

## Description

The MC74HC1G04 is high-speed CMOS inverter using silicon gate CMOS process. With CMOS lowpower dissipation, it provides high-speed equivalent to LS–TTL series. The internal circuit of three stages construction with buffer provides wide noise margin and stable output.

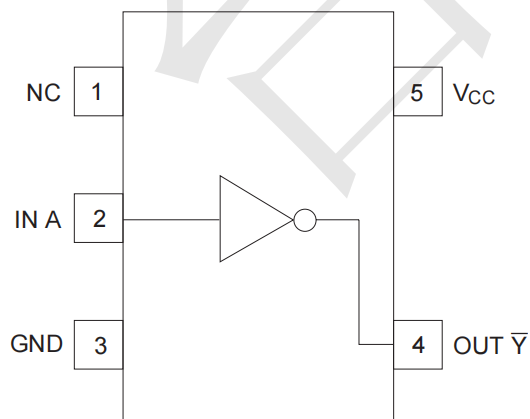
## Features

- The basic gate function is lined up as Renesas uni logic series.
- Supplied on emboss taping for high-speed automatic mounting.
- Electrical characteristics equivalent to the MC74HC1G04
- Supply voltage range : 2 to 6 V
- Operating temperature range : –40 to +85°C
- $|I_{OH}| = I_{OL} = 2 \text{ mA (min)}$
- Ordering Information

## Ordering Information

| ORDER NUMBER       | PACKAGE DESCRIPTION | PACKAGE OPTION     |
|--------------------|---------------------|--------------------|
| MC74HC1G04DTT1G-TP | SOT23-5             | Tape and Reel,3000 |
| MC74HC1G04DFT1G-TP | SOT353              | Tape and Reel,3000 |

## Pin Arrangement



(Top view)

## Function Table

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

H : High level

L : Low level

### Absolute Maximum Ratings

| Item                                                                                     | Symbol                | Ratings                | Unit | Test Conditions             |
|------------------------------------------------------------------------------------------|-----------------------|------------------------|------|-----------------------------|
| Supply voltage range                                                                     | $V_{CC}$              | -0.5 to 7.0            | V    |                             |
| Input voltage range <sup>*1</sup>                                                        | $V_I$                 | -0.5 to $V_{CC} + 0.5$ | V    |                             |
| Output voltage range <sup>*1, 2</sup>                                                    | $V_O$                 | -0.5 to $V_{CC} + 0.5$ | V    | Output : H or L             |
| Input clamp current                                                                      | $I_{IK}$              | ±20                    | mA   | $V_I < 0$ or $V_I > V_{CC}$ |
| Output clamp current                                                                     | $I_{OK}$              | ±20                    | mA   | $V_O < 0$ or $V_O > V_{CC}$ |
| Continuous output current                                                                | $I_O$                 | ±25                    | mA   | $V_O = 0$ to $V_{CC}$       |
| Continuous current through $V_{CC}$ or GND                                               | $I_{CC}$ or $I_{GND}$ | ±25                    | mA   |                             |
| Maximum power dissipation $P_T$ at $T_a = 25^\circ\text{C}$ (in still air) <sup>*3</sup> |                       | 200                    | mW   |                             |
| 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.
  3. The maximum package power dissipation was calculated using a junction temperature of 150°C.

### Recommended Operating Conditions

| Item                                | Symbol     | Min | Max      | Unit | Test Conditions         |
|-------------------------------------|------------|-----|----------|------|-------------------------|
| Supply voltage range                | $V_{CC}$   | 2   | 6        | V    |                         |
| Input voltage range                 | $V_I$      | 0   | $V_{CC}$ | V    |                         |
| Output voltage range                | $V_O$      | 0   | $V_{CC}$ | V    |                         |
| Output current                      | $I_{OL}$   | —   | 2.0      | mA   | $V_{CC} = 4.5\text{ V}$ |
|                                     |            | —   | 2.6      |      | $V_{CC} = 6.0\text{ V}$ |
|                                     | $I_{OH}$   | —   | -2.0     | mA   | $V_{CC} = 4.5\text{ V}$ |
|                                     |            | —   | -2.6     |      | $V_{CC} = 6.0\text{ V}$ |
| Input rise / fall time (10% to 90%) | $t_r, t_f$ | 0   | 1000     | ns   | $V_{CC} = 2.0\text{ V}$ |
|                                     |            | 0   | 500      |      | $V_{CC} = 4.5\text{ V}$ |
|                                     |            | 0   | 400      |      | $V_{CC} = 6.0\text{ V}$ |
| Operating temperature               | $T_a$      | -40 | 85       | °C   |                         |

