

# 74HC2G04; 74HCT2G04

## Dual inverter

Rev. 01 — 15 November 2006

Product data sheet

## 1. General description

The 74HC2G04; 74HCT2G04 is a high-speed Si-gate CMOS device.

The 74HC2G04; 74HCT2G04 provides two inverting buffers.

## 2. Features

- Wide supply voltage range from 2.0 V to 6.0 V
- Complies with JEDEC standard no. 7A
- High noise immunity
- ESD protection:
  - ◆ HBM JESD22-A114-D exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- Low power dissipation
- Balanced propagation delays
- Unlimited input rise and fall times
- Multiple package options
- Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$

## 3. Ordering information

Table 1. Ordering information

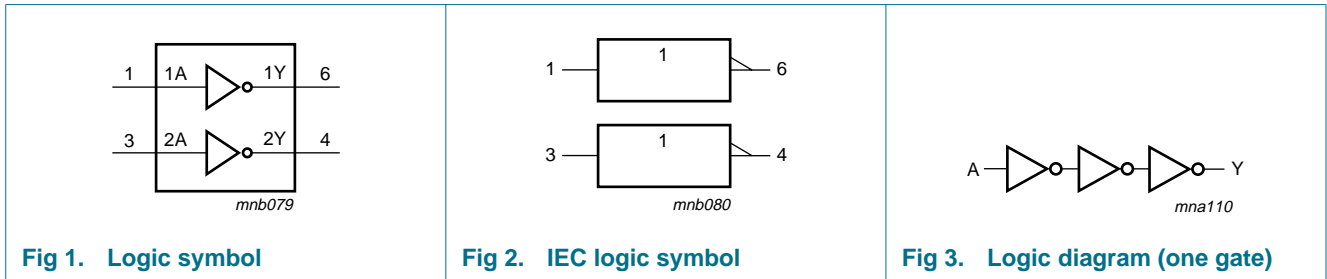
| Type number | Package   |       |  |         |
|-------------|---|-------|--|---------|
|             | Temperature range   | Name  | Description                                      | Version |
| 74HC2G04GW  | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-88 | plastic surface-mounted package; 6 leads         | SOT363  |
| 74HC2G04GV  | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |
| 74HCT2G04GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-88 | plastic surface-mounted package; 6 leads         | SOT363  |
| 74HCT2G04GV | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74 | plastic surface-mounted package (TSOP6); 6 leads | SOT457  |

## 4. Marking

Table 2. Marking

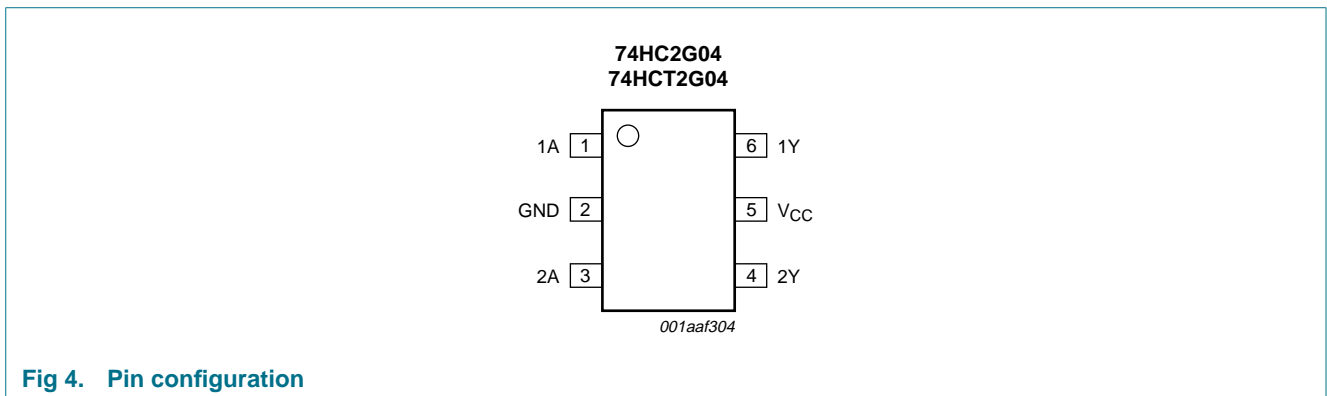
| Type number | Marking code |
|-------------|--------------|
| 74HC2G04GW  | H4           |
| 74HC2G04GV  | H04          |
| 74HCT2G04GW | T4           |
| 74HCT2G04GV | T04          |

