# HD74HC51

## 2-wide 2-input, 2-wide 3-input AND-OR-INVERT Gate

REJ03D0547-0200
(Previous ADE-205-419)
Rev.2.00
Oct 06, 2005

### Features

- High Speed Operation: $t_{pd}$ = 10.5 ns typ ($C_L$ = 50 pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage: $V_{CC}$ = 2 to 6 V
- Low Input Current: 1 µA max
- Low Quiescent Supply Current: $I_{CC}$ (static) = 1 µA max (Ta = 25°C)
- Ordering Information

| Part Name | Package Type | Package Code (Previous Code) | Package Abbreviation | Taping Abbreviation (Quantity) |
|---|---|---|---|---|
| HD74HC51P | DILP-14 pin | PRDP0014AB-B (DP-14AV) | P | — |
| HD74HC51FPEL | SOP-14 pin (JEITA) | PRSP0014DF-B (FP-14DAV) | FP | EL (2,000 pcs/reel) |
| HD74HC51RPEL | SOP-14 pin (JEDEC) | PRSP0014DE-A (FP-14DNV) | RP | EL (2,500 pcs/reel) |

Note: Please consult the sales office for the above package availability.

### Function Table

$$1Y = \overline{(1A \cdot 1B \cdot 1C)} + \overline{(1D \cdot 1E \cdot 1F)}$$

| Inputs | | | | | | Output |
|---|---|---|---|---|---|---|
| 1A | 1B | 1C | 1D | 1E | 1F | 1Y |
| H | H | H | X | X | X | L |
| X | X | X | H | H | H | L |
| L | X | X | L | X | X | H |
| L | X | X | X | L | X | H |
| L | X | X | X | X | L | H |
| X | L | X | L | X | X | L |
| X | L | X | X | L | X | H |
| X | L | X | X | X | L | H |
| X | X | L | L | X | X | H |
| X | X | L | X | L | X | H |
| X | X | L | X | X | L | H |

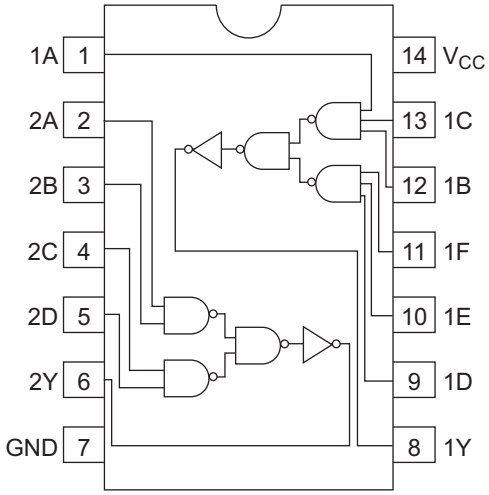
H : High level
L : Low level
X : Irrelevant

$2Y = \overline{(2A \cdot 2B)} + \overline{(2C \cdot 2D)}$

| Inputs | | | | Output |
|---|---|---|---|---|
| 2A | 2B | 2C | 2D | 2Y |
| H | H | X | X | L |
| X | X | H | H | L |
| L | X | L | X | H |
| L | X | X | L | H |
| X | L | L | X | H |
| X | L | X | L | H |

H : High level
L : Low level
X : Irrelevant

## Pin Arrangement




(Top view)

## Absolute Maximum Ratings

| Item | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply voltage range | $V_{CC}$ | –0.5 to 7.0 | V |
| Input / Output voltage | Vin, Vout | –0.5 to $V_{CC}$ +0.5 | V |
| Input / Output diode current | $I_{IK}$, $I_{OK}$ | ±20 | mA |
| Output current | $I_O$ | ±25 | mA |
| $V_{CC}$, GND current | $I_{CC}$ or $I_{GND}$ | ±50 | mA |
| Power dissipation | $P_T$ | 500 | mW |
| 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 to 6 | V | |
| Input / Output voltage | $V_{IN}$, $V_{OUT}$ | 0 to $V_{CC}$ | V | |
| Operating temperature | Ta | –40 to 85 | °C | |
| Input rise / fall time*1 | $t_r$, $t_f$ | 0 to 1000 | ns | $V_{CC}$ = 2.0 V |
| | | 0 to 500 | | $V_{CC}$ = 4.5 V |
| | | 0 to 400 | | $V_{CC}$ = 6.0 V |

Note: 1. This item guarantees maximum limit when one input switches.
Waveform: Refer to test circuit of switching characteristics.

