

# HD74ALVC1G04

## Single Inverter Buffer

# HITACHI

ADE-205-626 (Z)

Rev.0  
June. 2001

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### Description

The HD74ALVC1G04 has an inverter 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 hitachi uni logic series.
- Supplied on emboss taping for high speed automatic mounting.
- Supply voltage range : 1.2 to 3.6 V  
Operating temperature range : -40 to +85°C
- All inputs  $V_{IH}$  (Max.) = 3.6 V (@ $V_{CC}$  = 0 V to 3.6 V)  
All outputs  $V_O$  (Max.) = 3.6 V (@ $V_{CC}$  = 0 V)
- Output current            $\pm 2$  mA (@ $V_{CC}$  = 1.2)  
                                   $\pm 4$  mA (@ $V_{CC}$  = 1.4 V to 1.6 V)  
                                   $\pm 6$  mA (@ $V_{CC}$  = 1.65 V to 1.95 V)  
                                   $\pm 18$  mA (@ $V_{CC}$  = 2.3 V to 2.7 V)  
                                   $\pm 24$  mA (@ $V_{CC}$  = 3.0 V to 3.6 V)
- Package type

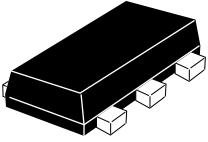
| Package type | Package code | Package suffix | Taping code          |
|--------------|--------------|----------------|----------------------|
| VSON-5 pin   | TNP-5D       | VS             | E (3,000 pcs / Reel) |

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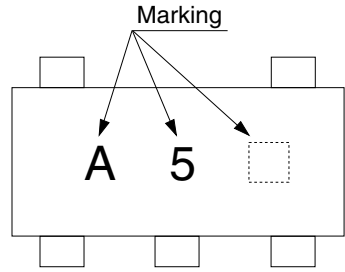
# HD74ALVC1G04

## Outline and Article Indication

- HD74ALVC1G04



VSON-5



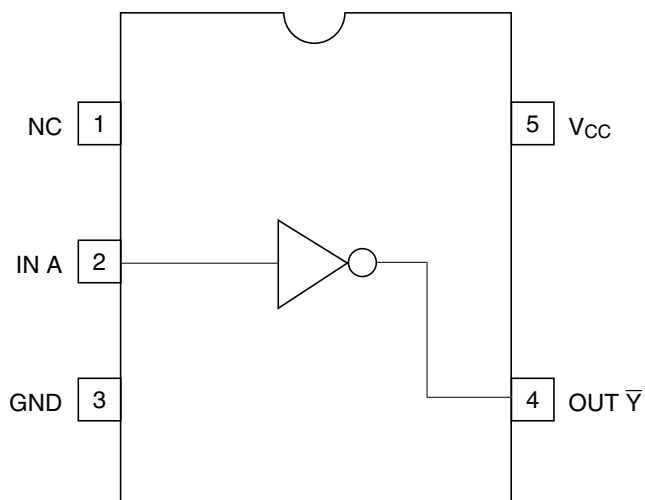
 = Control code

## Function Table

| Input A | Output $\bar{Y}$ |
|---------|------------------|
| H       | L                |
| L       | H                |

H: High level  
L: Low level

**Pin Arrangement**



(Top view)

**Absolute Maximum Ratings**

| Item  | Symbol                | Ratings                             | Unit             | Conditions                        |
|---|-----------------------|-------------------------------------|------------------|-----------------------------------|
| Supply voltage range  | $V_{CC}$              | -0.5 to 4.6                         | V                |                                   |
| Input voltage range <sup>1</sup>  | $V_I$                 | -0.5 to 4.6                         | V                |                                   |
| Output voltage range <sup>1,2</sup>   | $V_O$                 | -0.5 to $V_{CC}+0.5$<br>-0.5 to 4.6 | V                | Output : H or L<br>$V_{CC}$ : OFF |
| Input clamp current   | $I_{IK}$              | -50                                 | mA               | $V_I < 0$                         |
| Output clamp current  | $I_{OK}$              | $\pm 50$                            | mA               | $V_O < 0$ or $V_O > V_{CC}$       |
| 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               |                                   |
| Maximum power dissipation at $T_a = 25^\circ\text{C}$ (in still air) <sup>3</sup> | $P_T$                 | 200                                 | mW               |                                   |
| Storage temperature   | $T_{stg}$             | -65 to 150                          | $^\circ\text{C}$ |                                   |

- 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 4.6 V maximum.
  3. The maximum package power dissipation was calculated using a junction temperature of 150 $^\circ\text{C}$ .