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

**Table 3. Pin description**

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| 1A              | 1   | data input     |
| GND             | 2   | ground (0 V)   |
| 2A              | 3   | data input     |
| 2Y              | 4   | data output    |
| V <sub>CC</sub> | 5   | supply voltage |
| 1Y              | 6   | data output    |

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

| Input | Output |
|-------|--------|
| nA    | nY     |
| L     | H      |
| H     | L      |

[1] H = HIGH voltage level;  
L = LOW voltage level.

## 8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

| Symbol    | Parameter               | Conditions   | Min   | Max  | Unit |
|-----------|-------------------------|--|-------|------|------|
| $V_{CC}$  | supply voltage          |  | -0.5  | +7.0 | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$ | [1] - | ±20  | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | [1] - | ±20  | mA   |
| $I_O$     | output current          | $V_O = -0.5\text{ V}$ to $V_{CC} + 0.5\text{ V}$       | [1] - | ±25  | mA   |
| $I_{CC}$  | supply current          |  | [1] - | +50  | mA   |
| $I_{GND}$ | ground current          |  | [1] - | -50  | mA   |
| $T_{stg}$ | storage temperature     |  | -65   | +150 | °C   |
| $P_{tot}$ | total power dissipation |  | [2] - | 250  | mW   |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SC-88 and SC-74 packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.

## 9. Recommended operating conditions

Table 6. Recommended operating conditions

| Symbol               | Parameter           | Conditions                        | Min | Typ | Max      | Unit |
|----------------------|---------------------|-----------------------------------|-----|-----|----------|------|
| <b>Type 74HC2G04</b> |                     |                                   |     |     |          |      |
| $V_{CC}$             | supply voltage      |                                   | 2.0 | 5.0 | 6.0      | V    |
| $V_I$                | input voltage       |                                   | 0   | -   | $V_{CC}$ | V    |
| $V_O$                | output voltage      |                                   | 0   | -   | $V_{CC}$ | V    |
| $T_{amb}$            | ambient temperature |                                   | -40 | +25 | +125     | °C   |
| $t_r$                | rise time           | except for Schmitt trigger inputs |     |     |          |      |
|                      |                     | $V_{CC} = 2.0\text{ V}$           | -   | -   | 1000     | ns   |
|                      |                     | $V_{CC} = 4.5\text{ V}$           | -   | -   | 500      | ns   |
|                      |                     | $V_{CC} = 6.0\text{ V}$           | -   | -   | 400      | ns   |
| $t_f$                | fall time           | except for Schmitt trigger inputs |     |     |          |      |
|                      |                     | $V_{CC} = 2.0\text{ V}$           | -   | -   | 1000     | ns   |
|                      |                     | $V_{CC} = 4.5\text{ V}$           | -   | -   | 500      | ns   |
|                      |                     | $V_{CC} = 6.0\text{ V}$           | -   | -   | 400      | ns   |

Table 6. Recommended operating conditions ...continued

| Symbol                | Parameter           | Conditions                        | Min | Typ | Max      | Unit |
|-----------------------|---------------------|-----------------------------------|-----|-----|----------|------|
| <b>Type 74HCT2G04</b> |                     |                                   |     |     |          |      |
| $V_{CC}$              | supply voltage      |                                   | 4.5 | 5.0 | 5.5      | V    |
| $V_I$                 | input voltage       |                                   | 0   | -   | $V_{CC}$ | V    |
| $V_O$                 | output voltage      |                                   | 0   | -   | $V_{CC}$ | V    |
| $T_{amb}$             | ambient temperature |                                   | -40 | +25 | +125     | °C   |
| $t_r$                 | rise time           | except for Schmitt trigger inputs |     |     |          |      |
|                       |                     | $V_{CC} = 4.5\text{ V}$           | -   | -   | 500      | ns   |
| $t_f$                 | fall time           | except for Schmitt trigger inputs |     |     |          |      |
|                       |                     | $V_{CC} = 4.5\text{ V}$           | -   | -   | 500      | ns   |

