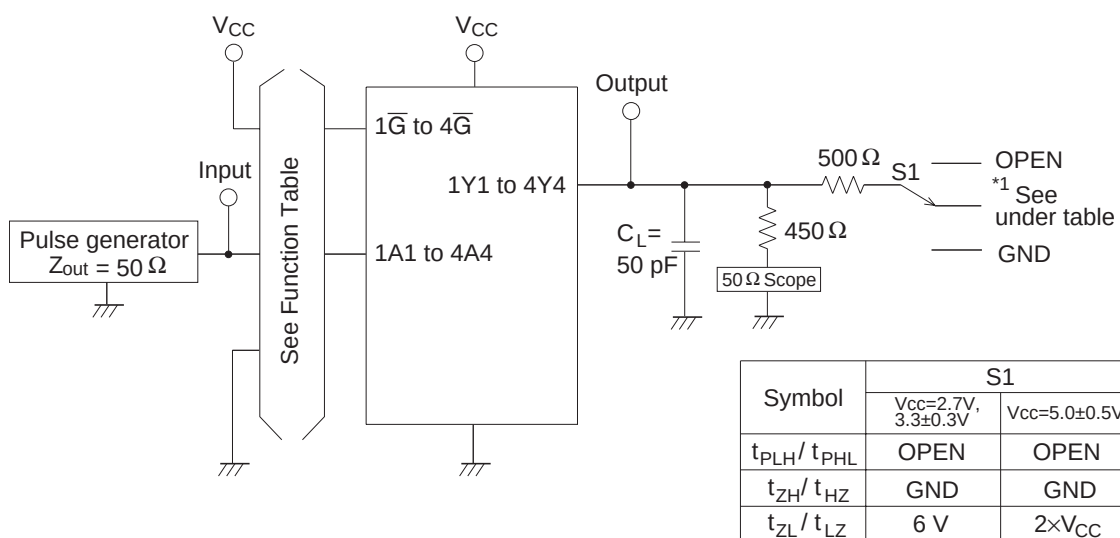
(Ta = -40 to 85°C)

| Item                                  | Symbol            | V <sub>CC</sub> (V) | Min | Typ | Max | Unit | FROM (Input) | TO (Output) |
|---------------------------------------|-------------------|---------------------|-----|-----|-----|------|--------------|-------------|
| Propagation delay time                | t <sub>PLH</sub>  | 2.7                 | —   | —   | 4.7 | ns   | A            | Y           |
|                                       | t <sub>PHL</sub>  | 3.3±0.3             | 1.1 | —   | 4.1 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 3.8 |      |              |             |
| Output enable time                    | t <sub>ZH</sub>   | 2.7                 | —   | —   | 5.8 | ns   | $\bar{G}$    | Y           |
|                                       | t <sub>ZL</sub>   | 3.3±0.3             | 1.0 | —   | 4.6 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 4.4 |      |              |             |
| Output disable time                   | t <sub>HZ</sub>   | 2.7                 | —   | —   | 6.2 | ns   | $\bar{G}$    | Y           |
|                                       | t <sub>LZ</sub>   | 3.3±0.3             | 1.8 | —   | 5.8 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 4.6 |      |              |             |
| Between output pin skew <sup>*1</sup> | t <sub>OSLH</sub> | 2.7                 | —   | —   | —   | ns   |              |             |
|                                       | t <sub>OSHL</sub> | 3.3±0.3             | —   | —   | 1.0 |      |              |             |
|                                       |                   | 5.0±0.5             | —   | —   | 1.0 |      |              |             |

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

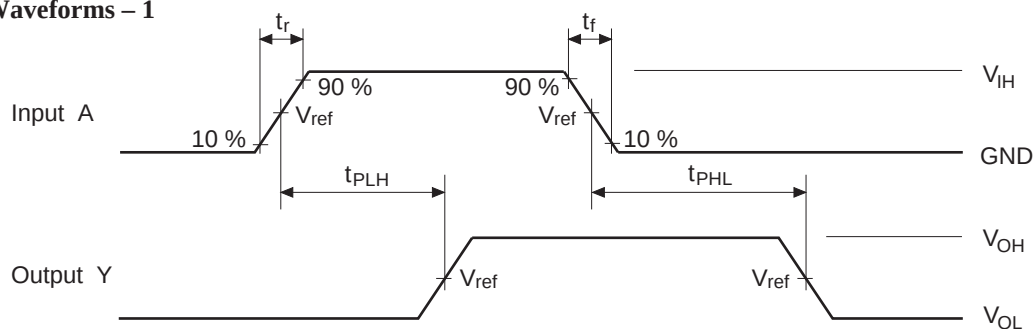
$$t_{OSLH} = |t_{PLHm} - t_{PLHn}|, t_{OSHL} = |t_{PHLm} - t_{PHLn}|$$

