

# HD74LVC1G98

## Configurable Multiple-Function Gate

REJ03D0013-0400Z

Rev.4.00

Jun. 30, 2004

### Description

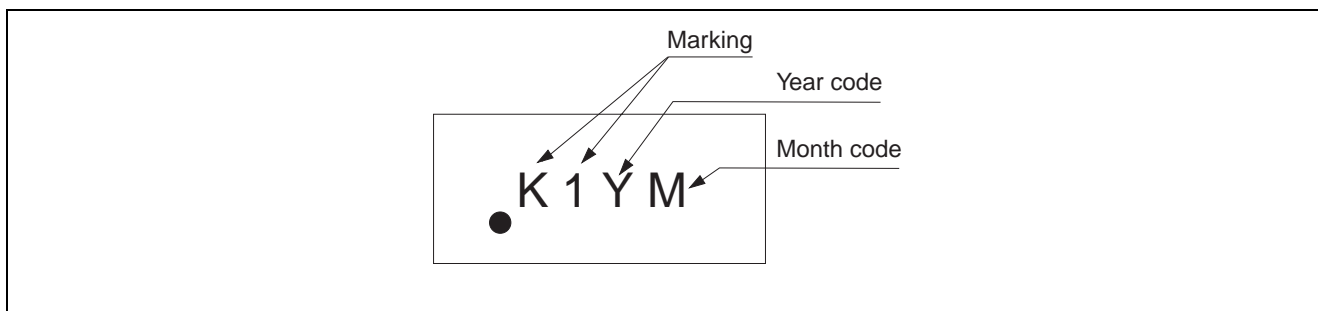
The HD74LVC1G98 has configurable multiple-function gate in a 6-pin package. The Output state is determined by eight patterns of 3-bit input. The user can choose the logic functions AND, NAND, OR, NOR, INVERTER, Non-Inverted Buffer, Data Selector. Low voltage and high-speed operation is suitable for the battery powered products (e.g., notebook computers), and the low power consumption extends the battery life.

### Features

- The basic gate function is lined up as Renesas uni logic series.
- Supply voltage range: 1.65 to 5.5 V  
Operating temperature range: -40 to +85°C
- All inputs  $V_{IH}$  (Max.) = 5.5 V (@  $V_{CC}$  = 0 V to 5.5 V)  
All outputs  $V_O$  (Max.) = 5.5 V (@  $V_{CC}$  = 0 V)
- Output current:
  - ±4 mA (@  $V_{CC}$  = 1.65 V)
  - ±8 mA (@  $V_{CC}$  = 2.3 V)
  - ±24 mA (@  $V_{CC}$  = 3.0 V)
  - ±32 mA (@  $V_{CC}$  = 4.5 V)
- All the logical input has hysteresis voltage for the slow transition.
- Ordering Information

| Part Name      | Package Type | Package Code | Package Abbreviation | Taping Abbreviation (Quantity) |
|----------------|--------------|--------------|----------------------|--------------------------------|
| HD74LVC1G98CPE | WCSP-6 pin   | TBS-6V       | CP                   | E (3,000 pcs/reel)             |
| HD74LVC1G98CLE |              | TBS-6AV      | CL                   |                                |