## 10. Static characteristics

Table 7. Static characteristics for 74HC2G04

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                     | Parameter                 | Conditions  | Min  | Typ  | Max       | Unit          |
|--|---------------------------|---|------|------|-----------|---------------|
| <b><math>T_{amb} = 25\text{ °C}</math></b> |                           |   |      |      |           |               |
| $V_{IH}$                                   | HIGH-level input voltage  | $V_{CC} = 2.0\text{ V}$   | 1.5  | 1.2  | -         | V             |
|  |                           | $V_{CC} = 4.5\text{ V}$   | 3.15 | 2.4  | -         | V             |
|  |                           | $V_{CC} = 6.0\text{ V}$   | 4.2  | 3.2  | -         | V             |
| $V_{IL}$                                   | LOW-level input voltage   | $V_{CC} = 2.0\text{ V}$   | -    | 0.8  | 0.5       | V             |
|  |                           | $V_{CC} = 4.5\text{ V}$   | -    | 2.1  | 1.35      | V             |
|  |                           | $V_{CC} = 6.0\text{ V}$   | -    | 2.8  | 1.8       | V             |
| $V_{OH}$                                   | HIGH-level output voltage | $V_I = V_{IH}$ or $V_{IL}$  |      |      |           |               |
|  |                           | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$                   | 1.9  | 2.0  | -         | V             |
|  |                           | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$                   | 4.4  | 4.5  | -         | V             |
|  |                           | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$                   | 5.9  | 6.0  | -         | V             |
|  |                           | $I_O = -4.0\text{ mA}; V_{CC} = 4.5\text{ V}$                           | 4.18 | 4.32 | -         | V             |
|  |                           | $I_O = -5.2\text{ mA}; V_{CC} = 6.0\text{ V}$                           | 5.68 | 5.81 | -         | V             |
| $V_{OL}$                                   | LOW-level output voltage  | $V_I = V_{IH}$ or $V_{IL}$  |      |      |           |               |
|  |                           | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 2.0\text{ V}$                    | -    | 0    | 0.1       | V             |
|  |                           | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 4.5\text{ V}$                    | -    | 0    | 0.1       | V             |
|  |                           | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 6.0\text{ V}$                    | -    | 0    | 0.1       | V             |
|  |                           | $I_O = 4.0\text{ mA}; V_{CC} = 4.5\text{ V}$                            | -    | 0.15 | 0.26      | V             |
|  |                           | $I_O = 5.2\text{ mA}; V_{CC} = 6.0\text{ V}$                            | -    | 0.16 | 0.26      | V             |
| $I_I$                                      | input leakage current     | $V_I = \text{GND}$ or $V_{CC}; V_{CC} = 6.0\text{ V}$                   | -    | -    | $\pm 0.1$ | $\mu\text{A}$ |
| $I_{CC}$                                   | supply current            | $V_I = \text{GND}$ or $V_{CC}; I_O = 0\text{ A}; V_{CC} = 6.0\text{ V}$ | -    | -    | 1.0       | $\mu\text{A}$ |
| $C_I$                                      | input capacitance         |   | -    | 1.5  | -         | pF            |