## Recommended Operating Conditions

| Item                               | Symbol                | Min | Max      | Unit                     | Conditions                            |
|------------------------------------|-----------------------|-----|----------|--------------------------|---------------------------------------|
| Supply voltage range               | $V_{CC}$              | 1.2 | 3.6      | V                        |                                       |
| Input voltage range                | $V_I$                 | 0   | 3.6      | V                        |                                       |
| Output voltage range               | $V_O$                 | 0   | $V_{CC}$ | V                        |                                       |
| Output current                     | $I_{OH}$              | —   | -2       | mA                       | $V_{CC} = 1.2\text{ V}$               |
|                                    |                       | —   | -4       |                          | $V_{CC} = 1.4\text{ V}$               |
|                                    |                       | —   | -6       |                          | $V_{CC} = 1.65\text{ V}$              |
|                                    |                       | —   | -18      |                          | $V_{CC} = 2.3\text{ V}$               |
|                                    |                       | —   | -24      |                          | $V_{CC} = 3.0\text{ V}$               |
|                                    | $I_{OL}$              | —   | 2        | $V_{CC} = 1.2\text{ V}$  |                                       |
|                                    |                       | —   | 4        | $V_{CC} = 1.4\text{ V}$  |                                       |
|                                    |                       | —   | 6        | $V_{CC} = 1.65\text{ V}$ |                                       |
|                                    |                       | —   | 18       | $V_{CC} = 2.3\text{ V}$  |                                       |
|                                    |                       | —   | 24       | $V_{CC} = 3.0\text{ V}$  |                                       |
| Input transition rise or fall rate | $\Delta t / \Delta v$ | 0   | 20       | ns / V                   | $V_{CC} = 1.2\text{ to }2.7\text{ V}$ |
|                                    |                       | 0   | 10       |                          | $V_{CC} = 3.3\pm 0.3\text{ V}$        |
| 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 conditions   |
|--------------------------|------------------|-----------------------|-----------------------|-----|-----------------------|--------------------------|---|
| Input voltage            | V <sub>IH</sub>  | 1.2                   | V <sub>cc</sub> ×0.75 | —   | —                     | V                        |   |
|                          |                  | 1.4 to 1.6            | V <sub>cc</sub> ×0.7  | —   | —                     |                          |   |
|                          |                  | 1.65 to 1.95          | V <sub>cc</sub> ×0.7  | —   | —                     |                          |   |
|                          |                  | 2.3 to 2.7            | 1.7                   | —   | —                     |                          |   |
|                          |                  | 3.0 to 3.6            | 2.0                   | —   | —                     |                          |   |
|                          | V <sub>IL</sub>  | 1.2                   | —                     | —   | V <sub>cc</sub> ×0.25 |                          |   |
|                          |                  | 1.4 to 1.6            | —                     | —   | V <sub>cc</sub> ×0.3  |                          |   |
|                          |                  | 1.65 to 1.95          | —                     | —   | V <sub>cc</sub> ×0.3  |                          |   |
|                          |                  | 2.3 to 2.7            | —                     | —   | 0.7                   |                          |   |
|                          |                  | 3.0 to 3.6            | —                     | —   | 0.8                   |                          |   |
| Output voltage           | V <sub>OH</sub>  | Min to Max            | V <sub>cc</sub> -0.2  | —   | —                     | V                        | I <sub>OH</sub> = -100 μA                                       |
|                          |                  | 1.2                   | 0.9                   | —   | —                     |                          | I <sub>OH</sub> = -2 mA   |
|                          |                  | 1.4                   | 1.1                   | —   | —                     |                          | I <sub>OH</sub> = -4 mA   |
|                          |                  | 1.65                  | 1.2                   | —   | —                     |                          | I <sub>OH</sub> = -6 mA   |
|                          |                  | 2.3                   | 1.7                   | —   | —                     |                          | I <sub>OH</sub> = -18 mA  |
|                          |                  | 3.0                   | 2.2                   | —   | —                     |                          | I <sub>OH</sub> = -24 mA  |
|                          | V <sub>OL</sub>  | Min to Max            | —                     | —   | 0.2                   | I <sub>OL</sub> = 100 μA |   |
|                          |                  | 1.2                   | —                     | —   | 0.3                   | I <sub>OL</sub> = 2 mA   |   |
|                          |                  | 1.4                   | —                     | —   | 0.3                   | I <sub>OL</sub> = 4 mA   |   |
|                          |                  | 1.65                  | —                     | —   | 0.3                   | I <sub>OL</sub> = 6 mA   |   |
|                          |                  | 2.3                   | —                     | —   | 0.55                  | I <sub>OL</sub> = 18 mA  |   |
|                          |                  | 3.0                   | —                     | —   | 0.55                  | I <sub>OL</sub> = 24 mA  |   |
|                          |                  | Input current         | I <sub>IN</sub>       | 3.6 | —                     | —                        | ±5  |
| Quiescent supply current | I <sub>CC</sub>  | 3.6                   | —                     | —   | 10                    | μA                       | V <sub>IN</sub> = V <sub>CC</sub> or GND,<br>I <sub>O</sub> = 0 |
| Output leakage current   | I <sub>OFF</sub> | 0                     | —                     | —   | 5                     | μA                       | V <sub>IN</sub> or V <sub>OUT</sub> =<br>0 to 3.6 V             |
| Input capacitance        | C <sub>IN</sub>  | 3.3                   | —                     | 4.5 | —                     | 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