# Test Circuit

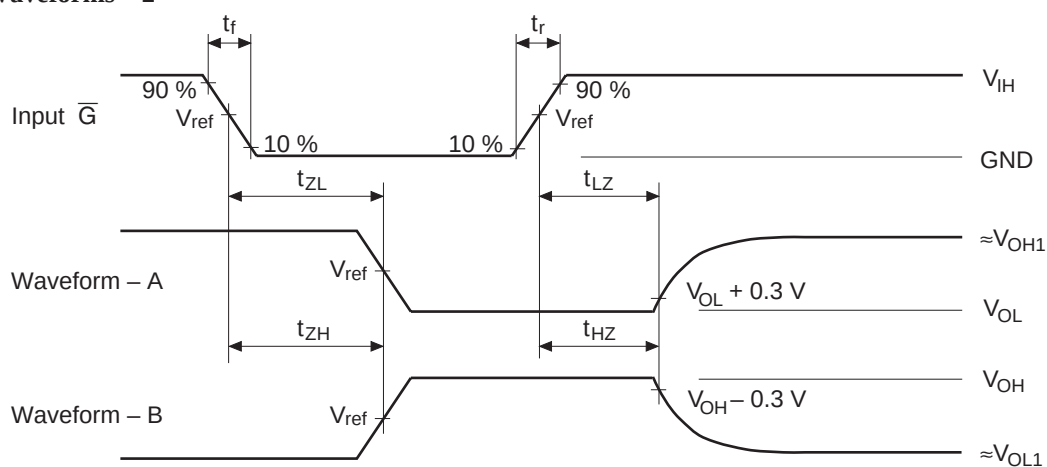


Note: 1.  $C_L$  includes probe and jig capacitance.