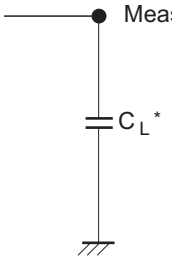
## Electrical Characteristics

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to+85°C | | Unit | Test Conditions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | | |
| Input voltage | $V_{IH}$ | 2.0 | 1.5 | — | — | 1.5 | — | V | | |
| | | 4.5 | 3.15 | — | — | 3.15 | — | | | |
| | | 6.0 | 4.2 | — | — | 4.2 | — | | | |
| | $V_{IL}$ | 2.0 | — | — | 0.5 | — | 0.5 | V | | |
| | | 4.5 | — | — | 1.35 | — | 1.35 | | | |
| | | 6.0 | — | — | 1.8 | — | 1.8 | | | |
| Output voltage | $V_{OH}$ | 2.0 | 1.9 | 2.0 | — | 1.9 | — | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OH}$ = –20 µA |
| | | 4.5 | 4.4 | 4.5 | — | 4.4 | — | | | |
| | | 6.0 | 5.9 | 6.0 | — | 5.9 | — | | | |
| | | 4.5 | 4.18 | — | — | 4.13 | — | | | $I_{OH}$ = –4 mA |
| | | 6.0 | 5.68 | — | — | 5.63 | — | | | $I_{OH}$ = –5.2 mA |
| | $V_{OL}$ | 2.0 | — | 0.0 | 0.1 | — | 0.1 | V | Vin = $V_{IH}$ or $V_{IL}$ | $I_{OL}$ = 20 µA |
| | | 4.5 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 6.0 | — | 0.0 | 0.1 | — | 0.1 | | | |
| | | 4.5 | — | — | 0.26 | — | 0.33 | | | $I_{OL}$ = 4 mA |
| | | 6.0 | — | — | 0.26 | — | 0.33 | | | $I_{OL}$ = 5.2 mA |
| Input current | Iin | 6.0 | — | — | ±0.1 | — | ±1.0 | µA | Vin = $V_{CC}$ or GND | |
| Quiescent supply current | $I_{CC}$ | 6.0 | — | — | 1.0 | — | 10 | µA | Vin = $V_{CC}$ or GND, Iout = 0 µA | |

## Switching Characteristics ($C_L$ = 50 pF, Input $t_r$ = $t_f$ = 6 ns)

| Item | Symbol | $V_{CC}$ (V) | Ta = 25°C | | | Ta = –40 to +85°C | | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | | |
| Propagation delay time | $t_{PLH}$ | 2.0 | — | — | 110 | — | 140 | ns | |
| | | 4.5 | — | 11 | 22 | — | 28 | | |
| | | 6.0 | — | — | 19 | — | 24 | | |
| | $t_{PHL}$ | 2.0 | — | — | 110 | — | 140 | ns | |
| | | 4.5 | — | 10 | 22 | — | 28 | | |
| | | 6.0 | — | — | 19 | — | 24 | | |
| Output rise time | $t_{TLH}$ | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Output fall time | $t_{THL}$ | 2.0 | — | — | 75 | — | 95 | ns | |
| | | 4.5 | — | 5 | 15 | — | 19 | | |
| | | 6.0 | — | — | 13 | — | 16 | | |
| Input capacitance | Cin | — | — | 5 | 10 | — | 10 | pF | |

