



**THE DATASHEET OF
74HC1G02GW,125**



74HC1G02; 74HCT1G02

2-input NOR gate

Rev. 04 — 11 July 2007

Product data sheet

1. General description

74HC1G02 and 74HCT1G02 are high speed Si-gate CMOS devices. They provide a 2-input NOR function.

The HC device has CMOS input switching levels and supply voltage range 2 V to 6 V.

The HCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

The standard output currents are half those of the 74HC02 and 74HCT02.

2. Features

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- SOT353-1 and SOT753 package options

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|---------------------------|-------------------|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74HC1G02GW 74HCT1G02GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74HC1G02GV 74HCT1G02GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |

4. Marking

Table 2. Marking codes

| Type number | Marking |
|-------------|---------|
| 74HC1G02GW | HB |
| 74HCT1G02GW | TB |
| 74HC1G02GV | H02 |
| 74HCT1G02GV | T02 |

5. Functional diagram

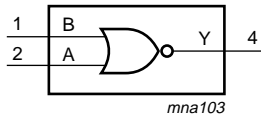


Fig 1. Logic symbol

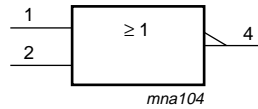


Fig 2. IEC logic symbol

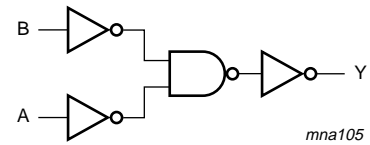


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

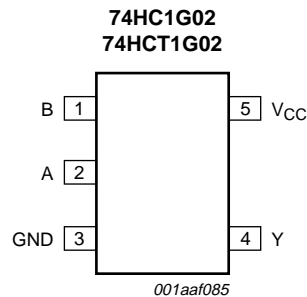


Fig 4. Pin configuration

6.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|-----------------|-----|----------------|
| B | 1 | data input |
| 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

| Inputs | | Output |
|--------|---|--------|
| A | B | Y |
| L | L | H |
| L | H | L |
| H | L | 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). [\[1\]](#)

| 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 $V_I > V_{CC} + 0.5\text{ V}$ | - | ± 20 | mA |
| I_{OK} | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | - | ± 20 | mA |
| I_O | output current | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ | - | ± 12.5 | mA |
| I_{CC} | supply current | | - | 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] - | 200 | mW |

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

[2] Above 55 °C the value of P_{tot} derates linearly with 2.5 mW/K.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

| Symbol | Parameter | Conditions | 74HC1G02 | | | 74HCT1G02 | | | 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 $T_{amb} = 25\text{ °C}$.

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|--------------------------|--------------------------|-------------------------|------------------|-----|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | |
| For type 74HC1G02 | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 2.0\text{ V}$ | 1.5 | 1.2 | - | 1.5 | - | V |
| | | $V_{CC} = 4.5\text{ V}$ | 3.15 | 2.4 | - | 3.15 | - | V |
| | | $V_{CC} = 6.0\text{ V}$ | 4.2 | 3.2 | - | 4.2 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 2.0\text{ V}$ | - | 0.8 | 0.5 | - | 0.5 | V |
| | | $V_{CC} = 4.5\text{ V}$ | - | 2.1 | 1.35 | - | 1.35 | V |
| | | $V_{CC} = 6.0\text{ V}$ | - | 2.8 | 1.8 | - | 1.8 | V |