### Article Indication

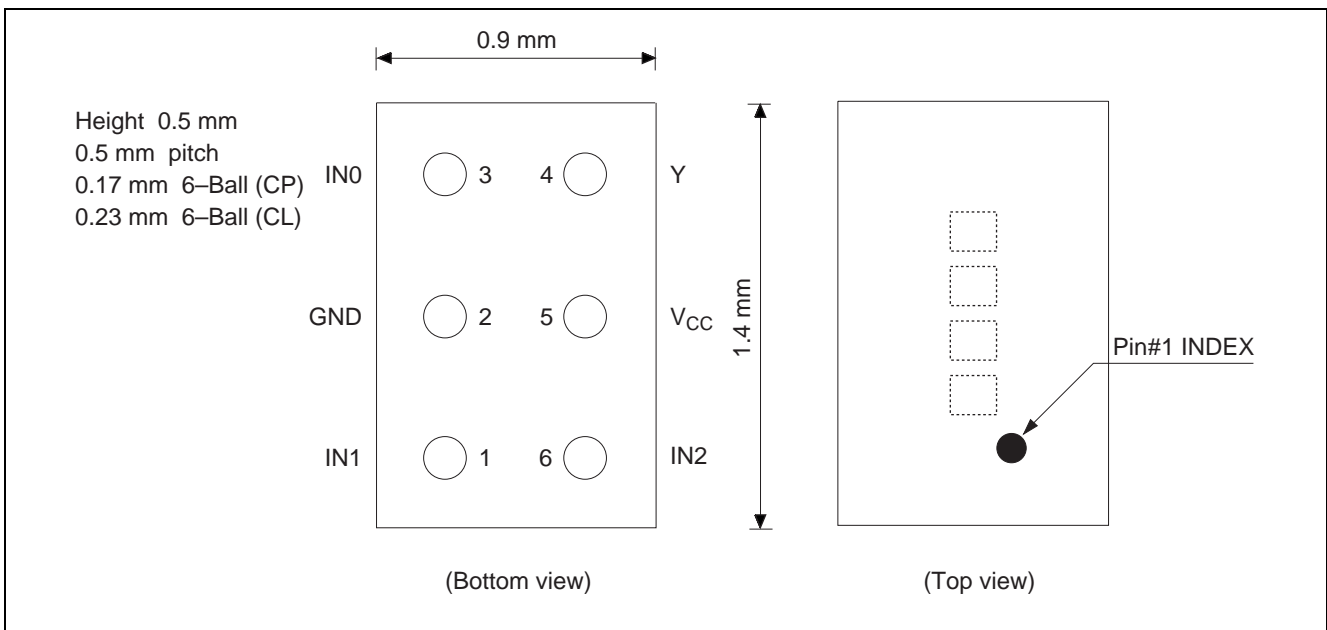


### Function Table

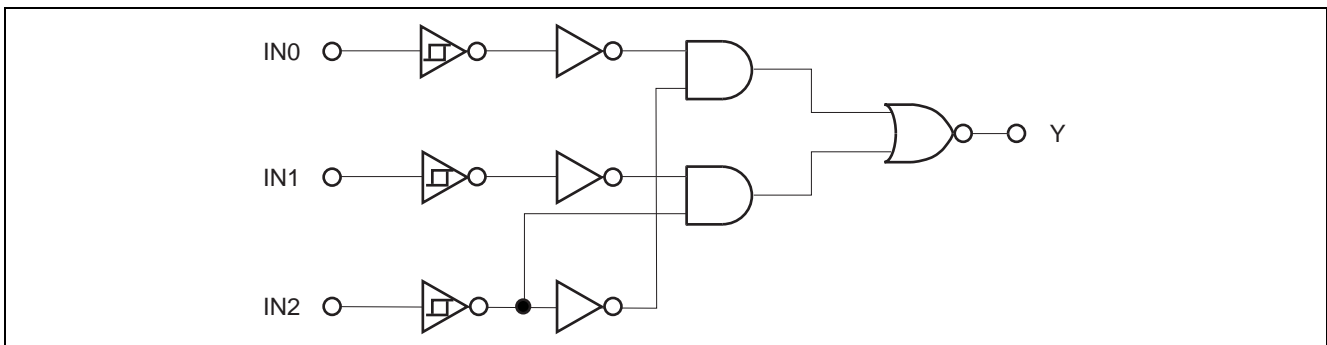
| IN2 | Inputs |     | Output<br>Y |
|-----|--------|-----|-------------|
|     | IN1    | IN0 |             |
| L   | L      | L   | H           |
| L   | L      | H   | H           |
| L   | H      | L   | L           |
| L   | H      | H   | L           |
| H   | L      | L   | H           |
| H   | L      | H   | L           |
| H   | H      | L   | H           |
| H   | H      | H   | L           |