( $T_a = -40$  to  $85^\circ\text{C}$ )

- $V_{CC} = 1.2\text{ V}$

| Item                   | Symbol                 | Min | Typ | Max | Unit | Test conditions      | FROM (Input) | TO (Output) |
|------------------------|------------------------|-----|-----|-----|------|----------------------|--------------|-------------|
| Propagation delay time | $t_{PLH}$<br>$t_{PHL}$ | —   | 5.0 | —   | ns   | $C_L = 15\text{ pF}$ | A            | $\bar{Y}$   |

- $V_{CC} = 1.5\pm 0.1\text{ V}$

| Item                   | Symbol                 | Min | Typ | Max | Unit | Test conditions      | FROM (Input) | TO (Output) |
|------------------------|------------------------|-----|-----|-----|------|----------------------|--------------|-------------|
| Propagation delay time | $t_{PLH}$<br>$t_{PHL}$ | 2.0 | —   | 7.0 | ns   | $C_L = 15\text{ pF}$ | A            | $\bar{Y}$   |

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

| Item                   | Symbol                 | Min | Typ | Max | Unit | Test conditions      | FROM (Input) | TO (Output) |
|------------------------|------------------------|-----|-----|-----|------|----------------------|--------------|-------------|
| Propagation delay time | $t_{PLH}$<br>$t_{PHL}$ | 1.5 | —   | 5.0 | ns   | $C_L = 30\text{ pF}$ | A            | $\bar{Y}$   |

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

| Item                   | Symbol                 | Min | Typ | Max | Unit | Test conditions      | FROM (Input) | TO (Output) |
|------------------------|------------------------|-----|-----|-----|------|----------------------|--------------|-------------|
| Propagation delay time | $t_{PLH}$<br>$t_{PHL}$ | 1.0 | —   | 3.5 | ns   | $C_L = 30\text{ pF}$ | A            | $\bar{Y}$   |