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

### Electrical Characteristics

| Item              | Symbol (V)      | V <sub>CC</sub> | T <sub>a</sub> = 25°C |      |      | T <sub>a</sub> = -40 to 85°C |      | Unit | Test Conditions                                            |
|-------------------|-----------------|-----------------|-----------------------|------|------|------------------------------|------|------|------------------------------------------------------------|
|                   |                 |                 | Min                   | Typ  | Max  | Min                          | Max  |      |                                                            |
| Input voltage     | V <sub>IH</sub> | 2.0             | 1.5                   | —    | —    | 1.5                          | —    | V    |                                                            |
|                   |                 | 4.5             | 3.15                  | —    | —    | 3.15                         | —    |      |                                                            |
|                   |                 | 6.0             | 4.2                   | —    | —    | 4.2                          | —    |      |                                                            |
|                   | V <sub>IL</sub> | 2.0             | —                     | —    | 0.5  | —                            | 0.5  |      |                                                            |
|                   |                 | 4.5             | —                     | —    | 1.35 | —                            | 1.35 |      |                                                            |
|                   |                 | 6.0             | —                     | —    | 1.8  | —                            | 1.8  |      |                                                            |
| Output voltage    | V <sub>OH</sub> | 2.0             | 1.9                   | 2.0  | —    | 1.9                          | —    | V    | V <sub>IN</sub> = V <sub>IL</sub> I <sub>OH</sub> = -20 μA |
|                   |                 | 4.5             | 4.4                   | 4.5  | —    | 4.4                          | —    |      |                                                            |
|                   |                 | 6.0             | 5.9                   | 6.0  | —    | 5.9                          | —    |      |                                                            |
|                   |                 | 4.5             | 4.18                  | 4.31 | —    | 4.13                         | —    |      | I <sub>OH</sub> = -2 mA                                    |
|                   |                 | 6.0             | 5.68                  | 5.80 | —    | 5.63                         | —    |      | I <sub>OH</sub> = -2.6 mA                                  |
|                   |                 | 6.0             | 5.68                  | 5.80 | —    | 5.63                         | —    |      | I <sub>OH</sub> = -2.6 mA                                  |
|                   | V <sub>OL</sub> | 2.0             | —                     | 0.0  | 0.1  | —                            | 0.1  | V    | V <sub>IN</sub> = V <sub>IH</sub> I <sub>OL</sub> = 20 μA  |
|                   |                 | 4.5             | —                     | 0.0  | 0.1  | —                            | 0.1  |      |                                                            |
|                   |                 | 6.0             | —                     | 0.0  | 0.1  | —                            | 0.1  |      |                                                            |
|                   |                 | 4.5             | —                     | 0.17 | 0.26 | —                            | 0.33 |      | I <sub>OL</sub> = 2 mA                                     |
|                   |                 | 6.0             | —                     | 0.18 | 0.26 | —                            | 0.33 |      | I <sub>OL</sub> = 2.6 mA                                   |
|                   |                 | 6.0             | —                     | —    | ±0.1 | —                            | ±1.0 |      | I <sub>OL</sub> = 2.6 mA                                   |
| Input current     | I <sub>IN</sub> | 6.0             | —                     | —    | ±0.1 | —                            | ±1.0 | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND                   |
| Operating current | I <sub>CC</sub> | 6.0             | —                     | —    | 1.0  | —                            | 10.0 | μA   | V <sub>IN</sub> = V <sub>CC</sub> or GND                   |

### Switching Characteristics

| Item                    | Symbol           | Ta = 25°C |     |     | Unit | Test Conditions |
|-------------------------|------------------|-----------|-----|-----|------|-----------------|
|                         |                  | Min       | Typ | Max |      |                 |
| Output rise / fall time | t <sub>TLH</sub> | —         | 5   | 10  | ns   | Test circuit    |
|                         | t <sub>THL</sub> | —         | 5   | 10  | ns   |                 |
| Propagation delay time  | t <sub>PLH</sub> | —         | 7   | 15  | ns   | Test circuit    |
|                         | t <sub>PHL</sub> | —         | 7   | 15  | ns   |                 |

(C<sub>L</sub> = 15 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns, V<sub>CC</sub> = 5 V)

