

# 74HC1G04-Q100; 74HCT1G04-Q100

## Inverter

Rev. 3 — 17 November 2023

Product data sheet

## 1. General description

The 74HC1G04-Q100; 74HCT1G04-Q100 is a single inverter. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ .

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
  - For 74HC1G04-Q100: CMOS level
  - For 74HCT1G04-Q100: TTL level
- Symmetrical output impedance
- High noise immunity
- CMOS low power dissipation
- Balanced propagation delays
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V

## 3. Ordering information

Table 1. Ordering information

| Type number                      | Package           |        |                                                                        |                          |
|----------------------------------|-------------------|--------|------------------------------------------------------------------------|--------------------------|
|                                  | Temperature range | Name   | Description                                                            | Version                  |
| <a href="#">74HC1G04GW-Q100</a>  | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | <a href="#">SOT353-1</a> |
| <a href="#">74HCT1G04GW-Q100</a> |                   |        |                                                                        |                          |
| <a href="#">74HC1G04GV-Q100</a>  | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads                               | <a href="#">SOT753</a>   |
| <a href="#">74HCT1G04GV-Q100</a> |                   |        |                                                                        |                          |

4. Marking

Table 2. Marking codes

| Type number      | Marking <sup>[1]</sup> |
|------------------|------------------------|
| 74HC1G04GW-Q100  | HC                     |
| 74HCT1G04GW-Q100 | TC                     |
| 74HC1G04GV-Q100  | H04                    |
| 74HCT1G04GV-Q100 | T04                    |

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

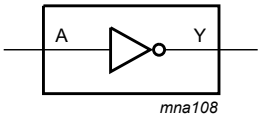


Fig. 1. Logic symbol

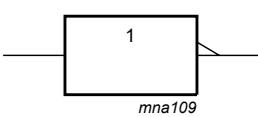


Fig. 2. IEC logic symbol

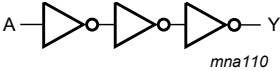
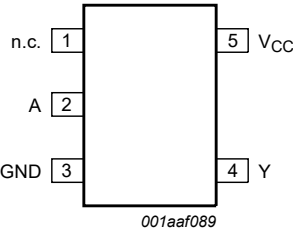


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

74HC1G04  
74HCT1G04



001aaf089

Fig. 4. Pin configuration for SOT353-1 (TSSOP5) and SOT753 (SC-74A)

6.2. Pin description

Table 3. Pin description

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| n.c.            | 1   | not connected  |
| A               | 2   | data input     |
| GND             | 3   | ground (0 V)   |
| Y               | 4   | data output    |
| V <sub>CC</sub> | 5   | supply voltage |

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

| Input | Output |
|-------|--------|
| A     | Y      |
| L     | H      |
| H     | L      |

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 <sub>CC</sub>  | supply voltage          |                                                                         | -0.5 | +7.0  | V    |
| I <sub>IK</sub>  | input clamping current  | V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V [1] | -    | ±20   | mA   |
| I <sub>OK</sub>  | output clamping current | V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V [1] | -    | ±20   | mA   |
| I <sub>O</sub>   | output current          | -0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V [1]                   | -    | ±12.5 | mA   |
| I <sub>CC</sub>  | supply current          | [1]                                                                     | -    | 25    | mA   |
| I <sub>GND</sub> | ground current          |                                                                         | -25  | -     | mA   |
| T <sub>stg</sub> | storage temperature     |                                                                         | -65  | +150  | °C   |
| P <sub>tot</sub> | total power dissipation | T <sub>amb</sub> = -40 °C to +125 °C [2]                                | -    | 250   | mW   |

- [1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- [2] For SOT353-1 (TSSOP5) package: P<sub>tot</sub> derates linearly with 3.3 mW/K above 74 °C.  
For SOT753 (SC-74A) package: P<sub>tot</sub> derates linearly with 3.8 mW/K above 85 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol           | Parameter                           | Conditions              | 74HC1G04-Q100 |     |                 | 74HCT1G04-Q100 |     |                 | Unit |
|------------------|-------------------------------------|-------------------------|---------------|-----|-----------------|----------------|-----|-----------------|------|
|                  |                                     |                         | Min           | Typ | Max             | Min            | Typ | Max             |      |
| V <sub>CC</sub>  | supply voltage                      |                         | 2.0           | 5.0 | 6.0             | 4.5            | 5.0 | 5.5             | V    |
| V <sub>I</sub>   | input voltage                       |                         | 0             | -   | V <sub>CC</sub> | 0              | -   | V <sub>CC</sub> | V    |
| V <sub>O</sub>   | output voltage                      |                         | 0             | -   | V <sub>CC</sub> | 0              | -   | V <sub>CC</sub> | V    |
| T <sub>amb</sub> | ambient temperature                 |                         | -40           | +25 | +125            | -40            | +25 | +125            | °C   |
| Δt/ΔV            | input transition rise and fall rate | V <sub>CC</sub> = 2.0 V | -             | -   | 625             | -              | -   | -               | ns/V |
|                  |                                     | V <sub>CC</sub> = 4.5 V | -             | -   | 139             | -              | -   | 139             | ns/V |
|                  |                                     | V <sub>CC</sub> = 6.0 V | -             | -   | 83              | -              | -   | -               | ns/V |