**Table 7. Static characteristics for 74HC2G04 ...continued**  
 At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                     | Parameter   | Conditions  | Min  | Typ | Max  | Unit |
|--|---|---|------|-----|------|------|
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b>  |   |   |      |     |      |      |
| V <sub>IH</sub>                            | HIGH-level input voltage                          | V <sub>CC</sub> = 2.0 V   | 1.5  | -   | -    | V    |
|  |   | V <sub>CC</sub> = 4.5 V   | 3.15 | -   | -    | V    |
|  |   | V <sub>CC</sub> = 6.0 V   | 4.2  | -   | -    | V    |
| V <sub>IL</sub>                            | LOW-level input voltage                           | V <sub>CC</sub> = 2.0 V   | -    | -   | 0.5  | V    |
|  |   | V <sub>CC</sub> = 4.5 V   | -    | -   | 1.35 | V    |
|  |   | V <sub>CC</sub> = 6.0 V   | -    | -   | 1.8  | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                     |      |     |      |      |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V  | 1.9  | -   | -    | V    |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V  | 4.4  | -   | -    | V    |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V  | 5.9  | -   | -    | V    |
|  |   | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                       | 4.13 | -   | -    | V    |
| V <sub>OL</sub>                            | LOW-level output voltage                          | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                     |      |     |      |      |
|  |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V   | -    | -   | 0.1  | V    |
|  |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V   | -    | -   | 0.1  | V    |
|  |   | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V   | -    | -   | 0.1  | V    |
|  |   | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V  | -    | -   | 0.33 | V    |
| I <sub>I</sub>                             | input leakage current                             | V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 6.0 V                       | -    | -   | ±1.0 | μA   |
|  |   | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -    | -   | 10.0 | μA   |
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |   |   |      |     |      |      |
| V <sub>IH</sub>                            | HIGH-level input voltage                          | V <sub>CC</sub> = 2.0 V   | 1.5  | -   | -    | V    |
|  |   | V <sub>CC</sub> = 4.5 V   | 3.15 | -   | -    | V    |
|  |   | V <sub>CC</sub> = 6.0 V   | 4.2  | -   | -    | V    |
| V <sub>IL</sub>                            | LOW-level input voltage                           | V <sub>CC</sub> = 2.0 V   | -    | -   | 0.5  | V    |
|  |   | V <sub>CC</sub> = 4.5 V   | -    | -   | 1.35 | V    |
|  |   | V <sub>CC</sub> = 6.0 V   | -    | -   | 1.8  | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage                         | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                     |      |     |      |      |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 2.0 V  | 1.9  | -   | -    | V    |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V  | 4.4  | -   | -    | V    |
|  |   | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V  | 5.9  | -   | -    | V    |
|  |   | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V                                       | 3.7  | -   | -    | V    |
| I <sub>O</sub>                             | I <sub>O</sub> = -5.2 mA; V <sub>CC</sub> = 6.0 V | 5.2   | -    | -   | V    |      |

**Table 7. Static characteristics for 74HC2G04 ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                | Conditions  | Min | Typ | Max  | Unit |
|-----------------|--------------------------|---|-----|-----|------|------|
| V <sub>OL</sub> | LOW-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>                                     |     |     |      |      |
|                 |                          | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 2.0 V   | -   | -   | 0.1  | V    |
|                 |                          | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V   | -   | -   | 0.1  | V    |
|                 |                          | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V   | -   | -   | 0.1  | V    |
|                 |                          | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V  | -   | -   | 0.4  | V    |
|                 |                          | I <sub>O</sub> = 5.2 mA; V <sub>CC</sub> = 6.0 V  | -   | -   | 0.4  | V    |
| I <sub>I</sub>  | input leakage current    | V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 6.0 V                       | -   | -   | ±1.0 | μA   |
| I <sub>CC</sub> | supply current           | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V | -   | -   | 20.0 | μA   |

**Table 8. Static characteristics for 74HCT2G04**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                    | Parameter                 | Conditions   | Min  | Typ  | Max  | Unit |
|---|---------------------------|--|------|------|------|------|
| <b>T<sub>amb</sub> = 25 °C</b>            |                           |  |      |      |      |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0  | 1.6  | -    | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -    | 1.2  | 0.8  | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|   |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V   | 4.4  | 4.5  | -    | V    |
|   |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V  | 4.18 | 4.32 | -    | V    |
| V <sub>OL</sub>                           | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|   |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V  | -    | 0    | 0.1  | V    |
|   |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V   | -    | 0.15 | 0.26 | V    |
| I <sub>I</sub>                            | input leakage current     | V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 5.5 V                                | -    | -    | ±0.1 | μA   |
| I <sub>CC</sub>                           | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V          | -    | -    | 1.0  | μA   |
| ΔI <sub>CC</sub>                          | additional supply current | V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A | -    | -    | 300  | μA   |
| C <sub>I</sub>                            | input capacitance         |  | -    | 1.5  | -    | pF   |
| <b>T<sub>amb</sub> = -40 °C to +85 °C</b> |                           |  |      |      |      |      |
| V <sub>IH</sub>                           | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0  | -    | -    | V    |
| V <sub>IL</sub>                           | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -    | -    | 0.8  | V    |
| V <sub>OH</sub>                           | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|   |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V   | 4.4  | -    | -    | V    |
|   |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V  | 4.13 | -    | -    | V    |
| V <sub>OL</sub>                           | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |      |      |      |      |
|   |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V  | -    | -    | 0.1  | V    |
|   |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V   | -    | -    | 0.33 | V    |
| I <sub>I</sub>                            | input leakage current     | V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 5.5 V                                | -    | -    | ±1.0 | μA   |
| I <sub>CC</sub>                           | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V          | -    | -    | 10.0 | μA   |
| ΔI <sub>CC</sub>                          | additional supply current | V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A | -    | -    | 375  | μA   |