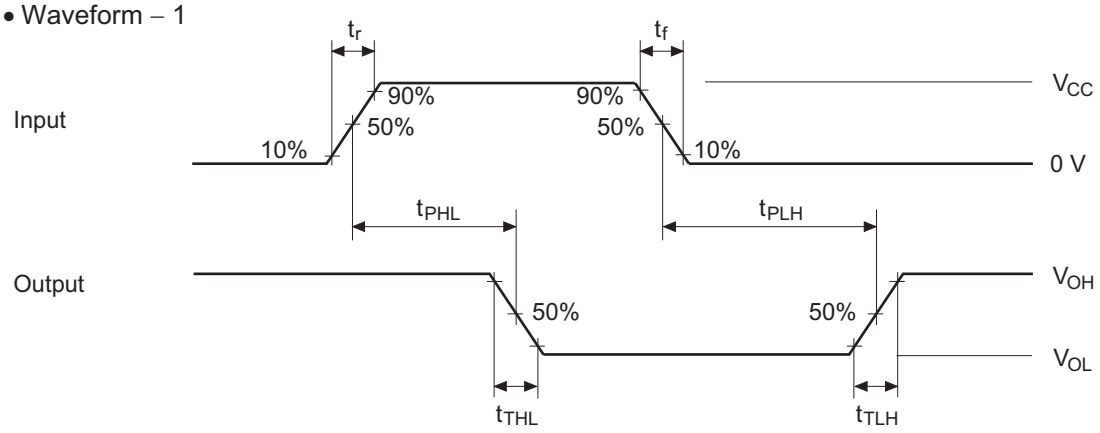
## Test Circuit




Note: $C_L$ includes the probe and fig capacitance.

### Waveforms

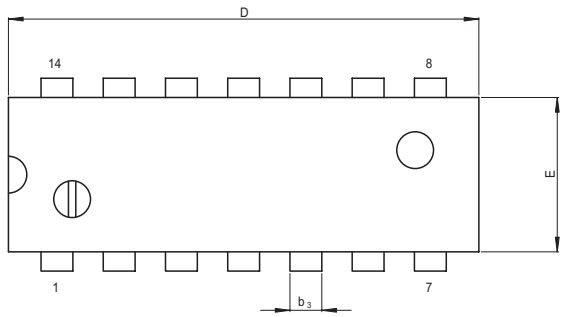
• Waveform – 1

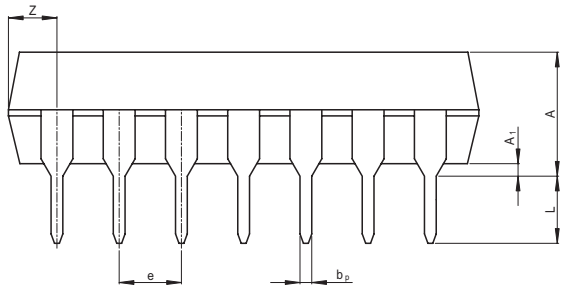


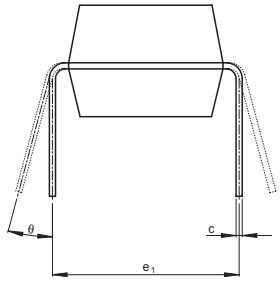

Notes: 1. Input waveform: PRR ≤ 1 MHz, Zo = 50 Ω, $t_r$ ≤ 6 ns, $t_f$ ≤ 6 ns
2. The output are measured one at a time with one transition per measurement.

# Package Dimensions

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-DIP14-6.3x19.2-2.54 | PRDP0014AB-B | DP-14AV | 0.97g |



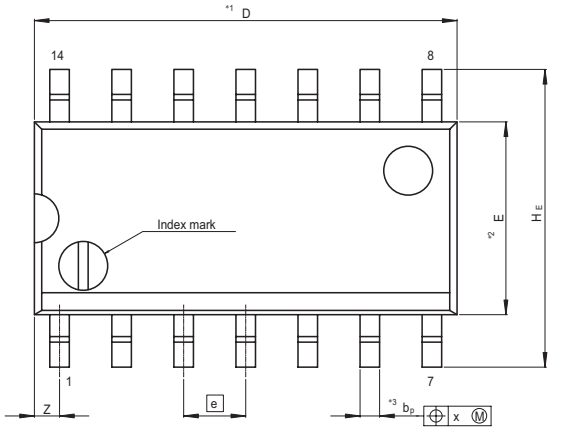



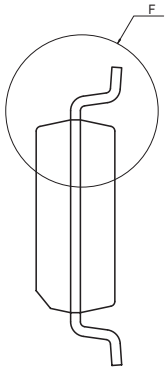




( Ni/Pd/Au plating )

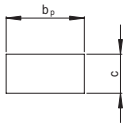
| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| e 1 | —— | 7.62 | —— |
| D | —— | 19.2 | 20.32 |
| E | —— | 6.3 | 7.4 |
| A | —— | —— | 5.06 |
| A 1 | 0.51 | —— | —— |
| b p | 0.40 | 0.48 | 0.56 |
| b 3 | —— | 1.30 | —— |
| c | 0.19 | 0.25 | 0.31 |
| θ | 0° | —— | 15° |
| e | 2.29 | 2.54 | 2.79 |
| Z | —— | —— | 2.39 |
| L | 2.54 | —— | —— |

| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-3.95x8.65-1.27 | PRSP0014DE-A | FP-14DNV | 0.13g |

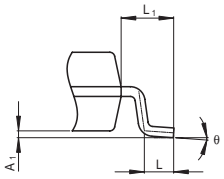



NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.