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

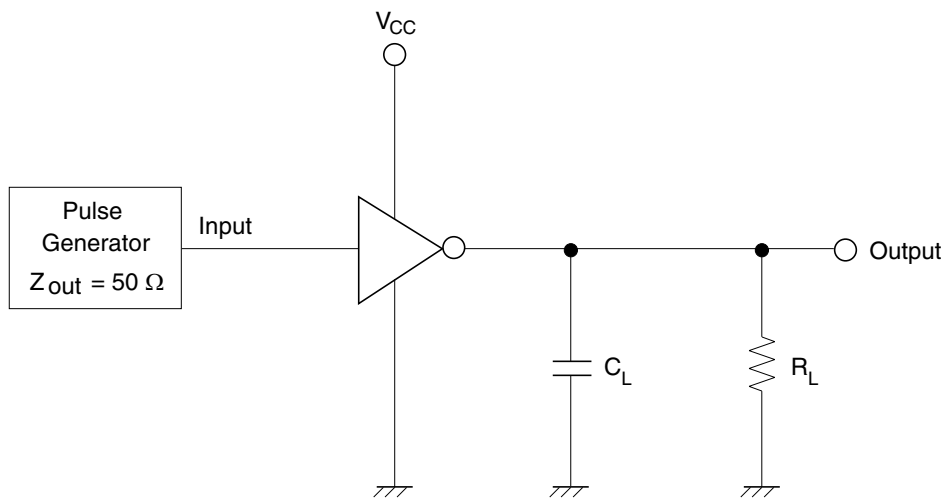
| Item                   | Symbol                 | Min | Typ | Max | Unit | Test conditions      | FROM (Input) | TO (Output) |
|------------------------|------------------------|-----|-----|-----|------|----------------------|--------------|-------------|
| Propagation delay time | $t_{PLH}$<br>$t_{PHL}$ | 1.0 | —   | 2.5 | ns   | $C_L = 30\text{ pF}$ | A            | $\bar{Y}$   |

### Operating Characteristics

(Ta = 25°C)

| Item                          | Symbol          | V <sub>CC</sub> (V) | Min | Typ  | Max | Unit | Test conditions |
|-------------------------------|-----------------|---------------------|-----|------|-----|------|-----------------|
| Power dissipation capacitance | C <sub>PD</sub> | 1.5                 | —   | 9.5  | —   | pF   | f = 10 MHz      |
|                               |                 | 1.8                 | —   | 9.5  | —   |      |                 |
|                               |                 | 2.5                 | —   | 10.0 | —   |      |                 |
|                               |                 | 3.3                 | —   | 10.5 | —   |      |                 |

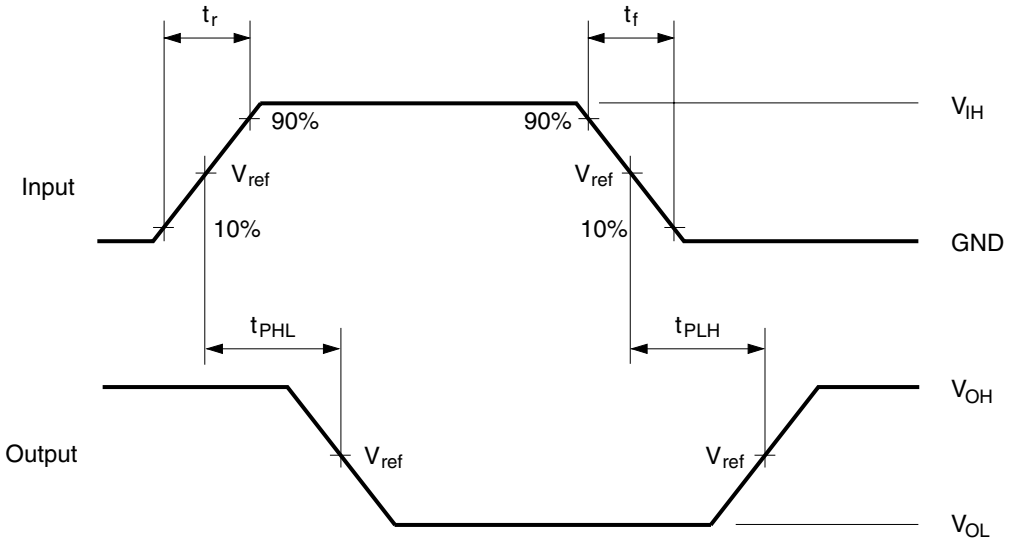
### Test Circuit



| Symbol         | V <sub>CC</sub> = 1.2 V,<br>1.5±0.1 V | V <sub>CC</sub> = 1.8±0.15 V | V <sub>CC</sub> = 2.5±0.2 V,<br>3.3±0.3 V |
|----------------|---------------------------------------|------------------------------|---|
| R <sub>L</sub> | 2.0 kΩ                                | 1.0 kΩ                       | 500 Ω                                     |
| C <sub>L</sub> | 15 pF                                 | 30 pF                        | 30 pF                                     |

Note: C<sub>L</sub> includes probe and jig capacitance.