H: High level  
L: Low level

### Pin Arrangement



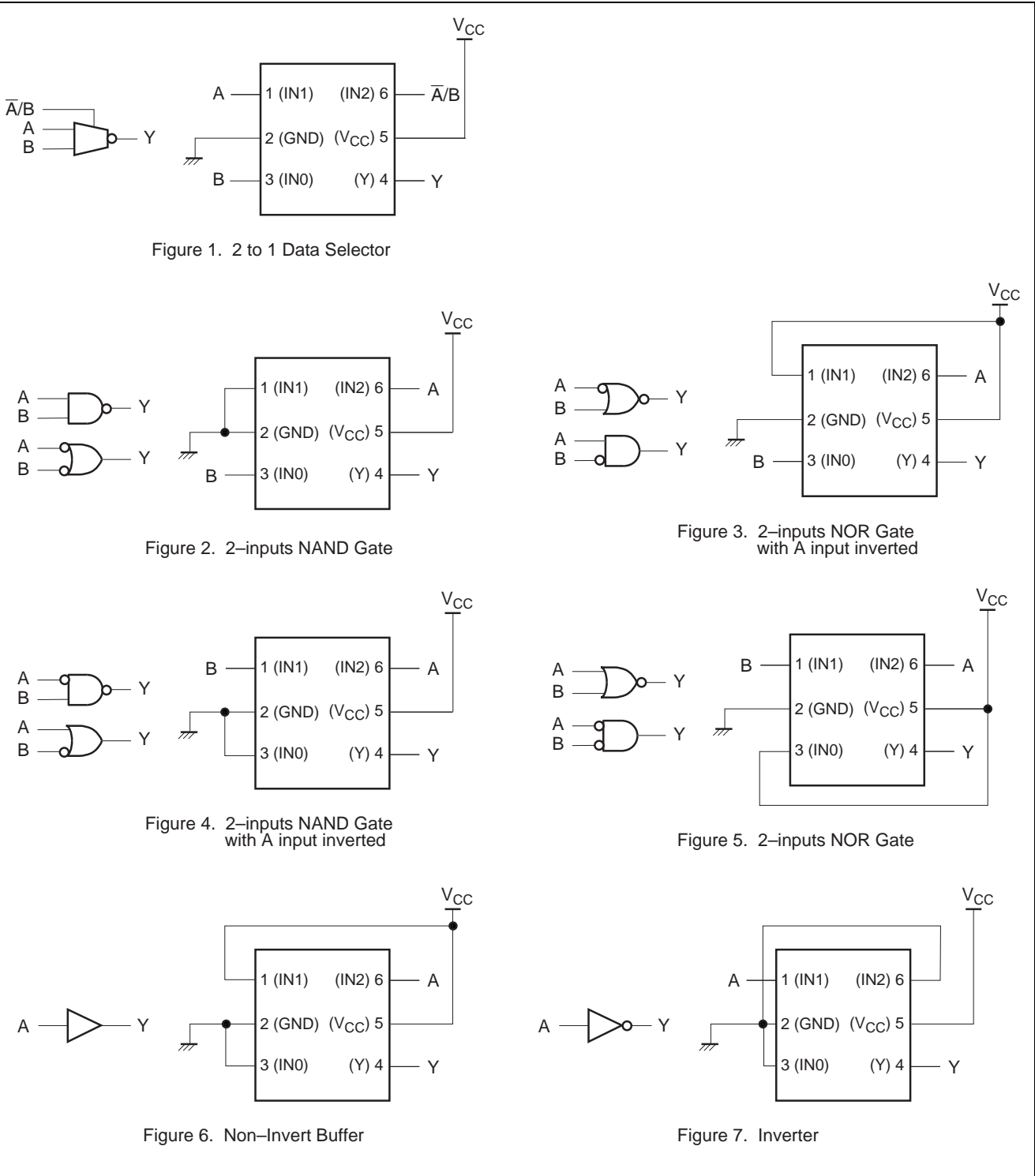
### Logic Diagram



**Function Selection Table**

| <b>Logic Function</b>                 | <b>Figure No.</b> |
|---------------------------------------|-------------------|
| 2 to 1 data Selector                  | 1                 |
| 2-inputs NAND                         | 2                 |
| 2-inputs NOR with one input inverted  | 3                 |
| 2-inputs AND with one input inverted  | 3                 |
| 2-inputs NAND with one input inverted | 4                 |
| 2-inputs OR with one input inverted   | 4                 |
| 2-inputs NOR                          | 5                 |
| Non-Invert Buffer                     | 6                 |
| Inverter                              | 7                 |

