# RD74LVC1G08

## 2–input AND Gate

REJ03D0510-0100
Rev.1.00
Oct. 06, 2005

## Description

The RD74LVC1G08 has two–input AND gate in a 5-pin package. 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.

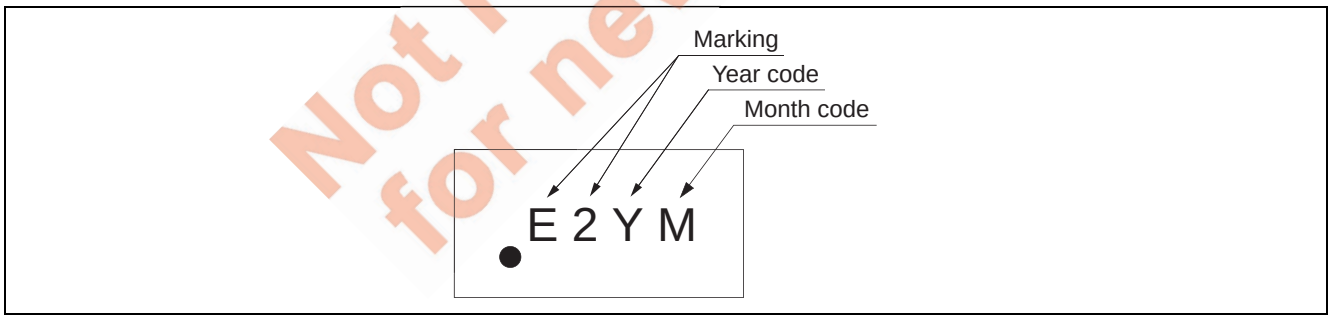
## Features

- 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)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| RD74LVC1G08WPE | WCSP-5 pin | SXBG0005LB-A (TBS-5CV) | WP | E (3,000 pcs/reel) |