## Waveforms



| Symbol      | $V_{CC} = 1.2\text{ V},$<br>$1.5 \pm 0.1\text{ V},$<br>$1.8 \pm 0.15\text{ V}$ | $V_{CC} = 2.5 \pm 0.2\text{ V}$ | $V_{CC} = 3.3 \pm 0.3\text{ V}$ |
|-------------|--|---------------------------------|---------------------------------|
| $t_r / t_f$ | 2.0 ns   | 2.5 ns                          | 2.5 ns                          |
| $V_{IH}$    | $V_{CC}$   | $V_{CC}$                        | 2.7 V                           |
| $V_{ref}$   | 50%  | 50%                             | 1.5 V                           |

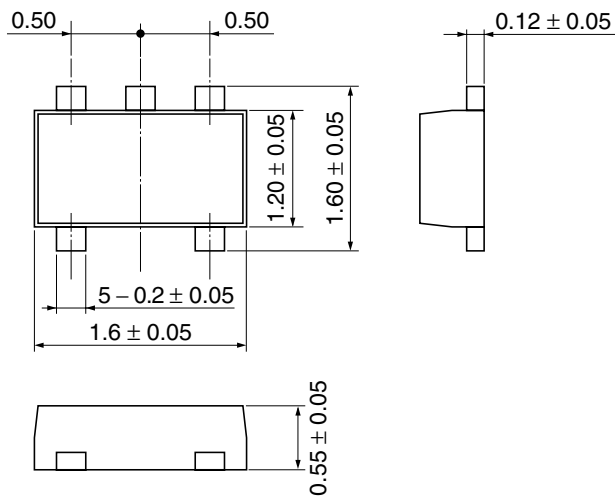
Note: Input waveform : PRR = 10 MHz, duty cycle 50%



Package Dimensions

As of January, 2001

Unit: mm



|                        |        |
|------------------------|--------|
| Hitachi Code           | TNP-5D |
| JEDEC                  | —      |
| EIAJ                   | —      |
| Mass (reference value) | —      |

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|---|--|
| Hitachi Semiconductor (America) Inc.<br>179 East Tasman Drive<br>San Jose, CA 95134<br>Tel: <1> (408) 433-1990<br>Fax: <1> (408) 433-0223 | Hitachi Europe Ltd.<br>Electronic Components Group<br>Whitebrook Park<br>Lower Cookham Road<br>Maidenhead<br>Berkshire SL6 8YA, United Kingdom<br>Tel: <44> (1628) 585000<br>Fax: <44> (1628) 585200 |
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Hitachi Asia Ltd.  
Hitachi Tower  
16 Collyer Quay #20-00  
Singapore 049318  
Tel : <65>-538-6533/538-8577  
Fax : <65>-538-6933/538-3877  
URL : <http://www.hitachi.com.sg>

Hitachi Asia Ltd.  
(Taipei Branch Office)  
4/F, No. 167, Tun Hwa North Road  
Hung-Kuo Building  
Taipei (105), Taiwan  
Tel : <886>-(2)-2718-3666  
Fax : <886>-(2)-2718-8180  
Telex : 23222 HAS-TP  
URL : <http://www.hitachi.com.tw>

Hitachi Asia (Hong Kong) Ltd.  
Group III (Electronic Components)  
7/F., North Tower  
World Finance Centre,  
Harbour City, Canton Road  
Tsim Sha Tsui, Kowloon  
Hong Kong  
Tel : <852>-(2)-735-9218  
Fax : <852>-(2)-730-0281  
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