Logic Configurations



### Absolute Maximum Ratings

| Item                                       | Symbol                | Ratings                | Unit | Test Conditions       |
|--|-----------------------|------------------------|------|-----------------------|
| Supply voltage range                       | $V_{CC}$              | -0.5 to 6.5            | V    |                       |
| Input voltage range <sup>*1</sup>          | $V_I$                 | -0.5 to 6.5            | V    |                       |
| Output voltage range <sup>*1, 2</sup>      | $V_O$                 | -0.5 to $V_{CC} + 0.5$ | V    | Output : H or L       |
|  |                       | -0.5 to 6.5            |      | $V_{CC} : OFF$        |
| Input clamp current                        | $I_{IK}$              | -50                    | mA   | $V_I < 0$             |
| Output clamp current                       | $I_{OK}$              | -50                    | mA   | $V_O < 0$             |
| Continuous output current                  | $I_O$                 | $\pm 50$               | mA   | $V_O = 0$ to $V_{CC}$ |
| Continuous current through $V_{CC}$ or GND | $I_{CC}$ or $I_{GND}$ | $\pm 100$              | mA   |                       |
| Package Thermal impedance                  | $\theta_{ja}$         | 143                    | °C/W | CP                    |
|  |                       | 123                    |      | CL                    |
| 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 if the input and output clamp-current ratings are observed.
2. This value is limited to 5.5 V maximum.

### Recommended Operating Conditions

| Item                               | Symbol                | Min  | Max      | Unit   | Conditions                                   |
|------------------------------------|-----------------------|------|----------|--------|--|
| Supply voltage range               | $V_{CC}$              | 1.65 | 5.5      | V      |  |
| Input voltage range                | $V_I$                 | 0    | 5.5      | V      |  |
| Output voltage range               | $V_O$                 | 0    | $V_{CC}$ | V      |  |
| Output current                     | $I_{OL}$              | —    | 4        | mA     | $V_{CC} = 1.65$ V                            |
|                                    |                       | —    | 8        |        | $V_{CC} = 2.3$ V                             |
|                                    |                       | —    | 16       |        | $V_{CC} = 3.0$ V                             |
|                                    |                       | —    | 24       |        |  |
|                                    |                       | —    | 32       |        | $V_{CC} = 4.5$ V                             |
|                                    |                       | —    | —        |        | $V_{CC} = 4.5$ V                             |
|                                    | $I_{OH}$              | —    | -4       |        | $V_{CC} = 1.65$ V                            |
|                                    |                       | —    | -8       |        | $V_{CC} = 2.3$ V                             |
|                                    |                       | —    | -16      |        | $V_{CC} = 3.0$ V                             |
|                                    |                       | —    | -24      |        |  |
|                                    |                       | —    | -32      |        | $V_{CC} = 4.5$ V                             |
|                                    |                       | —    | —        |        | $V_{CC} = 4.5$ V                             |
| Input transition rise or fall rate | $\Delta t / \Delta v$ | 0    | 20       | ns / V | $V_{CC} = 1.65$ to $1.95$ V,<br>2.3 to 2.7 V |
|                                    |                       | 0    | 10       |        | $V_{CC} = 3.0$ to 3.6 V                      |
|                                    |                       | 0    | 5        |        | $V_{CC} = 4.5$ to 5.5 V                      |
| Operating free-air temperature     | $T_a$                 | -40  | 85       | °C     |  |