**Table 8. Static characteristics for 74HCT2G04 ...continued**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

| Symbol                                     | Parameter                 | Conditions   | Min | Typ | Max  | Unit |
|--|---------------------------|--|-----|-----|------|------|
| <b>T<sub>amb</sub> = -40 °C to +125 °C</b> |                           |  |     |     |      |      |
| V <sub>IH</sub>                            | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V   | 2.0 | -   | -    | V    |
| V <sub>IL</sub>                            | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V   | -   | -   | 0.8  | V    |
| V <sub>OH</sub>                            | HIGH-level output voltage | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |     |     |      |      |
|  |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V   | 4.4 | -   | -    | V    |
|  |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 4.5 V  | 3.7 | -   | -    | V    |
| V <sub>OL</sub>                            | LOW-level output voltage  | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>  |     |     |      |      |
|  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V  | -   | -   | 0.1  | V    |
|  |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 4.5 V   | -   | -   | 0.4  | V    |
| I <sub>I</sub>                             | input leakage current     | V <sub>I</sub> = GND or V <sub>CC</sub> ; V <sub>CC</sub> = 5.5 V                                | -   | -   | ±1.0 | μA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = GND or V <sub>CC</sub> ; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V          | -   | -   | 20.0 | μA   |
| ΔI <sub>CC</sub>                           | additional supply current | V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; V <sub>CC</sub> = 4.5 V to 5.5 V; I <sub>O</sub> = 0 A | -   | -   | 410  | μA   |

## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 6](#).

| Symbol          | Parameter                     | Conditions  | 25 °C |     |     | -40 °C to +125 °C |             |              | Unit |
|-----------------|-------------------------------|---|-------|-----|-----|-------------------|-------------|--------------|------|
|                 |                               |   | Min   | Typ | Max | Min               | Max (85 °C) | Max (125 °C) |      |
| <b>74HC2G04</b> |                               |   |       |     |     |                   |             |              |      |
| t <sub>pd</sub> | propagation delay             | nA to nY; see <a href="#">Figure 5</a> <a href="#">[1]</a>  |       |     |     |                   |             |              |      |
|                 |                               | V <sub>CC</sub> = 2.0 V; C <sub>L</sub> = 50 pF             | -     | 22  | 75  | -                 | 90          | 110          | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF             | -     | 8   | 15  | -                 | 18          | 22           | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V; C <sub>L</sub> = 50 pF             | -     | 6   | 13  | -                 | 16          | 20           | ns   |
| t <sub>t</sub>  | transition time               | nY; see <a href="#">Figure 5</a> <a href="#">[2]</a>        |       |     |     |                   |             |              |      |
|                 |                               | V <sub>CC</sub> = 2.0 V; C <sub>L</sub> = 50 pF             | -     | 18  | 75  | -                 | 95          | 125          | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF             | -     | 6   | 15  | -                 | 19          | 25           | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V; C <sub>L</sub> = 50 pF             | -     | 5   | 13  | -                 | 16          | 20           | ns   |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> <a href="#">[3]</a> | -     | 9   | -   | -                 | -           | -            | pF   |

