

74AHC1G02; 74AHCT1G02

2-input NOR gate

Rev. 06 — 30 May 2007

Product data sheet

1. General description

74AHC1G02 and 74AHCT1G02 are high-speed Si-gate CMOS devices. They provide a 2-input NOR function.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

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

2. Features

- Symmetrical output impedance
- High noise immunity
- Low power dissipation
- Balanced propagation delays
- SOT353-1 and SOT753 package options
- ESD protection:
 - ◆ HBM JESD22-A114E: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101C: exceeds 1000 V
- Specified from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$

3. Ordering information

Table 1. Ordering information

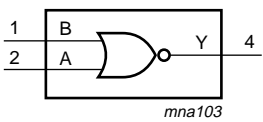
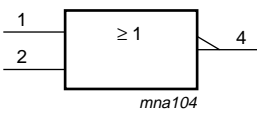
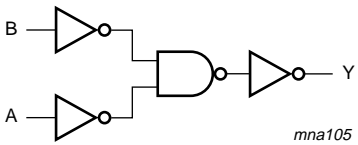
| Type number | Package | | | |
|-----------------------------|---|--------|---|----------|
| | Temperature range | Name | Description | Version |
| 74AHC1G02GW 74AHCT1G02GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74AHC1G02GV 74AHCT1G02GV | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |

4. Marking

Table 2. Marking codes

| Type number | Marking |
|--------------|---------|
| 74AHC1G02GW | AB |
| 74AHC1G02GV | A02 |
| 74AHCT1G02GW | CB |
| 74AHCT1G02GV | C02 |

5. Functional diagram

| | | |
|---|---|--|
|  <p>Fig 1. Logic symbol</p> |  <p>Fig 2. IEC logic symbol</p> |  <p>Fig 3. Logic diagram</p> |
|---|---|--|

6. Pinning information

6.1 Pinning

74AHC1G02
74AHCT1G02

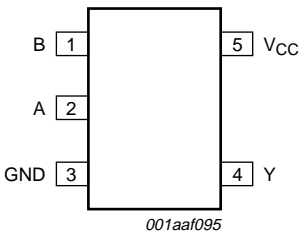


Fig 4. Pin configuration

6.2 Pin description

Table 3. Pin description

| Symbol | Pin | Description |
|-----------------|-----|----------------|
| B | 1 | data input B |
| A | 2 | data input A |
| GND | 3 | ground (0 V) |
| Y | 4 | data output Y |
| 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).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|-----------|-------------------------|--|-------|------|------|
| V_{CC} | supply voltage | | -0.5 | +7.0 | V |
| V_I | input voltage | | -0.5 | +7.0 | V |
| I_{IK} | input clamping current | $V_I < -0.5\text{ V}$ | -20 | - | mA |
| I_{OK} | output clamping current | $V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$ | [1] - | ±20 | mA |
| I_O | output current | $-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ | - | ±25 | mA |
| I_{CC} | supply current | | - | 75 | mA |
| I_{GND} | ground current | | -75 | - | 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 both TSSOP5 and SC-74A 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

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

| Symbol | Parameter | Conditions | 74AHC1G02 | | | 74AHCT1G02 | | | Unit |
|---------------------|-------------------------------------|--|-----------|-----|----------|------------|-----|----------|------|
| | | | Min | Typ | Max | Min | Typ | Max | |
| V_{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | 4.5 | 5.0 | 5.5 | V |
| V_I | input voltage | | 0 | - | 5.5 | 0 | - | 5.5 | 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 | $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ | - | - | 100 | - | - | - | ns/V |
| | | $V_{CC} = 5.0\text{ V} \pm 0.5\text{ V}$ | - | - | 20 | - | - | 20 | ns/V |

10. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|---|---------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| For type 74AHC1G02 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 2.0 V | 1.5 | - | - | 1.5 | - | 1.5 | - | V |
| | | V _{CC} = 3.0 V | 2.1 | - | - | 2.1 | - | 2.1 | - | V |
| | | V _{CC} = 5.5 V | 3.85 | - | - | 3.85 | - | 3.85 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 2.0 V | - | - | 0.5 | - | 0.5 | - | 0.5 | V |
| | | V _{CC} = 3.0 V | - | - | 0.9 | - | 0.9 | - | 0.9 | V |
| | | V _{CC} = 5.5 V | - | - | 1.65 | - | 1.65 | - | 1.65 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = -50 μA; V _{CC} = 2.0 V | 1.9 | 2.0 | - | 1.9 | - | 1.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 3.0 V | 2.9 | 3.0 | - | 2.9 | - | 2.9 | - | V |
| | | I _O = -50 μA; V _{CC} = 4.5 V | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -4.0 mA; V _{CC} = 3.0 V | 2.58 | - | - | 2.48 | - | 2.40 | - | V |
| I _O = -8.0 mA; V _{CC} = 4.5 V | 3.94 | - | - | 3.8 | - | 3.70 | - | V | | |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | | | | | |
| | | I _O = 50 μA; V _{CC} = 2.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 3.0 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 50 μA; V _{CC} = 4.5 V | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 4.0 mA; V _{CC} = 3.0 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _O = 8.0 mA; V _{CC} = 4.5 V | - | - | 0.36 | - | 0.44 | - | 0.55 | V | | |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | μA |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |
| For type 74AHCT1G02 | | | | | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 4.5 V to 5.5 V | 2.0 | - | - | 2.0 | - | 2.0 | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 4.5 V to 5.5 V | - | - | 0.8 | - | 0.8 | - | 0.8 | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = -50 μA | 4.4 | 4.5 | - | 4.4 | - | 4.4 | - | V |
| | | I _O = -8.0 mA | 3.94 | - | - | 3.8 | - | 3.70 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} ; V _{CC} = 4.5 V | | | | | | | | |
| | | I _O = 50 μA | - | 0 | 0.1 | - | 0.1 | - | 0.1 | V |
| | | I _O = 8.0 mA | - | - | 0.36 | - | 0.44 | - | 0.55 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | 0.1 | - | 1.0 | - | 2.0 | μA |