Table 7. Static characteristics ...continued

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 | |
| 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 | - | 1.9 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | V |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | 5.9 | 6.0 | - | 5.9 | - | V |
| | | $I_O = -2.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | 4.13 | 4.32 | - | 3.7 | - | V |
| | | $I_O = -2.6\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | 5.63 | 5.81 | - | 5.2 | - | 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 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | V |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 6.0\text{ V}$ | - | 0 | 0.1 | - | 0.1 | V |
| | | $I_O = 2.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | 0.15 | 0.33 | - | 0.4 | V |
| | | $I_O = 2.6\text{ mA}$; $V_{CC} = 6.0\text{ V}$ | - | 0.16 | 0.33 | - | 0.4 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 6.0\text{ V}$ | - | - | 1.0 | - | 1.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 6.0\text{ V}$ | - | - | 10 | - | 20 | μA |
| C_I | input capacitance | | - | 1.5 | - | - | - | pF |
| For type 74HCT1G02 | | | | | | | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 4.5\text{ V}$ to 5.5 V | 2.0 | 1.6 | - | 2.0 | - | V |
| V_{IL} | LOW-level input voltage | $V_{CC} = 4.5\text{ V}$ to 5.5 V | - | 1.2 | 0.8 | - | 0.8 | V |
| V_{OH} | HIGH-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | |
| | | $I_O = -20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | 4.4 | 4.5 | - | 4.4 | - | V |
| | | $I_O = -2.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | 4.13 | 4.32 | - | 3.7 | - | V |
| V_{OL} | LOW-level output voltage | $V_I = V_{IH}$ or V_{IL} | | | | | | |
| | | $I_O = 20\text{ }\mu\text{A}$; $V_{CC} = 4.5\text{ V}$ | - | 0 | 0.1 | - | 0.1 | V |
| | | $I_O = 2.0\text{ mA}$; $V_{CC} = 4.5\text{ V}$ | - | 0.15 | 0.33 | - | 0.4 | V |
| I_I | input leakage current | $V_I = V_{CC}$ or GND; $V_{CC} = 5.5\text{ V}$ | - | - | 1.0 | - | 1.0 | μA |
| I_{CC} | supply current | $V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$; $V_{CC} = 5.5\text{ V}$ | - | - | 10 | - | 20 | μA |
| ΔI_{CC} | additional supply current | per input; $V_{CC} = 4.5\text{ V}$ to 5.5 V ; $V_I = V_{CC} - 2.1\text{ V}$; $I_O = 0\text{ A}$ | - | - | 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 [Figure 6](#)

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---------------------------|-------------------------------|--|------------------|-----|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | |
| For type 74HC1G02 | | | | | | | | |
| t_{pd} | propagation delay | A and B to Y; see Figure 5 | [1] | | | | | |
| | | $V_{CC} = 2.0\text{ V}$; $C_L = 50\text{ pF}$ | - | 25 | 115 | - | 135 | ns |
| | | $V_{CC} = 4.5\text{ V}$; $C_L = 50\text{ pF}$ | - | 9 | 23 | - | 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 | 20 | - | 23 | ns |
| C_{PD} | power dissipation capacitance | $V_I = GND\text{ to }V_{CC}$ | [2] | 18 | - | - | - | pF |
| For type 74HCT1G02 | | | | | | | | |
| t_{pd} | propagation delay | A and B to Y; see Figure 5 | [1] | | | | | |
| | | $V_{CC} = 4.5\text{ V}$; $C_L = 50\text{ pF}$ | - | 11 | 24 | - | 27 | ns |
| | | $V_{CC} = 5.0\text{ V}$; $C_L = 15\text{ pF}$ | - | 9 | - | - | - | ns |
| C_{PD} | power dissipation capacitance | $V_I = GND\text{ to }V_{CC} - 1.5\text{ V}$ | [2] | 19 | - | - | - | 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).