**Table 9. Dynamic characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 6](#).

| Symbol           | Parameter                     | Conditions  | 25 °C |     |     | -40 °C to +125 °C |             |              | Unit |
|------------------|-------------------------------|---|-------|-----|-----|-------------------|-------------|--------------|------|
|                  |                               |   | Min   | Typ | Max | Min               | Max (85 °C) | Max (125 °C) |      |
| <b>74HCT2G04</b> |                               |   |       |     |     |                   |             |              |      |
| t <sub>pd</sub>  | propagation delay             | nA to nY; see <a href="#">Figure 5</a> <a href="#">[1]</a>          |       |     |     |                   |             |              |      |
|                  |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF                     | -     | 10  | 18  | -                 | 23          | 29           | ns   |
| t <sub>t</sub>   | transition time               | nY; see <a href="#">Figure 5</a> <a href="#">[2]</a>                |       |     |     |                   |             |              |      |
|                  |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF                     | -     | 6   | 15  | -                 | 19          | 22           | ns   |
| C <sub>PD</sub>  | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V <a href="#">[3]</a> | -     | 9   | -   | -                 | -           | -            | pF   |

[1] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[2] t<sub>t</sub> is the same as t<sub>TLH</sub> and t<sub>THL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

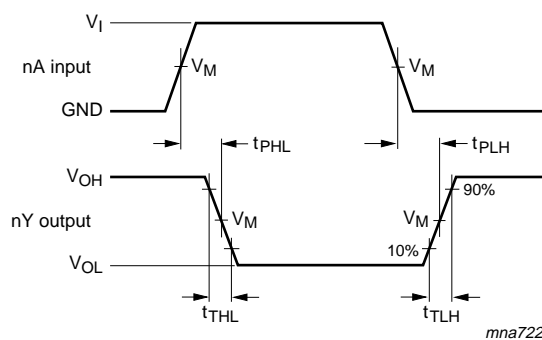
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

Σ(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of the outputs.

## 12. Waveforms



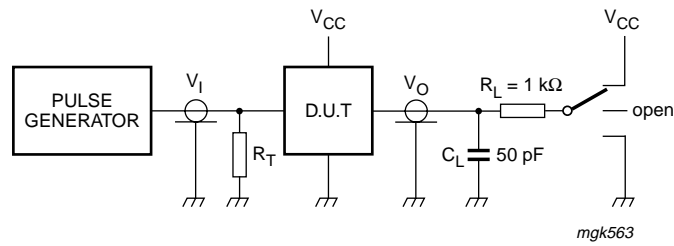
Measurement points are given in [Table 10](#).

V<sub>OL</sub> and V<sub>OH</sub> are typical voltage output drop that occur with the output load.

**Fig 5. The data input (nA) to output (nY) propagation delays and output transition times**

**Table 10. Measurement points**

| Type      | Input              |                        |                                 | Output             |
|-----------|--------------------|------------------------|---------------------------------|--------------------|
|           | V <sub>M</sub>     | V <sub>I</sub>         | t <sub>r</sub> = t <sub>f</sub> | V <sub>M</sub>     |
| 74HC2G04  | 0.5V <sub>CC</sub> | GND to V <sub>CC</sub> | 6.0 ns                          | 0.5V <sub>CC</sub> |
| 74HCT2G04 | 1.3 V              | GND to 3.0 V           | 6.0 ns                          | 1.3 V              |



Test data is given in [Table 11](#).

Definitions test circuit:

$R_L$  = Load resistance.

$C_L$  = Load capacitance including jig and probe capacitance.

$R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

**Fig 6. Load circuitry for switching times**

**Table 11. Test data**

| Type      | Input           |            | Test               |
|-----------|-----------------|------------|--------------------|
|           | $V_I$           | $t_r, t_f$ | $t_{PHL}, t_{PLH}$ |
| 74HC2G04  | GND to $V_{CC}$ | 6 ns       | open               |
| 74HCT2G04 | GND to 3.0 V    | 6 ns       | open               |

