

74HC1G04; 74HCT1G04

Inverter

Rev. 6 — 21 January 2022

Product data sheet

1. General description

The 74HC1G04; 74HCT1G04 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} .

2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Input levels:
 - For 74HC1G04: CMOS level
 - For 74HCT1G04: 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 JESD22-A114E exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

3. Ordering information

Table 1. Ordering information

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

4. Marking

Table 2. Marking codes

| Type number | Marking ^[1] |
|-------------|------------------------|
| 74HC1G04GW | HC |
| 74HCT1G04GW | TC |
| 74HC1G04GV | H04 |
| 74HCT1G04GV | T04 |

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

5. Functional diagram

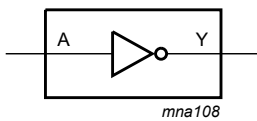


Fig. 1. Logic symbol

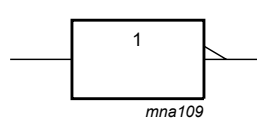


Fig. 2. IEC logic symbol

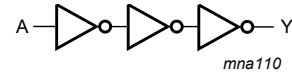


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

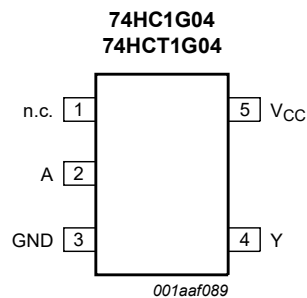


Fig. 4. Pin configuration for SOT353-1 (TSSOP5) and SOT753 (SC-74A)

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 _{CC} | 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_{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 | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ [1] | - | ± 12.5 | mA |
| I_{CC} | supply current | [1] | - | 25 | mA |
| I_{GND} | ground current | | -25 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [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_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT753 (SC-74A) package: P_{tot} 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 | | | 74HCT1G04 | | | Unit |
|---------------------|-------------------------------------|-------------------------|----------|-----|----------|-----------|-----|----------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 6.0 | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | V_{CC} | 0 | - | V_{CC} | V |
| V_O | output voltage | | 0 | - | V_{CC} | 0 | - | V_{CC} | V |
| T_{amb} | ambient temperature | | -40 | +25 | +125 | -40 | +25 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 2.0\text{ V}$ | - | - | 625 | - | - | - | ns/V |
| | | $V_{CC} = 4.5\text{ V}$ | - | - | 139 | - | - | 139 | ns/V |
| | | $V_{CC} = 6.0\text{ V}$ | - | - | 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 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | 1.2 | - | 1.5 | - | V |
| | | V _{CC} = 4.5 V | 3.15 | 2.4 | - | 3.15 | - | V |
| | | V _{CC} = 6.0 V | 4.2 | 3.2 | - | 4.2 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | 0.8 | 0.5 | - | 0.5 | V |
| | | V _{CC} = 4.5 V | - | 2.1 | 1.35 | - | 1.35 | V |
| | | V _{CC} = 6.0 V | - | 2.8 | 1.8 | - | 1.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = -20 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | V |
| | | I _O = -20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | V |
| | | I _O = -20 μA; V _{CC} = 6.0 V | 5.9 | 6.0 | - | 5.9 | - | V |
| | | I _O = -2.0 mA; V _{CC} = 4.5 V | 4.13 | 4.32 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = 20 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | V |
| | | I _O = 20 μA; V _{CC} = 6.0 V | - | 0 | 0.1 | - | 0.1 | V |
| | | I _O = 2.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 6.0 V | - | - | 1.0 | - | 1.0 | μA |
| | | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 10 | - | 20 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 6.0 V | - | - | 10 | - | 20 | μA |
| C _I | input capacitance | | - | 1.5 | - | - | - | pF |
| 74HCT1G04 | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = -20 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | V |
| | | I _O = -2.0 mA; V _{CC} = 4.5 V | 4.13 | 4.32 | - | 3.7 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | |
| | | I _O = 20 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | V |
| | | I _O = 2.0 mA; V _{CC} = 4.5 V | - | 0.15 | 0.33 | - | 0.4 | V |
| I _I | input leakage current | V _I = V _{CC} or GND; V _{CC} = 5.5 V | - | - | 1.0 | - | 1.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 10 | - | 20 | μA |
| ΔI _{CC} | additional supply current | per input; V _{CC} = 4.5 V to 5.5 V; V _I = V _{CC} - 2.1 V; I _O = 0 A | - | - | 500 | - | 850 | μA |
| C _I | 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 $T_{amb} = 25\text{ }^\circ\text{C}$. 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 | | | | | | | | |
| t_{pd} | propagation delay | A to Y; see Fig. 5 [1] | | | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $C_L = 50\text{ pF}$ | - | 25 | 105 | - | 135 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $C_L = 50\text{ pF}$ | - | 9 | 21 | - | 27 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$ | - | 7 | - | - | - | ns |
| | | $V_{CC} = 6.0\text{ V}$; $C_L = 50\text{ pF}$ | - | 8 | 18 | - | 23 | ns |
| C_{PD} | power dissipation capacitance | $V_I = GND\text{ to }V_{CC}$ [2] | - | 16 | - | - | - | pF |
| 74HCT1G04 | | | | | | | | |
| t_{pd} | propagation delay | A to Y; see Fig. 5 [1] | | | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $C_L = 50\text{ pF}$ | - | 10 | 24 | - | 27 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$ | - | 8 | - | - | - | ns |
| C_{PD} | power dissipation capacitance | $V_I = GND\text{ to }V_{CC} - 1.5\text{ V}$ [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 (μW).