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

f_i = input frequency in MHz

f_o = output frequency in MHz

C_L = output load capacitance in pF

V_{CC} = supply voltage in Volts

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

12. Waveforms

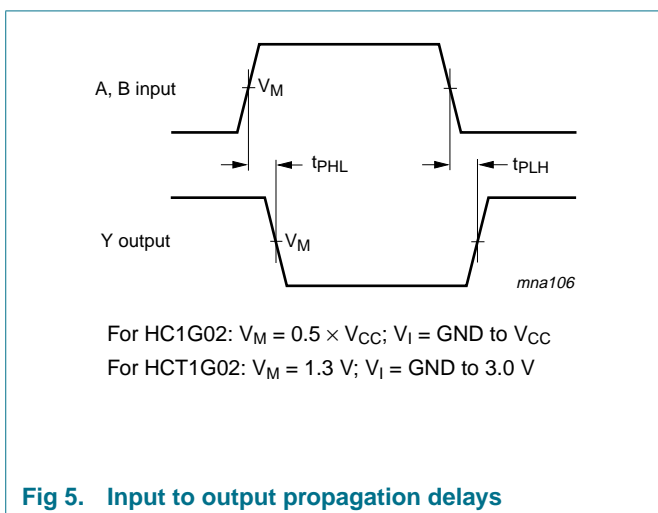


Fig 5. Input to output propagation delays

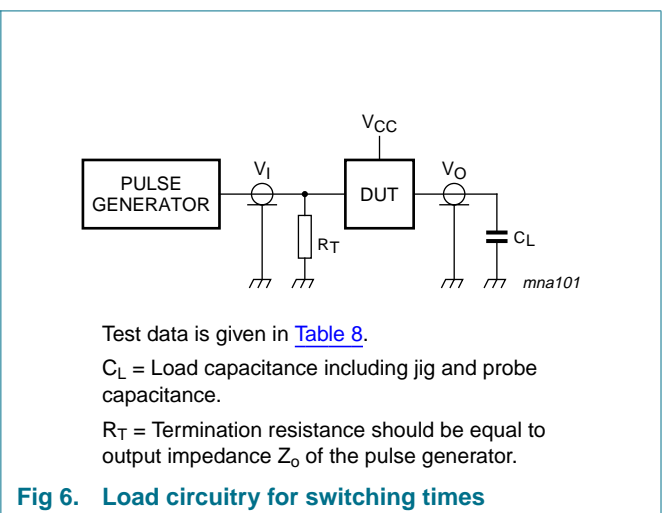


Fig 6. Load circuitry for switching times

13. Package outline

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

SOT353-1

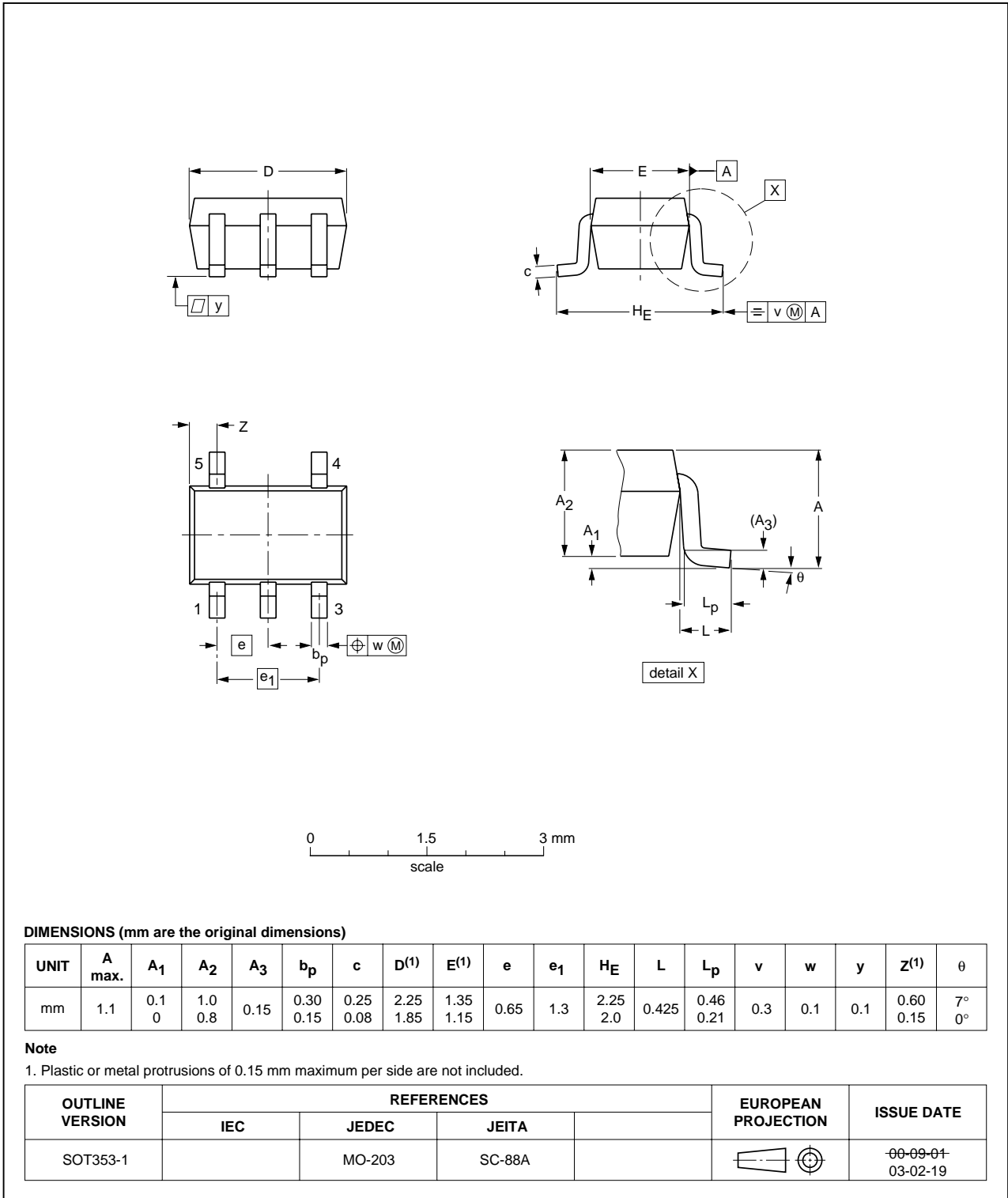


Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

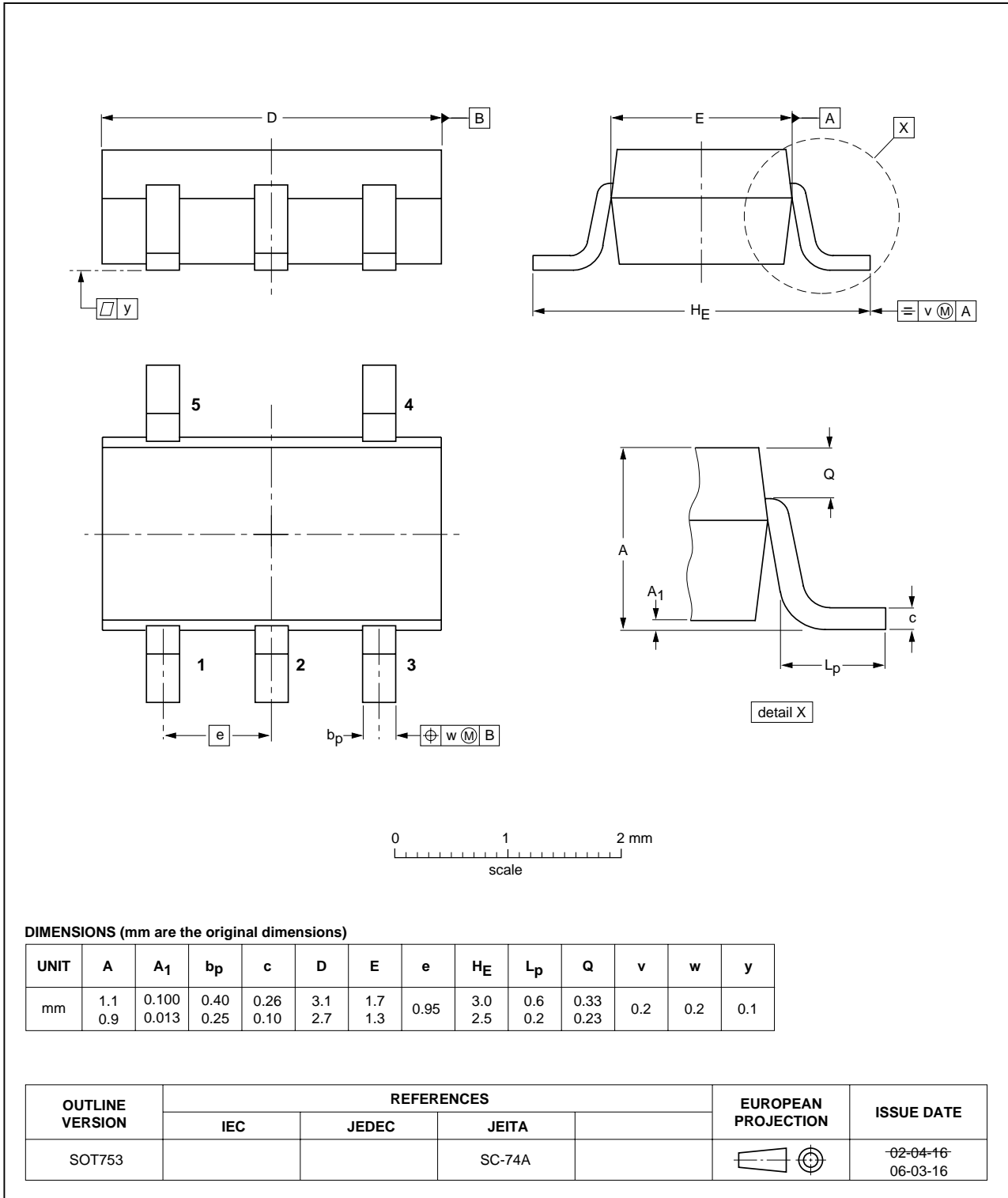


Fig 8. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 9. Abbreviations

| Acronym | Description |
|---------|-----------------------------|
| DUT | Device Under Test |