## 10. Static characteristics

**Table 7. Static characteristics**

Voltages are referenced to GND (ground = 0 V). All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

| Symbol           | Parameter                 | Conditions                                                                                                  | -40 °C to +85 °C |      |      | -40 °C to +125 °C |      | Unit |
|------------------|---------------------------|-------------------------------------------------------------------------------------------------------------|------------------|------|------|-------------------|------|------|
|                  |                           |                                                                                                             | Min              | Typ  | Max  | Min               | Max  |      |
| 74HC1G04-Q100    |                           |                                                                                                             |                  |      |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 2.0 V                                                                                     | 1.5              | 1.2  | -    | 1.5               | -    | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                                     | 3.15             | 2.4  | -    | 3.15              | -    | V    |
|                  |                           | V <sub>CC</sub> = 6.0 V                                                                                     | 4.2              | 3.2  | -    | 4.2               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 2.0 V                                                                                     | -                | 0.8  | 0.5  | -                 | 0.5  | V    |
|                  |                           | V <sub>CC</sub> = 4.5 V                                                                                     | -                | 2.1  | 1.35 | -                 | 1.35 | V    |
|                  |                           | V <sub>CC</sub> = 6.0 V                                                                                     | -                | 2.8  | 1.8  | -                 | 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              | 2.0  | -    | 1.9               | -    | V    |
|                  |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V                                                            | 4.4              | 4.5  | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V                                                            | 5.9              | 6.0  | -    | 5.9               | -    | V    |
|                  |                           | I <sub>O</sub> = -2.0 mA; V <sub>CC</sub> = 4.5 V                                                           | 4.13             | 4.32 | -    | 3.7               | -    | V    |
|                  |                           | I <sub>O</sub> = -2.6 mA; V <sub>CC</sub> = 6.0 V                                                           | 5.63             | 5.81 | -    | 5.2               | -    | 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    | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V                                                             | -                | 0    | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V                                                             | -                | 0    | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 2.0 mA; V <sub>CC</sub> = 4.5 V                                                            | -                | 0.15 | 0.33 | -                 | 0.4  | V    |
|                  |                           | I <sub>O</sub> = 2.6 mA; V <sub>CC</sub> = 6.0 V                                                            | -                | 0.16 | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V                                            | -                | -    | 1.0  | -                 | 1.0  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 6.0 V                      | -                | -    | 10   | -                 | 20   | μA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                             | -                | 1.5  | -    | -                 | -    | pF   |
| 74HCT1G04-Q100   |                           |                                                                                                             |                  |      |      |                   |      |      |
| V <sub>IH</sub>  | HIGH-level input voltage  | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                            | 2.0              | 1.6  | -    | 2.0               | -    | V    |
| V <sub>IL</sub>  | LOW-level input voltage   | V <sub>CC</sub> = 4.5 V to 5.5 V                                                                            | -                | 1.2  | 0.8  | -                 | 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  | -    | 4.4               | -    | V    |
|                  |                           | I <sub>O</sub> = -2.0 mA; V <sub>CC</sub> = 4.5 V                                                           | 4.13             | 4.32 | -    | 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    | 0.1  | -                 | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 2.0 mA; V <sub>CC</sub> = 4.5 V                                                            | -                | 0.15 | 0.33 | -                 | 0.4  | V    |
| I <sub>I</sub>   | input leakage current     | V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V                                            | -                | -    | 1.0  | -                 | 1.0  | μA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V                      | -                | -    | 10   | -                 | 20   | μA   |
| ΔI <sub>CC</sub> | additional supply current | per input; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A | -                | -    | 500  | -                 | 850  | μA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                             | -                | 1.5  | -    | -                 | -    | pF   |