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

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

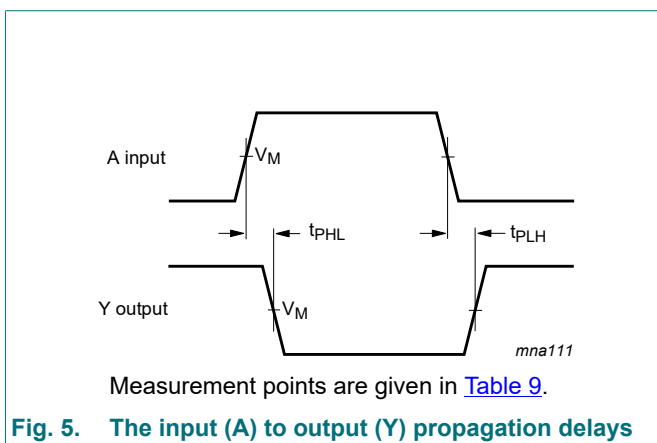


Fig. 5. The input (A) to output (Y) propagation delays

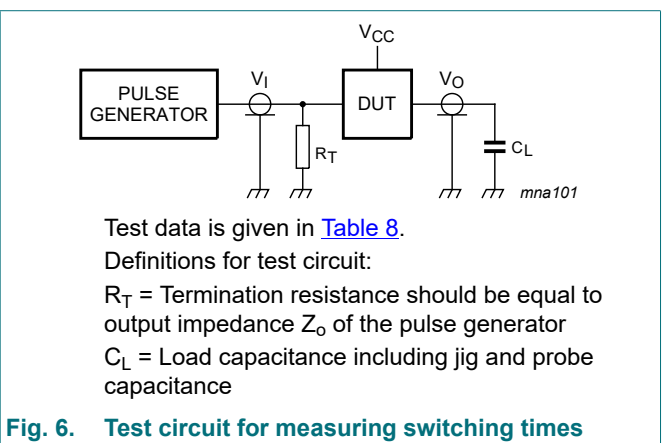


Fig. 6. Test circuit for measuring switching times

Table 9. Measurement points

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

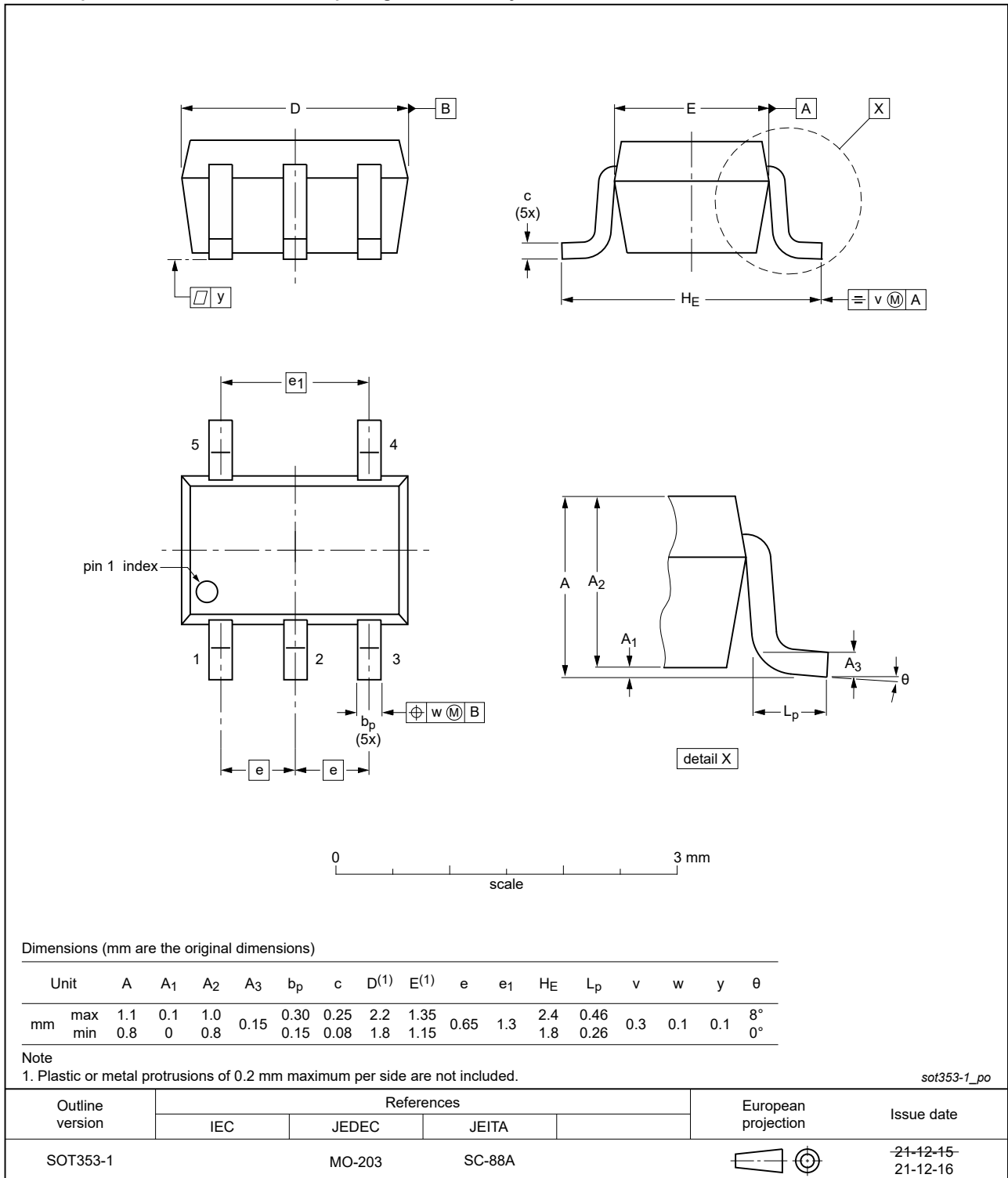


Fig. 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

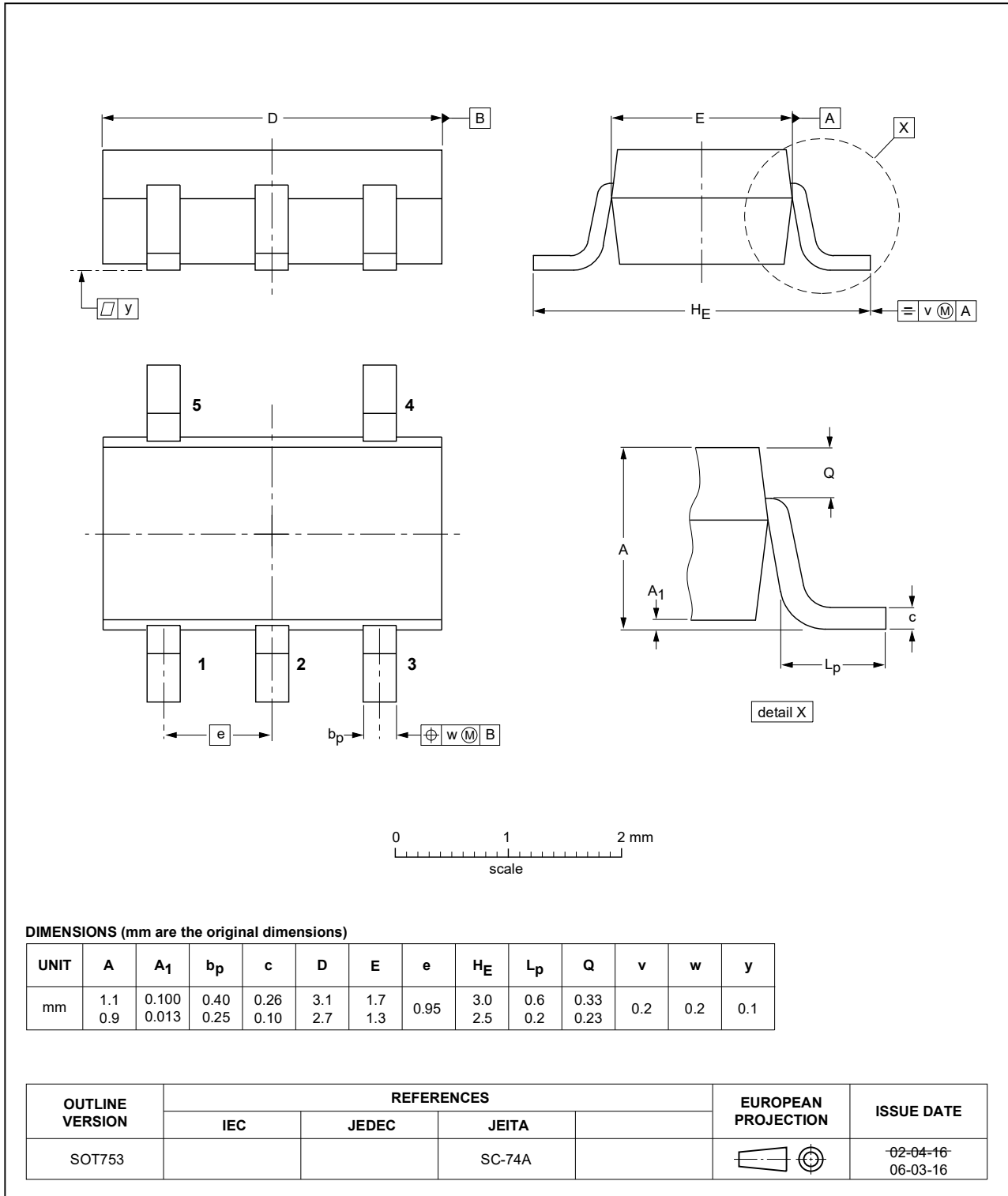


Fig. 8. Package outline SOT753 (SC-74A)

13. Abbreviations

Table 10. Abbreviations

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

14. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|------------------|---|---------------------------|---------------|------------------|
| 74HC_HCT1G04 v.6 | 20220121 | Product data sheet | - | 74HC_HCT1G04 v.5 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Section 1 and Section 2 updated. Table 5: Derating values for P_{tot} total power dissipation updated. Fig. 7: Package outline drawing SOT353-1 (TSSOP5) has changed. | | | |
| 74HC_HCT1G04 v.5 | 20130925 | Product data sheet | - | 74HC_HCT1G04 v.4 |
| Modifications: | <ul style="list-style-type: none"> Section 1 updated. | | | |
| 74HC_HCT1G04 v.4 | 20070716 | Product data sheet | - | 74HC_HCT1G04 v.3 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. Legal texts have been adapted to the new company name where appropriate. Package SOT353 changed to SOT353-1 in Table 1 and Fig. 7. Quick Reference Data and Soldering sections removed. Section 2 updated. | | | |
| 74HC_HCT1G04 v.3 | 20020517 | Product specification | - | 74HC_HCT1G04 v.2 |
| 74HC_HCT1G04 v.2 | 20010302 | Product specification | - | 74HC_HCT1G04 v.1 |
| 74HC_HCT1G04 v.1 | 19980831 | Preliminary specification | - | - |

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. |
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