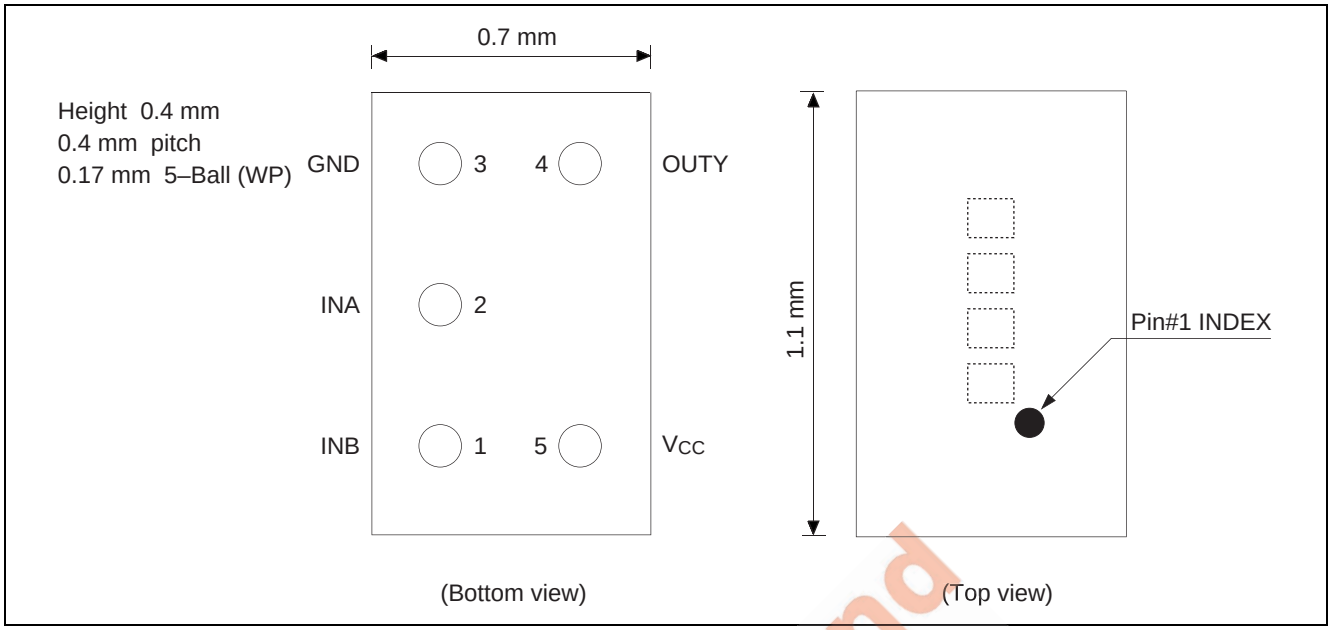


## Article Indication

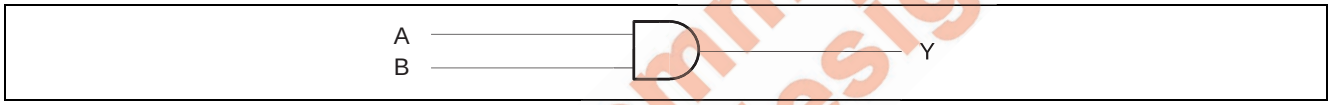


## Pin Arrangement






## Logic Diagram




## Function Table

| Inputs | | Output Y |
|---|---|---|
| **A** | **B** | |
| L | L | L |
| H | L | L |
| L | H | L |
| H | H | H |

H: High level

L: Low level

## Absolute Maximum Ratings



| Item | Symbol | Ratings | Unit | Test Conditions |
|---|---|---|---|---|
| Supply voltage range | $V_{CC}$ | –0.5 to 6.5 | V | |
| Input voltage range *1 | $V_I$ | –0.5 to 6.5 | V | |
| Output voltage range *1, 2 | $V_O$ | –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 | $I_O$ | ±50 | mA | $V_O$ = 0 to $V_{CC}$ |
| Continuous current through $V_{CC}$ or GND | $I_{CC}$ or $I_{GND}$ | ±100 | mA | |
| Package Thermal impedance | $\theta_{ja}$ | 200 | °C/W | WP |
| Storage temperature | Tstg | –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 |
| | $I_{OH}$ | — | –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 |
| Input transition rise or fall rate | $\Delta t / \Delta v$ | 0 | 20 | ns / V | $V_{CC}$ = 1.65 to 1.95 V, 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 | $V_{CC}$ (V) | Min | Typ | Max | Unit | Test condition |
|---|---|---|---|---|---|---|---|
| Input voltage | $V_{IH}$ | 1.65 to 1.95 | $V_{CC}$×0.65 | — | — | V | |
| | | 2.3 to 2.7 | 1.7 | — | — | | |
| | | 3.0 to 3.6 | 2.0 | — | — | | |
| | | 4.5 to 5.5 | $V_{CC}$×0.7 | — | — | | |
| | $V_{IL}$ | 1.65 to 1.95 | — | — | $V_{CC}$×0.35 | | |
| | | 2.3 to 2.7 | — | — | 0.7 | | |
| | | 3.0 to 3.6 | — | — | 0.8 | | |
| | | 4.5 to 5.5 | — | — | $V_{CC}$×0.3 | | |
| Output voltage | $V_{OH}$ | Min to Max | $V_{CC}$–0.1 | — | — | V | $I_{OH}$ = –100 µA |
| | | 1.65 | 1.2 | — | — | | $I_{OH}$ = –4 mA |
| | | 2.3 | 1.9 | — | — | | $I_{OH}$ = –8 mA |
| | | 3.0 | 2.4 | — | — | | $I_{OH}$ = –16 mA |
| | | | 2.3 | — | — | | $I_{OH}$ = –24 mA |
| | | 4.5 | 3.8 | — | — | | $I_{OH}$ = –32 mA |
| | $V_{OL}$ | Min to Max | — | — | 0.1 | | $I_{OL}$ = 100 µA |
| | | 1.65 | — | — | 0.45 | | $I_{OL}$ = 4 mA |
| | | 2.3 | — | — | 0.3 | | $I_{OL}$ = 8 mA |
| | | 3.0 | — | — | 0.4 | | $I_{OL}$ = 16 mA |
| | | | — | — | 0.55 | | $I_{OL}$ = 24 mA |
| | | 4.5 | — | — | 0.55 | | $I_{OL}$ = 32 mA |
| Input current | $I_{IN}$ | 0 to 5.5 | — | — | ±5 | µA | $V_{IN}$ = 5.5 V or GND |
| Quiescent supply current | $I_{CC}$ | 5.5 | — | — | 10 | µA | $V_{IN}$ = $V_{CC}$ or GND, $I_O$ = 0 |
| | $\Delta I_{CC}$ | 3 to 5.5 | — | — | 500 | | One input at $V_{CC}$–0.6 V, Other input at $V_{CC}$ or GND |
| Output leakage current | $I_{OFF}$ | 0 | — | — | ±10 | µA | $V_{IN}$ or $V_O$ = 0 to 5.5 V |
| Input capacitance | $C_{IN}$ | 3.3 | — | 4.0 | — | pF | $V_{IN}$ = $V_{CC}$ or GND |