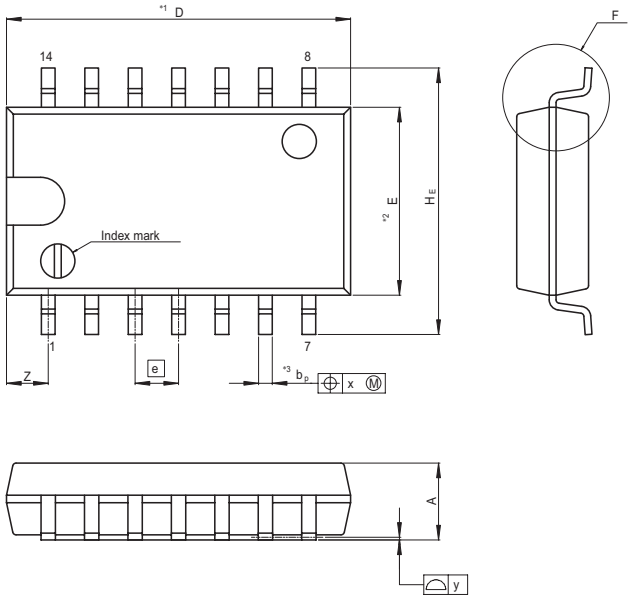

Terminal cross section
( Ni/Pd/Au plating )




Detail F

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | —— | 8.65 | 9.05 |
| E | —— | 3.95 | —— |
| A 2 | —— | —— | —— |
| A 1 | 0.10 | 0.14 | 0.25 |
| A | —— | —— | 1.75 |
| b p | 0.34 | 0.40 | 0.46 |
| b 1 | —— | —— | —— |
| c | 0.15 | 0.20 | 0.25 |
| c 1 | —— | —— | —— |
| θ | 0° | —— | 8° |
| H E | 5.80 | 6.10 | 6.20 |
| e | —— | 1.27 | —— |
| x | —— | —— | 0.25 |
| y | —— | —— | 0.15 |
| Z | —— | —— | 0.635 |
| L | 0.40 | 0.60 | 1.27 |
| L 1 | —— | 1.08 | —— |

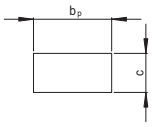
| JEITA Package Code | RENESAS Code | Previous Code | MASS[Typ.] |
|---|---|---|---|
| P-SOP14-5.5x10.06-1.27 | PRSP0014DF-B | FP-14DAV | 0.23g |



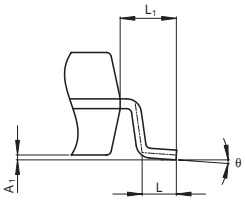




NOTE)
1. DIMENSIONS"*1 (Nom)"AND"*2" DO NOT INCLUDE MOLD FLASH.
2. DIMENSION"*3"DOES NOT INCLUDE TRIM OFFSET.




Terminal cross section
( Ni/Pd/Au plating )




Detail F

| Reference Symbol | Dimension in Millimeters | | |
|---|---|---|---|
| | Min | Nom | Max |
| D | — | 10.06 | 10.5 |
| E | — | 5.50 | — |
| A 2 | — | — | — |
| A 1 | 0.00 | 0.10 | 0.20 |
| A | — | — | 2.20 |
| b p | 0.34 | 0.40 | 0.46 |
| b 1 | — | — | — |
| c | 0.15 | 0.20 | 0.25 |
| c 1 | — | — | — |
| θ | 0° | — | 8° |
| H E | 7.50 | 7.80 | 8.00 |
| e | — | 1.27 | — |
| x | — | — | 0.12 |
| y | — | — | 0.15 |
| Z | — | — | 1.42 |
| L | 0.50 | 0.70 | 0.90 |
| L 1 | — | 1.15 | — |

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan



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**Renesas Technology America, Inc.**
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

**Renesas Technology Europe Limited**
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

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10th Floor, No.99, Fushing North Road, Taipei, Taiwan
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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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