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

## Electrical Characteristics

Ta = -40 to 85°C

| Item                     | Symbol                      | V <sub>CC</sub> (V) | Min                  | Typ | Max  | Unit | Test condition  |
|--------------------------|-----------------------------|---------------------|----------------------|-----|------|------|---|
| Threshold voltage        | V <sub>T</sub> <sup>+</sup> | 1.8                 | 0.8                  | —   | 1.4  | V    |   |
|                          |                             | 2.5                 | 1.2                  | —   | 1.7  |      |   |
|                          |                             | 3.3                 | 1.6                  | —   | 2.3  |      |   |
|                          |                             | 5.0                 | 2.3                  | —   | 3.0  |      |   |
|                          | V <sub>T</sub> <sup>-</sup> | 1.8                 | 0.4                  | —   | 0.7  |      |   |
|                          |                             | 2.5                 | 0.6                  | —   | 1.0  |      |   |
|                          |                             | 3.3                 | 0.9                  | —   | 1.4  |      |   |
|                          |                             | 5.0                 | 1.5                  | —   | 2.0  |      |   |
|                          | ΔV <sub>T</sub>             | 1.8                 | 0.4                  | —   | 0.7  |      |   |
|                          |                             | 2.5                 | 0.4                  | —   | 0.8  |      |   |
|                          |                             | 3.3                 | 0.4                  | —   | 0.9  |      |   |
|                          |                             | 5.0                 | 0.4                  | —   | 1.0  |      |   |
| Output voltage           | V <sub>OH</sub>             | 1.65 to 5.5         | V <sub>CC</sub> -0.1 | —   | —    | V    | I <sub>OH</sub> = -100 μA   |
|                          |                             | 1.65                | 1.2                  | —   | —    |      | I <sub>OH</sub> = -4 mA   |
|                          |                             | 2.3                 | 1.9                  | —   | —    |      | I <sub>OH</sub> = -8 mA   |
|                          |                             | 3.0                 | 2.4                  | —   | —    |      | I <sub>OH</sub> = -16 mA  |
|                          |                             |                     | 2.3                  | —   | —    |      | I <sub>OH</sub> = -24 mA  |
|                          |                             | 4.5                 | 3.8                  | —   | —    |      | I <sub>OH</sub> = -32 mA  |
|                          | V <sub>OL</sub>             | 1.65 to 5.5         | —                    | —   | 0.1  |      | I <sub>OL</sub> = 100 μA  |
|                          |                             | 1.65                | —                    | —   | 0.45 |      | I <sub>OL</sub> = 4 mA  |
|                          |                             | 2.3                 | —                    | —   | 0.3  |      | I <sub>OL</sub> = 8 mA  |
|                          |                             | 3.0                 | —                    | —   | 0.4  |      | I <sub>OL</sub> = 16 mA   |
|                          |                             |                     | —                    | —   | 0.55 |      | I <sub>OL</sub> = 24 mA   |
|                          |                             | 4.5                 | —                    | —   | 0.55 |      | I <sub>OL</sub> = 32 mA   |
| Input current            | I <sub>IN</sub>             | 0 to 5.5            | —                    | —   | ±5   | μA   | V <sub>IN</sub> = 5.5 V or GND  |
| Quiescent supply current | I <sub>CC</sub>             | 5.5                 | —                    | —   | 10   | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND,<br>I <sub>O</sub> = 0               |
|                          | ΔI <sub>CC</sub>            | 3 to 5.5            | —                    | —   | 500  |      | One input at V <sub>CC</sub> -0.6 V,<br>Other input at V <sub>CC</sub> or GND |
| Output leakage current   | I <sub>OFF</sub>            | 0                   | —                    | —   | ±10  | μA   | V <sub>IN</sub> or V <sub>O</sub> = 0 to 5.5 V                                |
| Input capacitance        | C <sub>IN</sub>             | 3.3                 | —                    | 3.5 | —    | pF   | V <sub>IN</sub> = V <sub>CC</sub> or GND                                      |

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

**Switching Characteristics**

$V_{CC} = 1.8 \pm 0.15 \text{ V}$

| Item                   | Symbol                               | Ta = -40 to 85°C |      | Unit | Test Conditions                                    | FROM (Input) | TO (Output) |
|------------------------|--------------------------------------|------------------|------|------|--|--------------|-------------|
|                        |                                      | Min              | Max  |      |  |              |             |
| Propagation delay time | t <sub>PLH</sub><br>t <sub>PHL</sub> | 3.2              | 14.4 | ns   | C <sub>L</sub> = 30 pF,<br>R <sub>L</sub> = 1.0 kΩ | IN           | Y           |