• Waveforms – 1



• Waveforms – 2

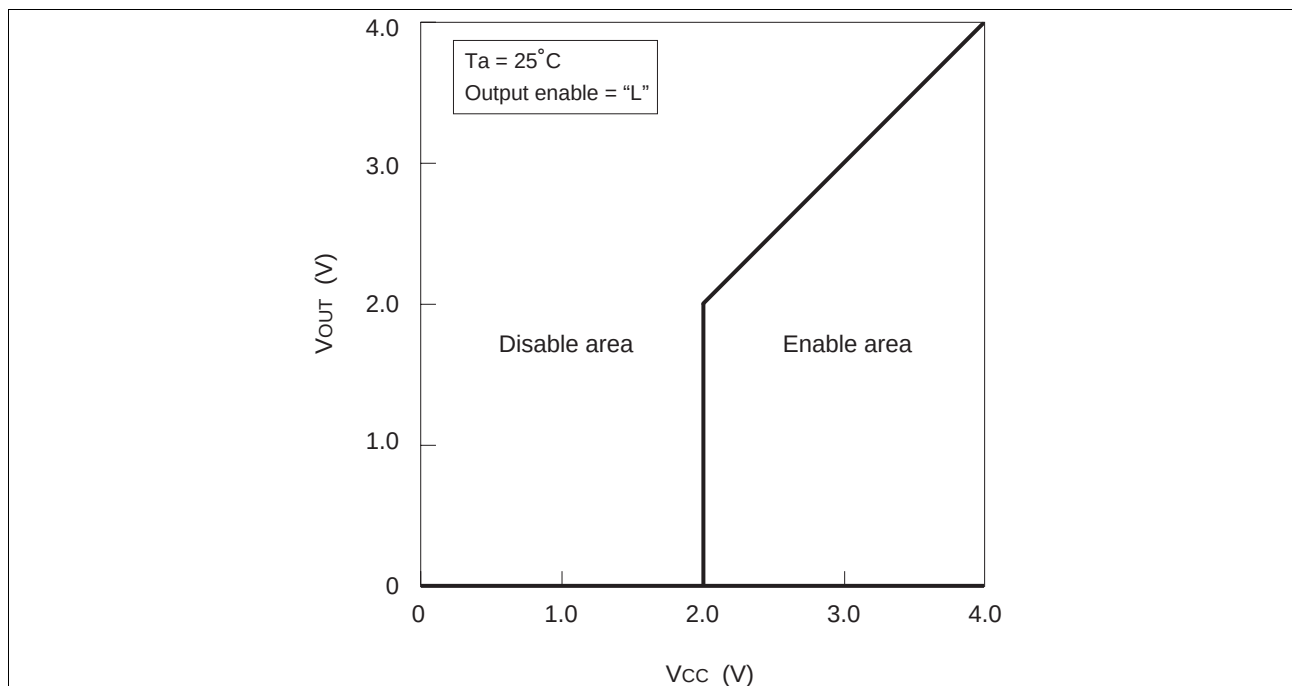


| TEST      | $V_{CC}=2.7V, 3.3\pm0.3V$ | $V_{CC}=5.0\pm0.5V$ |
|-----------|---------------------------|---------------------|
| $V_{IH}$  | 2.7 V                     | $V_{CC}$            |
| $V_{ref}$ | 1.5 V                     | $50\%V_{CC}$        |
| $V_{OH1}$ | 3 V                       | $V_{CC}$            |
| $V_{OL1}$ | GND                       | GND                 |

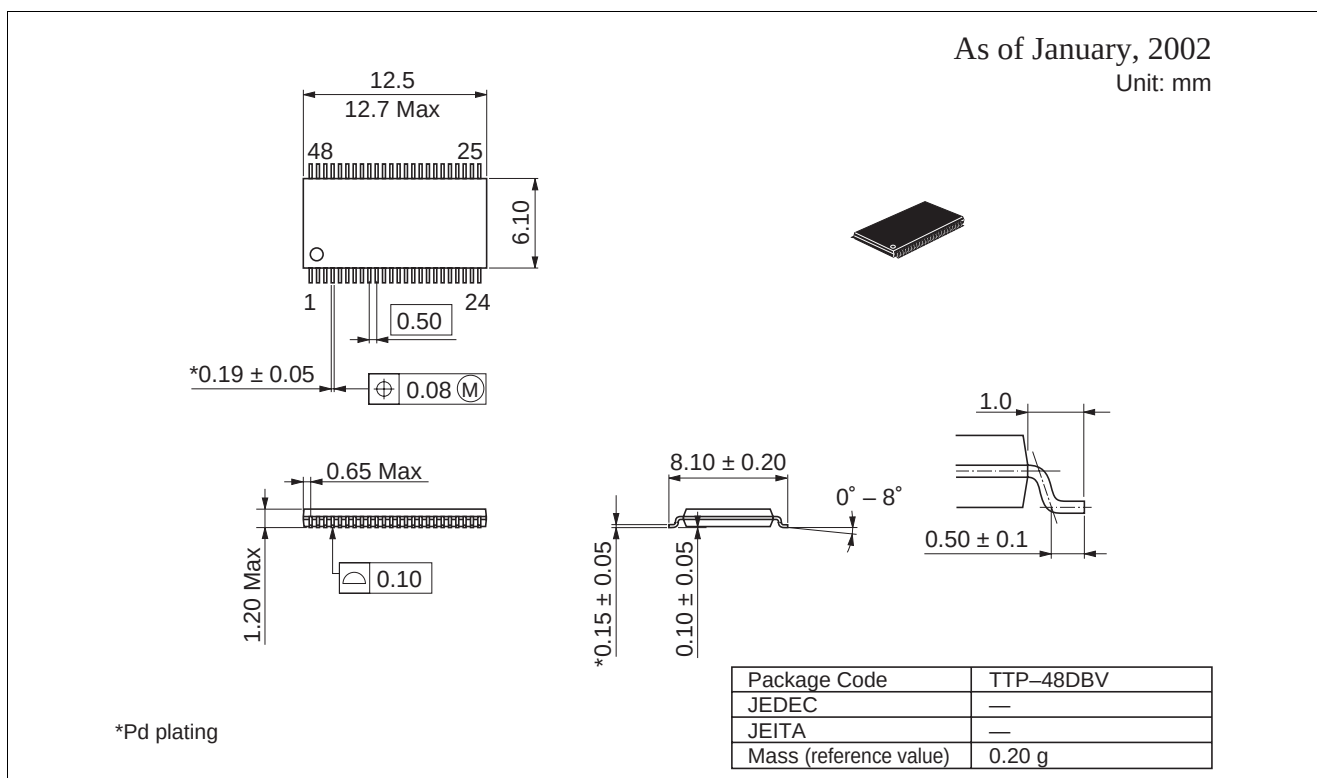
- Notes:
1. Input waveform : PRR = 10 MHz, duty cycle 50%,  $t_r = 2.5$  ns,  $t_f = 2.5$  ns
  2. Waveform – A shows input conditions such that the output is "L" level when enabled by the output control.
  3. Waveform – B shows input conditions such that the output is "H" level when enabled by the output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



## Power up / down Characteristics



## Package Dimensions



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Dornacher Str. 3, D-85622 Feldkirchen, Germany  
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#### **Renesas Technology (Shanghai) Co., Ltd.**

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Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

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