| TTL | Transistor-Transistor Logic |

15. Revision history

Table 10. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|---|-----------------------|---------------|----------------|
| 74HC_HCT1G02_4 | 20070711 | Product data sheet | - | 74HC_HCT1G02_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 Figure 7. Quick reference data and Soldering sections removed. Section 2 "Features" updated. | | | |
| 74HC_HCT1G02_3 | 20020517 | Product specification | - | 74HC_HCT1G02_2 |
| 74HC_HCT1G02_2 | 20010302 | Product specification | - | 74HC_HCT1G02_1 |
| 74HC_HCT1G02_1 | 19980831 | Product specification | - | - |

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16.1 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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[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".

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18. Contents

| | | |
|-----------|---|-----------|
| 1 | General description | 1 |
| 2 | Features | 1 |
| 3 | Ordering information | 1 |
| 4 | Marking | 1 |
| 5 | Functional diagram | 2 |
| 6 | Pinning information | 2 |
| 6.1 | Pinning | 2 |
| 6.2 | Pin description | 2 |
| 7 | Functional description | 2 |
| 8 | Limiting values | 3 |
| 9 | Recommended operating conditions | 3 |
| 10 | Static characteristics | 3 |
| 11 | Dynamic characteristics | 5 |
| 12 | Waveforms | 5 |
| 13 | Package outline | 6 |
| 14 | Abbreviations | 8 |
| 15 | Revision history | 8 |
| 16 | Legal information | 9 |
| 16.1 | Data sheet status | 9 |
| 16.2 | Definitions | 9 |
| 16.3 | Disclaimers | 9 |
| 16.4 | Trademarks | 9 |
| 17 | Contact information | 9 |
| 18 | Contents | 10 |

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