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

| Item                   | Symbol                               | Ta = -40 to 85°C |     | Unit | Test Conditions                                   | FROM (Input) | TO (Output) |
|------------------------|--------------------------------------|------------------|-----|------|---|--------------|-------------|
|                        |                                      | Min              | Max |      |   |              |             |
| Propagation delay time | t <sub>PLH</sub><br>t <sub>PHL</sub> | 2.0              | 8.3 | ns   | C <sub>L</sub> = 30 pF,<br>R <sub>L</sub> = 500 Ω | IN           | Y           |

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

| Item                   | Symbol                               | Ta = -40 to 85°C |     | Unit | Test Conditions                                   | FROM (Input) | TO (Output) |
|------------------------|--------------------------------------|------------------|-----|------|---|--------------|-------------|
|                        |                                      | Min              | Max |      |   |              |             |
| Propagation delay time | t <sub>PLH</sub><br>t <sub>PHL</sub> | 1.5              | 6.3 | ns   | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω | IN           | Y           |

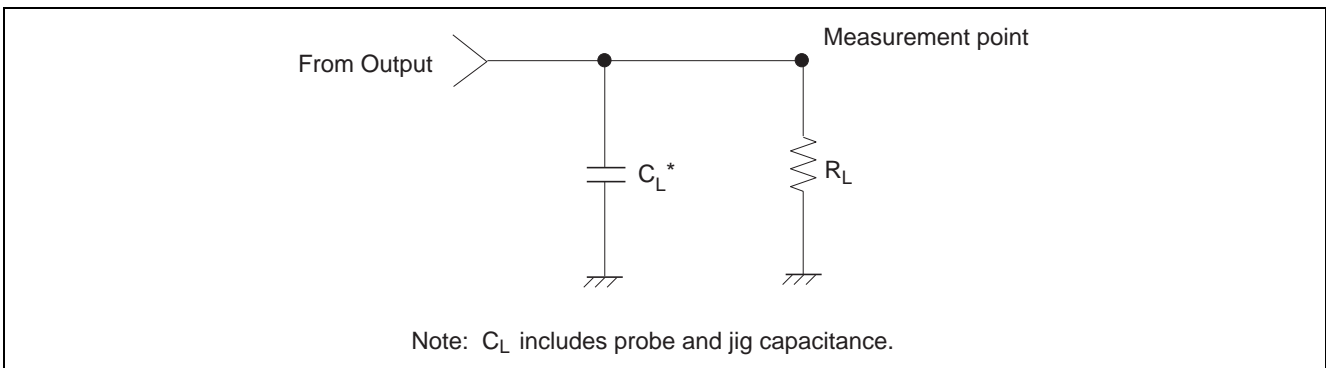
$V_{CC} = 5.0 \pm 0.5 \text{ V}$

| Item                   | Symbol                               | Ta = -40 to 85°C |     | Unit | Test Conditions                                   | FROM (Input) | TO (Output) |
|------------------------|--------------------------------------|------------------|-----|------|---|--------------|-------------|
|                        |                                      | Min              | Max |      |   |              |             |
| Propagation delay time | t <sub>PLH</sub><br>t <sub>PHL</sub> | 1.1              | 5.1 | ns   | C <sub>L</sub> = 50 pF,<br>R <sub>L</sub> = 500 Ω | IN           | Y           |