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

## Switching Characteristics



$V_{CC}$ = 1.8 ± 0.15 V

| Item | Symbol | Ta = –40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | |
| Propagation delay time | $t_{PLH}$ | 1.5 | 7.2 | ns | $C_L$ = 15 pF, $R_L$ = 1 MΩ | A or B | Y |
| | $t_{PHL}$ | 2.4 | 8.0 | | $C_L$ = 30 pF, $R_L$ = 1.0 kΩ | | |

$V_{CC}$ = 2.5 ± 0.2 V

| Item | Symbol | Ta = –40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | |
| Propagation delay time | $t_{PLH}$ | 0.7 | 4.4 | ns | $C_L$ = 15 pF, $R_L$ = 1 MΩ | A or B | Y |
| | $t_{PHL}$ | 1.1 | 5.5 | | $C_L$ = 30 pF, $R_L$ = 500 Ω | | |

$V_{CC}$ = 3.3 ± 0.3 V

| Item | Symbol | Ta = –40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | |
| Propagation delay time | $t_{PLH}$ | 0.8 | 3.6 | ns | $C_L$ = 15 pF, $R_L$ = 1 MΩ | A or B | Y |
| | $t_{PHL}$ | 1.0 | 4.5 | | $C_L$ = 50 pF, $R_L$ = 500 Ω | | |

$V_{CC}$ = 5.0 ± 0.5 V

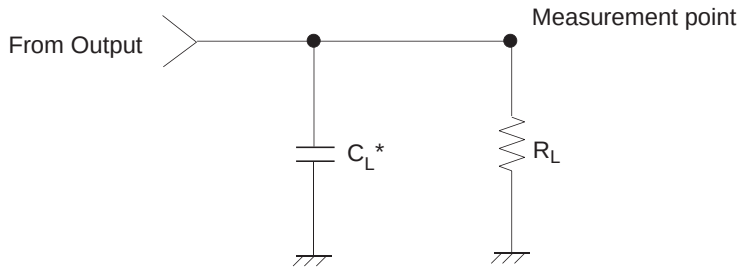
| Item | Symbol | Ta = –40 to 85°C | | Unit | Test Conditions | FROM (Input) | TO (Output) |
|---|---|---|---|---|---|---|---|
| | | Min | Max | | | | |
| Propagation delay time | $t_{PLH}$ | 0.8 | 3.4 | ns | $C_L$ = 15 pF, $R_L$ = 1 MΩ | A or B | Y |
| | $t_{PHL}$ | 1.0 | 4.0 | | $C_L$ = 50 pF, $R_L$ = 500 Ω | | |

## Operating Characteristics

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | | |
| Power dissipation capacitance | $C_{PD}$ | 1.8 | — | 21 | — | pF | f = 10 MHz |
| | | 2.5 | — | 24 | — | | |
| | | 3.3 | — | 26 | — | | |
| | | 5.0 | — | 31 | — | | |

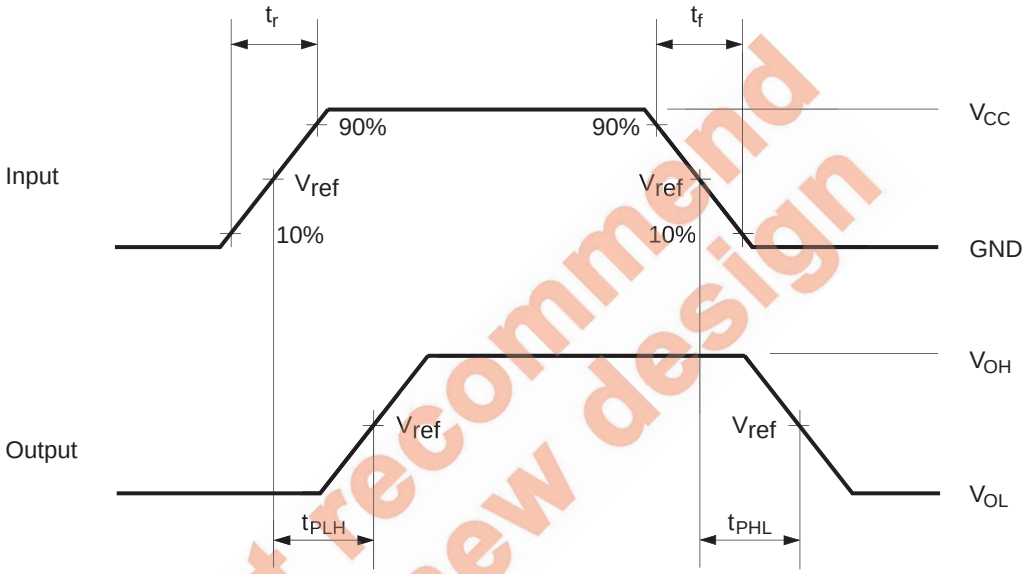
## Test Circuit






Note: $C_L$ includes probe and jig capacitance.