13. Package outline

Plastic surface-mounted package; 6 leads

SOT363

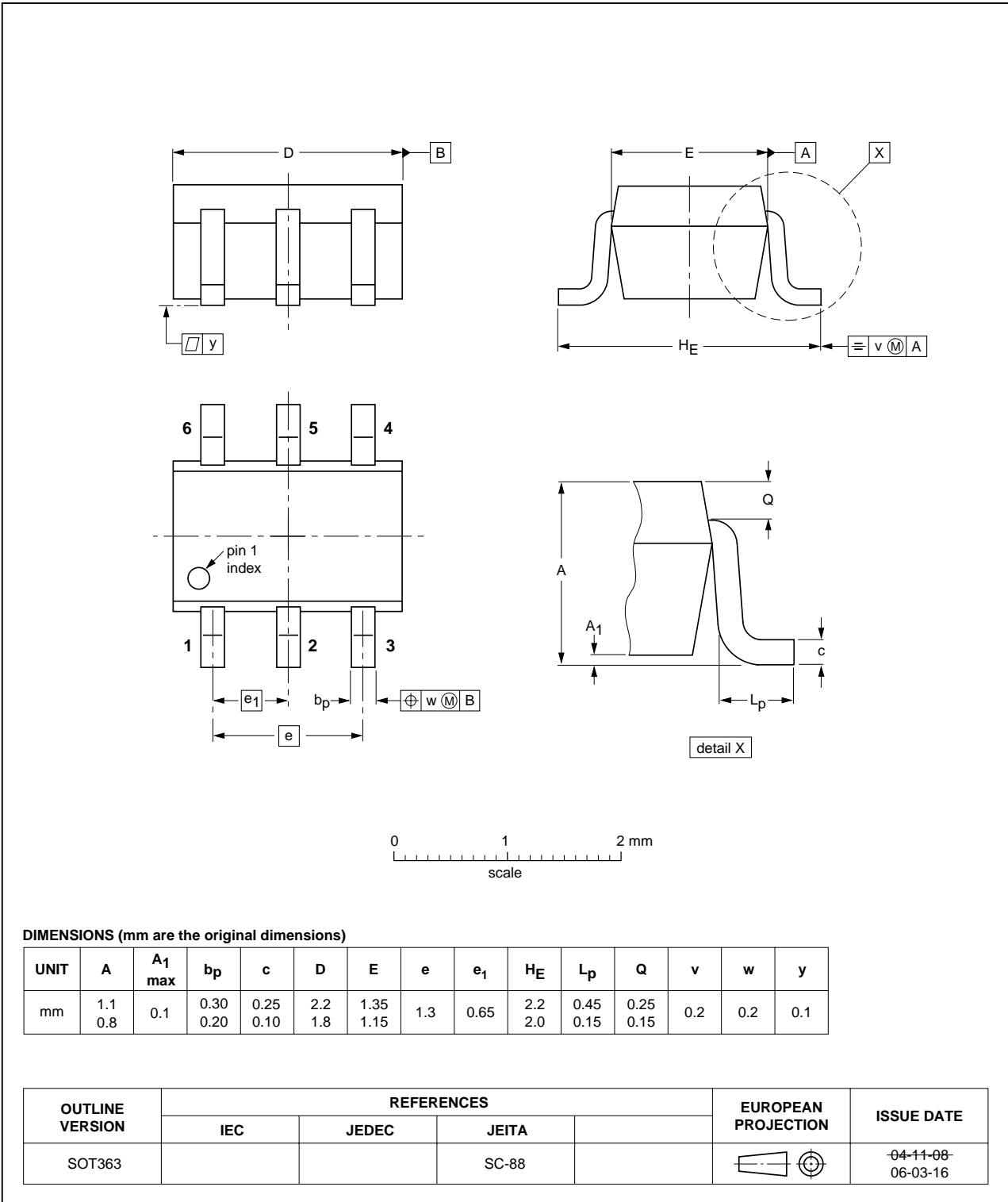


Fig 7. Package outline SOT363 (SC-88)