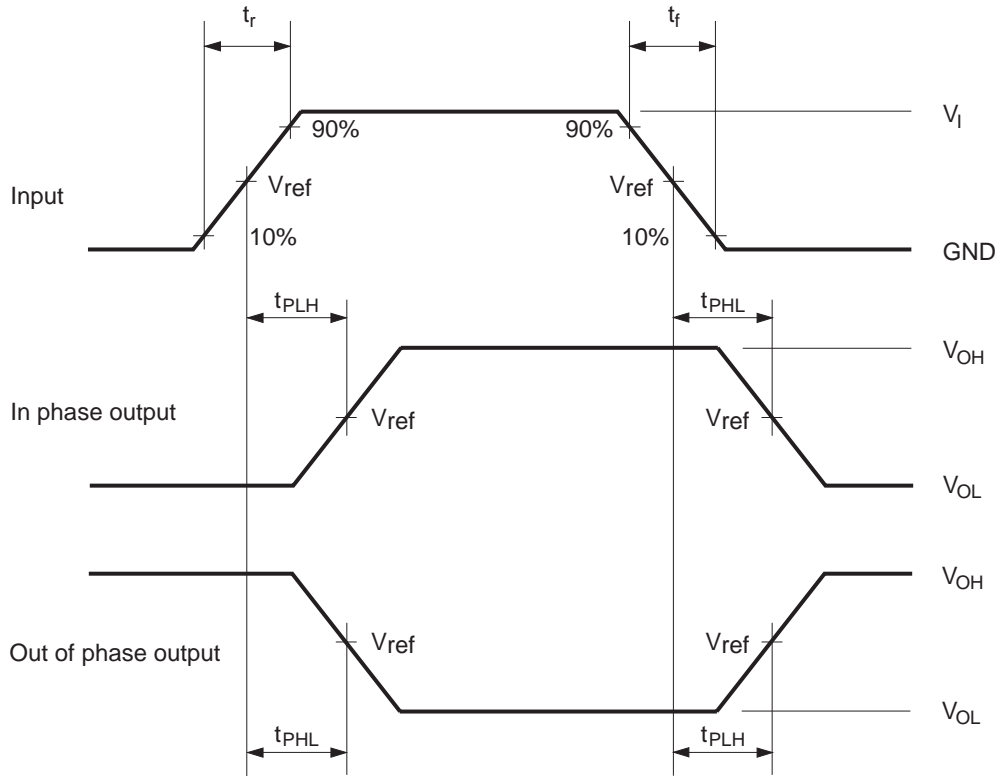
**Operating Characteristics**

| Item                          | Symbol          | V <sub>CC</sub> (V) | Ta = 25°C |     |     | Unit | Test Conditions |
|-------------------------------|-----------------|---------------------|-----------|-----|-----|------|-----------------|
|                               |                 |                     | Min       | Typ | Max |      |                 |
| Power dissipation capacitance | C <sub>PD</sub> | 1.8                 | —         | 23  | —   | pF   | f = 10 MHz      |
|                               |                 | 2.5                 | —         | 23  | —   |      |                 |
|                               |                 | 3.3                 | —         | 23  | —   |      |                 |
|                               |                 | 5.0                 | —         | 26  | —   |      |                 |

**Test Circuit**



• Waveforms



| $V_{CC}$ (V)   | INPUTS   |               | $V_{ref}$    | $C_L$ | $R_L$          |
|----------------|----------|---------------|--------------|-------|----------------|
|                | $V_I$    | $t_r / t_f$   |              |       |                |
| $1.8 \pm 0.15$ | $V_{CC}$ | $\leq 2$ ns   | $V_{CC} / 2$ | 30 pF | 1.0 k $\Omega$ |
| $2.5 \pm 0.2$  | $V_{CC}$ | $\leq 2$ ns   | $V_{CC} / 2$ | 30 pF | 500 $\Omega$   |
| $3.3 \pm 0.3$  | 3 V      | $\leq 2.5$ ns | 1.5 V        | 50 pF | 500 $\Omega$   |
| $5.0 \pm 0.5$  | $V_{CC}$ | $\leq 2.5$ ns | $V_{CC} / 2$ | 50 pF | 500 $\Omega$   |