• Waveforms






| $V_{CC}$ (V) | INPUTS | | Vref | $C_L$ | $R_L$ |
|---|---|---|---|---|---|
| | $V_I$ | $t_r$ / $t_f$ | | | |
| 1.8±0.15 | $V_{CC}$ | ≤ 2 ns | $V_{CC}$ / 2 | 15 pF | 1 MΩ |
| 2.5±0.2 | $V_{CC}$ | ≤ 2 ns | $V_{CC}$ / 2 | 15 pF | 1 MΩ |
| 3.3±0.3 | 3 V | ≤ 2.5 ns | 1.5 V | 15 pF | 1 MΩ |
| 5.0±0.5 | $V_{CC}$ | ≤ 2.5 ns | $V_{CC}$ / 2 | 15 pF | 1 MΩ |

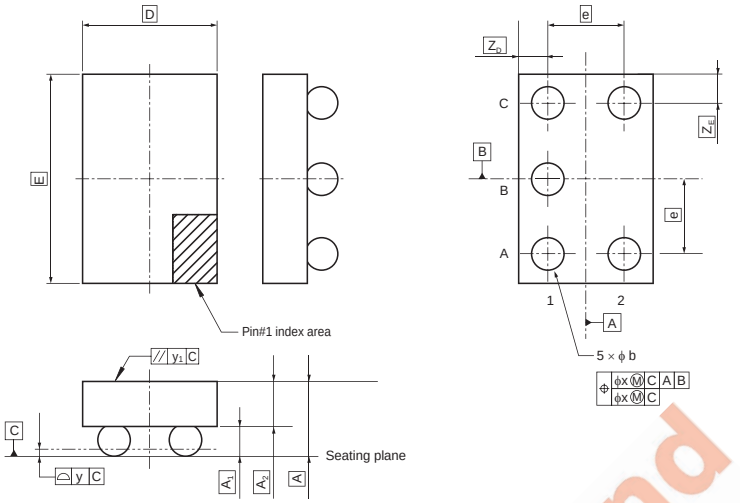
| $V_{CC}$ (V) | INPUTS | | Vref | $C_L$ | $R_L$ |
|---|---|---|---|---|---|
| | $V_I$ | $t_r$ / $t_f$ | | | |
| 1.8±0.15 | $V_{CC}$ | ≤ 2 ns | $V_{CC}$ / 2 | 30 pF | 1.0 kΩ |
| 2.5±0.2 | $V_{CC}$ | ≤ 2 ns | $V_{CC}$ / 2 | 30 pF | 500 Ω |
| 3.3±0.3 | 3 V | ≤ 2.5 ns | 1.5 V | 50 pF | 500 Ω |
| 5.0±0.5 | $V_{CC}$ | ≤ 2.5 ns | $V_{CC}$ / 2 | 50 pF | 500 Ω |

Notes: 1. Input waveform: PRR ≤ 10 MHz, Zo = 50 Ω.
2. The output are measured one at a time with one transition per measurement.

# Package Dimensions



| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| S-XFBGA5-0.7x1.1-0.40 | SXBG0005LB-A | TBS-5CV | 0.001g |




| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | — | — | 0.40 |
| $A_1$ | 0.110 | — | 0.140 |
| $A_2$ | — | — | (0.235)* |
| b | 0.15 | — | 0.19 |
| D | — | 0.70 | — |
| E | — | 1.10 | — |
| e | — | 0.40 | — |
| x | — | — | 0.05 |
| y | — | — | 0.05 |
| $y_1$ | — | — | 0.20 |
| $Z_D$ | — | 0.15 | — |
| $Z_E$ | — | 0.15 | — |

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**Renesas Technology (Shanghai) Co., Ltd.**
Unit2607 Ruijing Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

**Renesas Technology Singapore Pte. Ltd.**
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

**Renesas Technology Korea Co., Ltd.**
Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> 2-796-3115, Fax: <82> 2-796-2145

**Renesas Technology Malaysia Sdn. Bhd.**
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jalan Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510



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