## 11. Dynamic characteristics

**Table 8. Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f \leq 6.0\text{ ns}$ ; All typical values are measured at  $T_{amb} = 25\text{ °C}$ . For test circuit, see Fig. 6.

| Symbol          | Parameter                     | Conditions                                          | -40 °C to +85 °C |     |     | -40 °C to +125 °C |     | Unit |
|-----------------|-------------------------------|-----------------------------------------------------|------------------|-----|-----|-------------------|-----|------|
|                 |                               |                                                     | Min              | Typ | Max | Min               | Max |      |
| 74HC1G04-Q100   |                               |                                                     |                  |     |     |                   |     |      |
| t <sub>pd</sub> | propagation delay             | A to Y; see <a href="#">Fig. 5</a> [1]              |                  |     |     |                   |     |      |
|                 |                               | V <sub>CC</sub> = 2.0 V; C <sub>L</sub> = 50 pF     | -                | 25  | 105 | -                 | 135 | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF     | -                | 9   | 21  | -                 | 27  | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF     | -                | 7   | -   | -                 | -   | ns   |
|                 |                               | V <sub>CC</sub> = 6.0 V; C <sub>L</sub> = 50 pF     | -                | 8   | 18  | -                 | 23  | ns   |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> [2]         | -                | 16  | -   | -                 | -   | pF   |
| 74HCT1G04-Q100  |                               |                                                     |                  |     |     |                   |     |      |
| t <sub>pd</sub> | propagation delay             | A to Y; see <a href="#">Fig. 5</a> [1]              |                  |     |     |                   |     |      |
|                 |                               | V <sub>CC</sub> = 4.5 V; C <sub>L</sub> = 50 pF     | -                | 10  | 24  | -                 | 27  | ns   |
|                 |                               | V <sub>CC</sub> = 5.0 V; C <sub>L</sub> = 15 pF     | -                | 8   | -   | -                 | -   | ns   |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> - 1.5 V [2] | -                | 18  | -   | -                 | -   | pF   |

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[2]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz

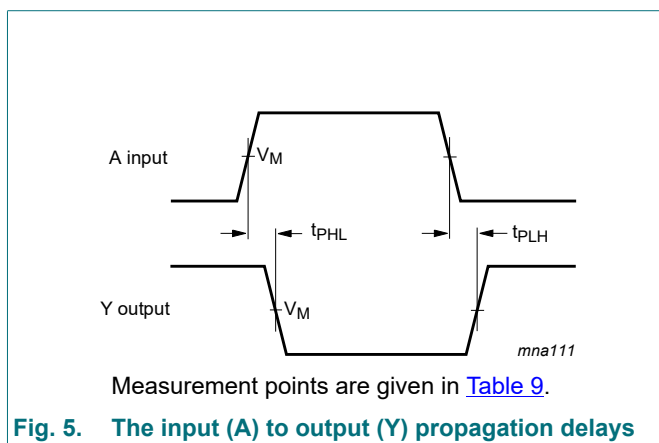
$f_o$  = output frequency in MHz

$C_L$  = output load capacitance in pF

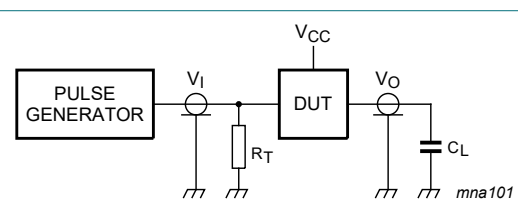
$V_{CC}$  = supply voltage in V

$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

### 11.1. Waveforms and test circuit



**Fig. 5. The input (A) to output (Y) propagation delays**



Test data is given in Table 8.

Definitions for test circuit:

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

$C_L$  = Load capacitance including jig and probe capacitance

**Fig. 6. Test circuit for measuring switching times**

**Table 9. Measurement points**

| Type           | $V_I$           | $V_M$               |
|----------------|-----------------|---------------------|
| 74HC1G04-Q100  | GND to $V_{CC}$ | $0.5 \times V_{CC}$ |
| 74HCT1G04-Q100 | GND to 3.0 V    | 1.3 V               |

12. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

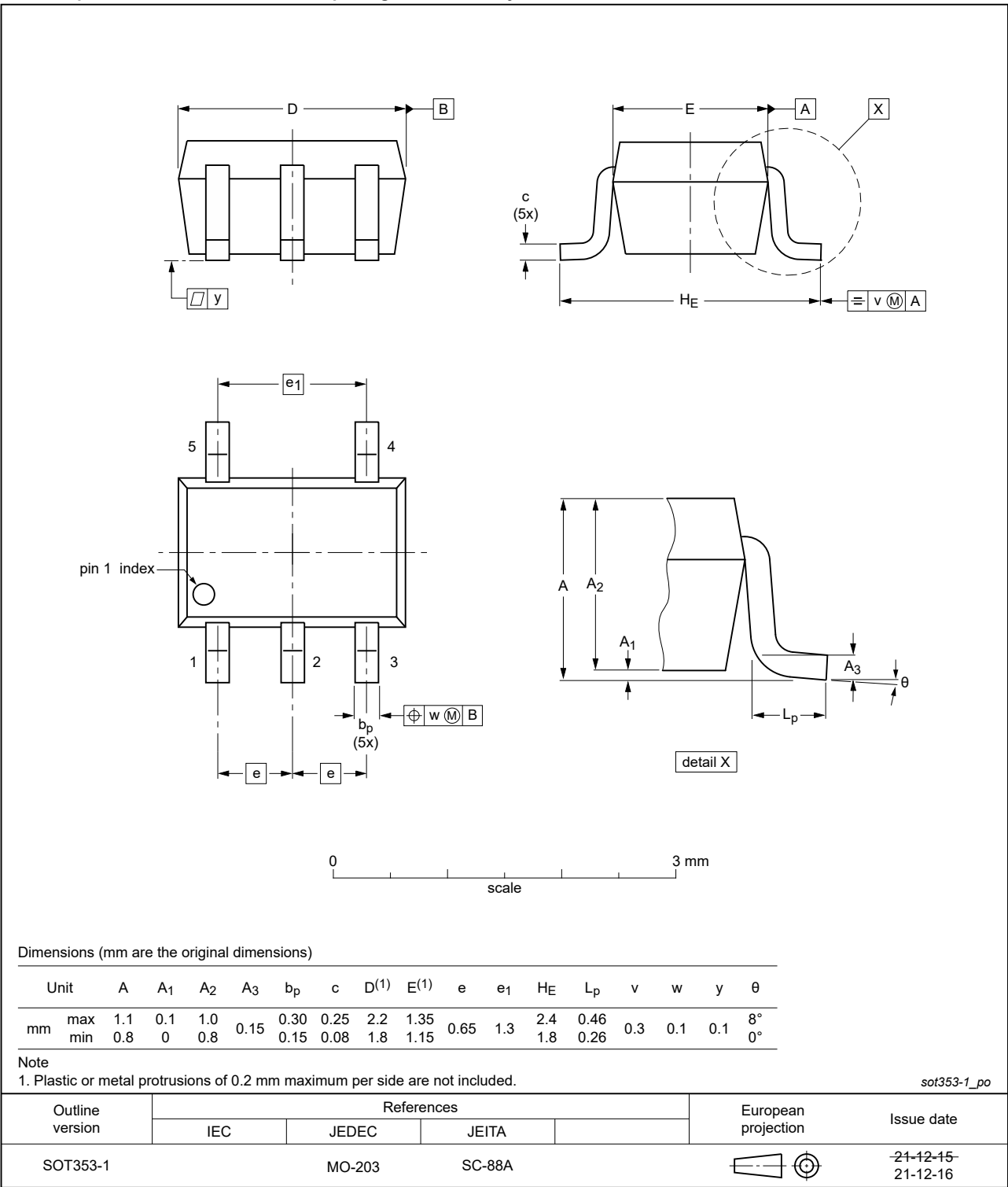


Fig. 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

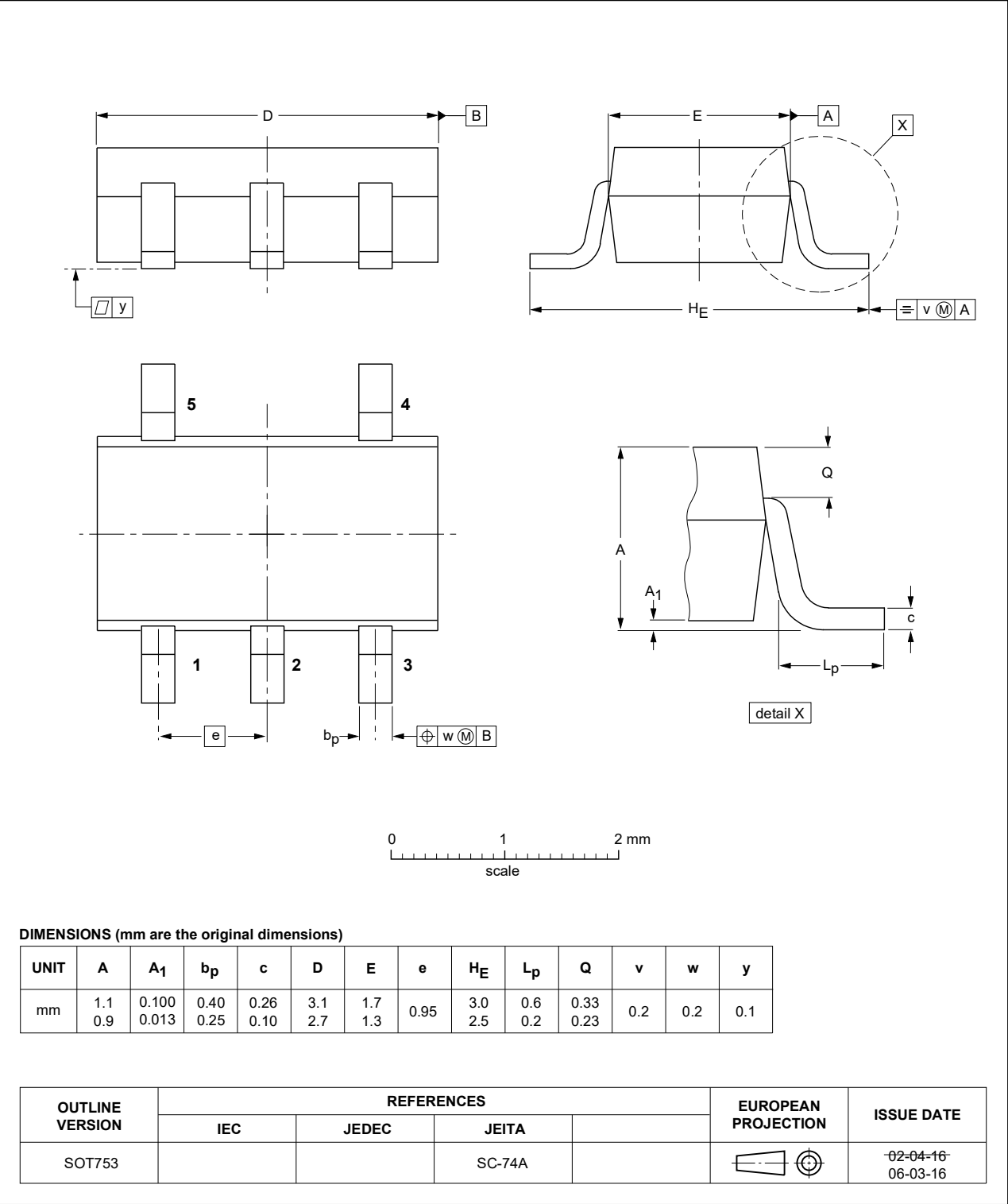


Fig. 8. Package outline SOT753 (SC-74A)

### 13. Abbreviations

Table 10. Abbreviations

| Acronym | Description                             |
|---------|-----------------------------------------|
| CDM     | Charged Device Model                    |
| CMOS    | Complementary Metal Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| TTL     | Transistor-Transistor Logic             |

### 14. Revision history

Table 11. Revision history

| Document ID           | Release date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Data sheet status  | Change notice | Supersedes            |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------|-----------------------|
| 74HC_HCT1G04_Q100 v.3 | 20231117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74HC_HCT1G04_Q100 v.2 |
| Modifications         | <ul style="list-style-type: none"><li>• <a href="#">Section 2</a>: ESD specification updated according to the latest JEDEC standard.</li></ul>                                                                                                                                                                                                                                                                                                                                                                         |                    |               |                       |
| 74HC_HCT1G04_Q100 v.2 | 20220121                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | 74HC_HCT1G04_Q100 v.1 |
| Modifications         | <ul style="list-style-type: none"><li>• The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li><li>• Legal texts have been adapted to the new company name where appropriate.</li><li>• <a href="#">Section 1</a> and <a href="#">Section 2</a> updated.</li><li>• <a href="#">Table 5</a>: Derating values for P<sub>tot</sub> total power dissipation updated.</li><li>• <a href="#">Fig. 7</a>: Package outline drawing SOT353-1 (TSSOP5) has changed.</li></ul> |                    |               |                       |
| 74HC_HCT1G04_Q100 v.1 | 20130925                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Product data sheet | -             | -                     |

## 15. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | 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 <https://www.nexperia.com>.

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Date of release: 17 November 2023