Plastic surface-mounted package (TSOP6); 6 leads

SOT457

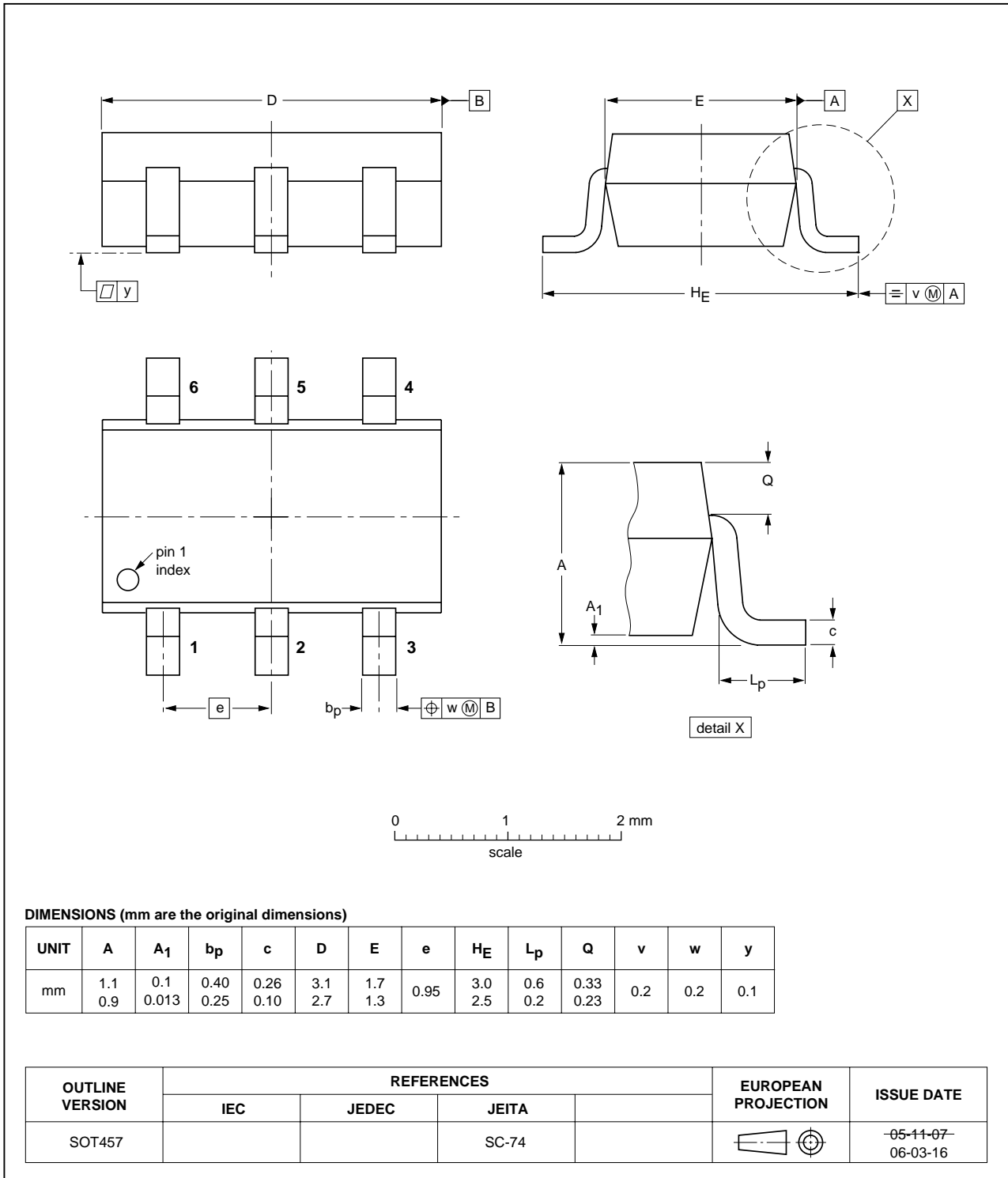


Fig 8. Package outline SOT457 (SC-74)

## 14. Abbreviations

Table 12. Abbreviations

| Acronym | Description                             |
|---------|---|
| CMOS    | Complementary Metal Oxide Semiconductor |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |
| DUT     | Device Under Test                       |

## 15. Revision history

Table 13. Revision history

| Document ID    | Release date | Data sheet status  | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|------------|
| 74HC_HCT2G04_1 | 20061115     | Product data sheet | -             | -          |

## 16. Legal information

### 16.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition  |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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