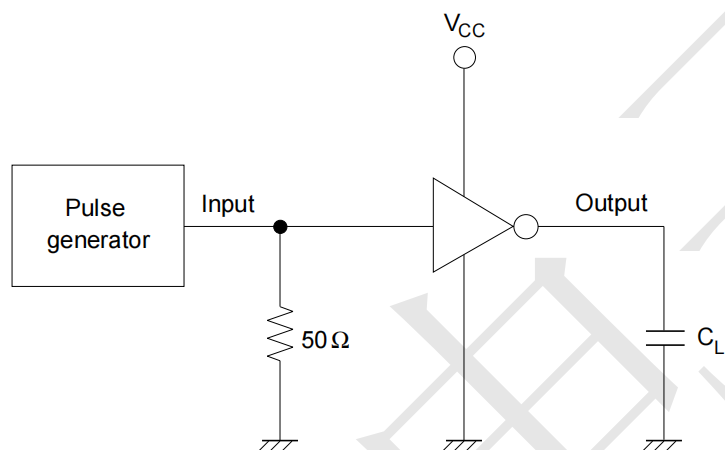
| Item                    | Symbol           | V <sub>CC</sub> (V) | Ta = 25°C |     |     | Ta = -40 to 85°C |     | Unit | Test Conditions |
|-------------------------|------------------|---------------------|-----------|-----|-----|------------------|-----|------|-----------------|
|                         |                  |                     | Min       | Typ | Max | Min              | Max |      |                 |
| Output rise / fall time | t <sub>TLH</sub> | 2.0                 | —         | 50  | 125 | —                | 155 | ns   | Test circuit    |
|                         | t <sub>THL</sub> | 4.5                 | —         | 14  | 25  | —                | 31  |      |                 |
|                         |                  | 6.0                 | —         | 12  | 21  | —                | 26  |      |                 |
| Propagation delay time  | t <sub>PLH</sub> | 2.0                 | —         | 48  | 100 | —                | 125 | ns   | Test circuit    |
|                         | t <sub>PHL</sub> | 4.5                 | —         | 12  | 20  | —                | 25  |      |                 |
|                         |                  | 6.0                 | —         | 9   | 17  | —                | 21  |      |                 |
| Input capacitance       | C <sub>IN</sub>  | —                   | —         | 2.5 | 5   | —                | 5   | pF   |                 |
| Equivalent capacitance  | C <sub>PD</sub>  | —                   | —         | 10  | —   | —                | —   | pF   |                 |

(C<sub>L</sub> = 50 pF, t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Note: C<sub>PD</sub> is equivalent capacitance inside of the IC calculated from the operating current without load (see test circuit). The average operating current without load is calculated according to the expression below.

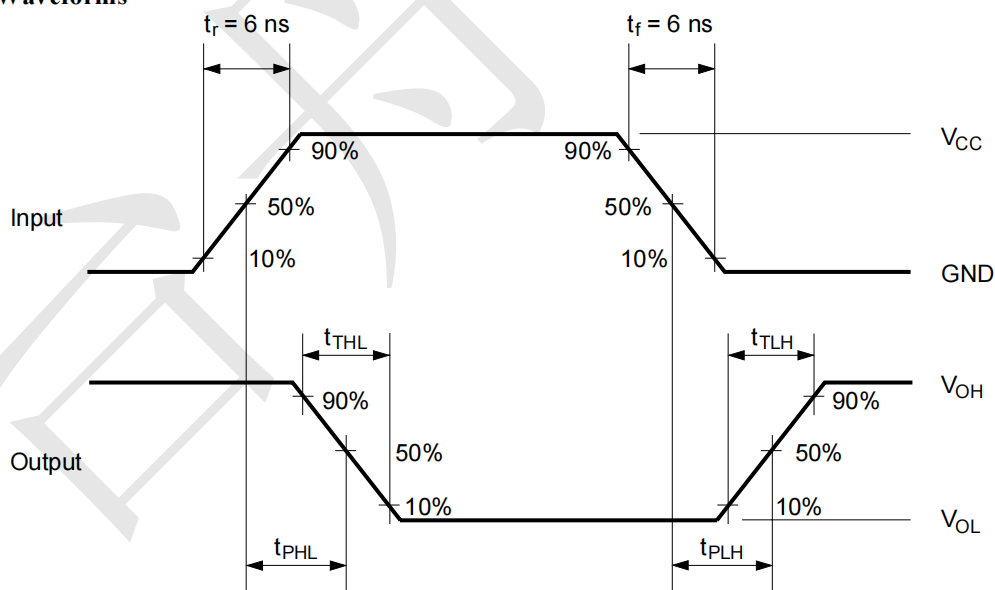
$$I_{CC}(\text{opr}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