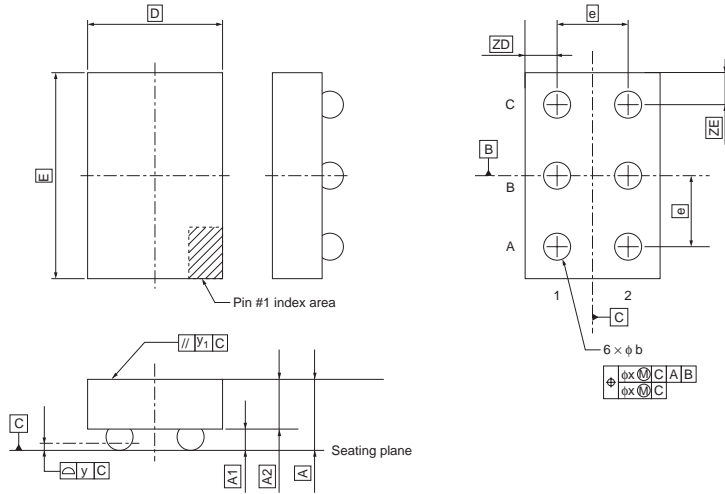
- Notes: 1. Input waveform : PRR  $\leq$  10 MHz,  $Z_o = 50 \Omega$ .  
 2. The output are measured one at a time with one transition per measurement.



Package Dimensions

TBS-6V

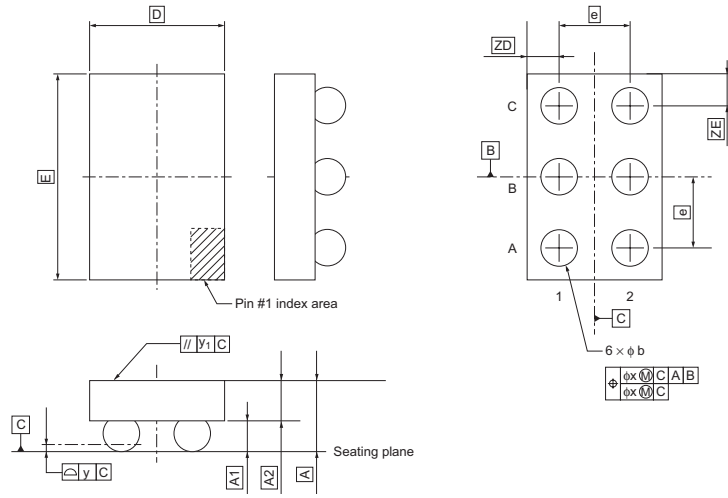
|                   |            |          |               |
|-------------------|------------|----------|---------------|
| EIAJ Package Code | JEDEC Code | Mass (g) | Lead Material |
| —                 | —          | 0.001    | —             |



| Symbol         | Dimension in Millimeters |      |      |
|----------------|--------------------------|------|------|
|                | Min                      | Typ  | Max  |
| A              | —                        | —    | 0.50 |
| A <sub>1</sub> | 0.10                     | —    | 0.15 |
| A <sub>2</sub> | —                        | —    | 0.35 |
| b              | 0.15                     | 0.17 | 0.19 |
| D              | —                        | 0.90 | —    |
| E              | —                        | 1.40 | —    |
| e              | —                        | 0.50 | —    |
| x              | —                        | —    | 0.05 |
| y              | —                        | —    | 0.05 |
| y <sub>1</sub> | —                        | —    | 0.20 |
| ZD             | —                        | 0.20 | —    |
| ZE             | —                        | 0.20 | —    |

TBS-6AV

|                   |            |          |               |
|-------------------|------------|----------|---------------|
| EIAJ Package Code | JEDEC Code | Mass (g) | Lead Material |
| —                 | —          | 0.001    | —             |



| Symbol         | Dimension in Millimeters |      |          |
|----------------|--------------------------|------|----------|
|                | Min                      | Nom  | Max      |
| A              | —                        | —    | 0.50     |
| A <sub>1</sub> | 0.155                    | —    | 0.185    |
| A <sub>2</sub> | —                        | —    | (0.315)* |
| b              | 0.20                     | —    | 0.25     |
| D              | —                        | 0.90 | —        |
| E              | —                        | 1.40 | —        |
| e              | —                        | 0.50 | —        |
| x              | —                        | —    | 0.05     |
| y              | —                        | —    | 0.05     |
| y <sub>1</sub> | —                        | —    | 0.20     |
| ZD             | —                        | 0.20 | —        |
| ZE             | —                        | 0.20 | —        |

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