## Test Circuit



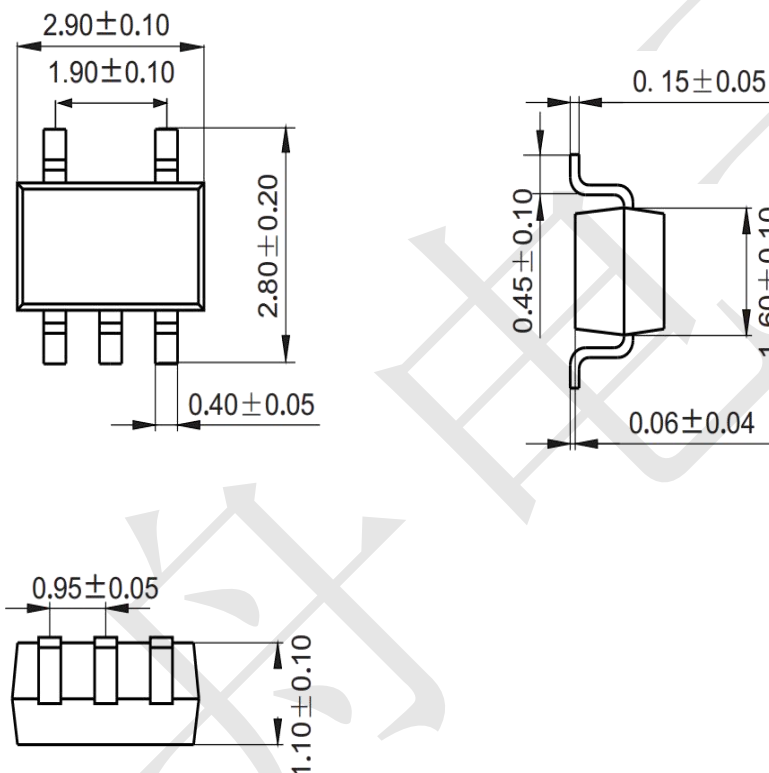
Note: 1.  $C_L$  includes probe and jig capacitance.

### • Waveforms

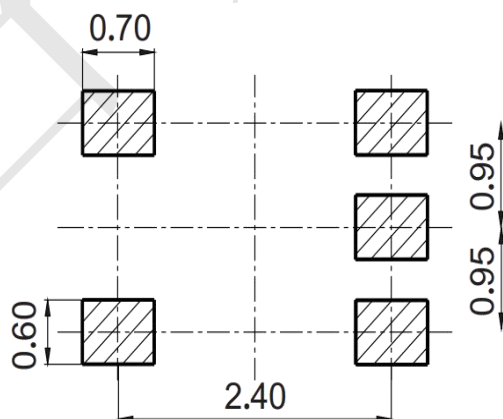


## Package information

SOT23-5 (Unit: mm)

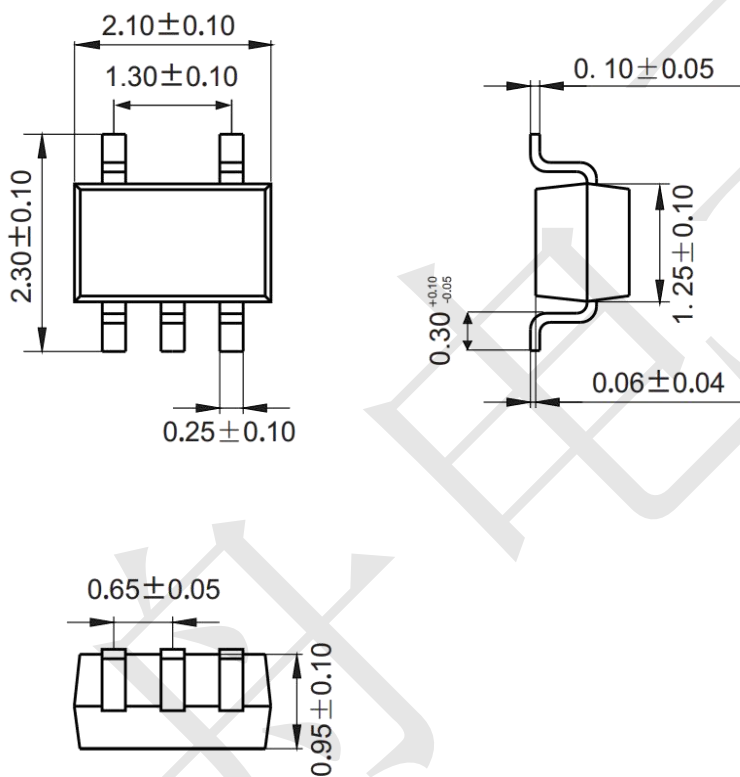


## Mounting Pad Layout (Unit: mm)



## Package information

SOT353 (Unit: mm)



## Mounting Pad Layout (Unit: mm)