Table 7. Static characteristics ...continued
 Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|--|-------|-----|------|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 40 | μA |
| ΔI _{CC} | additional supply current | per input pin; V _I = 3.4 V; other inputs at V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.35 | - | 1.5 | - | 1.5 | mA |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |

11. Dynamic characteristics

Table 8. Dynamic characteristics
 GND = 0 V; t_r = t_f = ≤ 3.0 ns. For test circuit see [Figure 6](#).

| Symbol | Parameter | Conditions | 25 °C | | | -40 °C to +85 °C | | -40 °C to +125 °C | | Unit |
|--------|-----------|------------|-------|-----|-----|------------------|-----|-------------------|-----|------|
| | | | Min | Typ | Max | Min | Max | Min | Max | |

For type 74AHC1G02

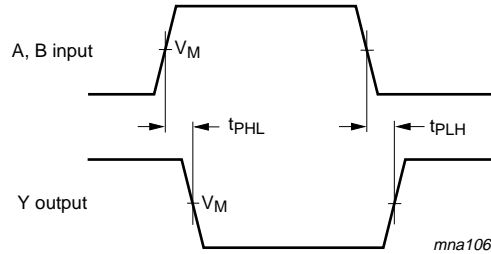
| | | | | | | | | | | |
|-----------------|-------------------------------|--|-----|-----|------|-----|-----|-----|------|----|
| t _{pd} | propagation delay | A and B to Y; see Figure 5 | [1] | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | [2] | | | | | | | |
| | | C _L = 15 pF | - | 4.4 | 7.9 | 1.0 | 9.5 | 1.0 | 10.5 | ns |
| | | C _L = 50 pF | - | 6.3 | 11.4 | 1.0 | 13 | 1.0 | 14.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | [3] | | | | | | | |
| | | C _L = 15 pF | - | 3.2 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| | | C _L = 50 pF | - | 4.6 | 7.5 | 1.0 | 8.5 | 1.0 | 9.5 | ns |
| C _{PD} | power dissipation capacitance | per buffer; C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} | [4] | 18 | - | - | - | - | - | pF |

For type 74AHCT1G02

| | | | | | | | | | | |
|-----------------|-------------------------------|--|-----|-----|-----|-----|-----|-----|-----|----|
| t _{pd} | propagation delay | A and B to Y; see Figure 5 | [1] | | | | | | | |
| | | V _{CC} = 4.5 V to 5.5 V | [3] | | | | | | | |
| | | C _L = 15 pF | - | 3.5 | 5.5 | 1.0 | 6.5 | 1.0 | 7.0 | ns |
| | | C _L = 50 pF | - | 4.9 | 7.5 | 1.0 | 8.5 | 1.0 | 9.5 | ns |
| C _{PD} | power dissipation capacitance | per buffer; C _L = 50 pF; f = 1 MHz; V _I = GND to V _{CC} | [4] | 19 | - | - | - | - | - | pF |

- [1] t_{pd} is the same as t_{PLH} and t_{PHL}.
- [2] Typical values are measured at V_{CC} = 3.3 V.
- [3] Typical values are measured at V_{CC} = 5.0 V.
- [4] C_{PD} is used to determine the dynamic power dissipation P_D (μW).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ 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.

12. Waveforms

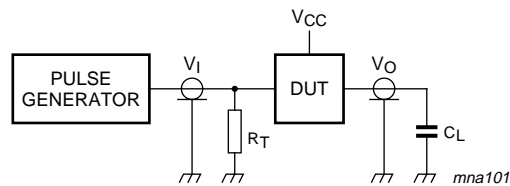


Measurement points are given in [Table 9](#).

Fig 5. The inputs (A and B) to output (Y) propagation delays

Table 9. Measurement point

| Type | Input | | Output |
|------------|-----------------|---------------------|---------------------|
| | V_I | V_M | V_M |
| 74AHC1G02 | GND to V_{CC} | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74AHCT1G02 | GND to 3.0 V | 1.5 V | $0.5 \times V_{CC}$ |



Test data is given in [Table 8](#). Definitions for test circuit:

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

13. Package outline

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

SOT353-1

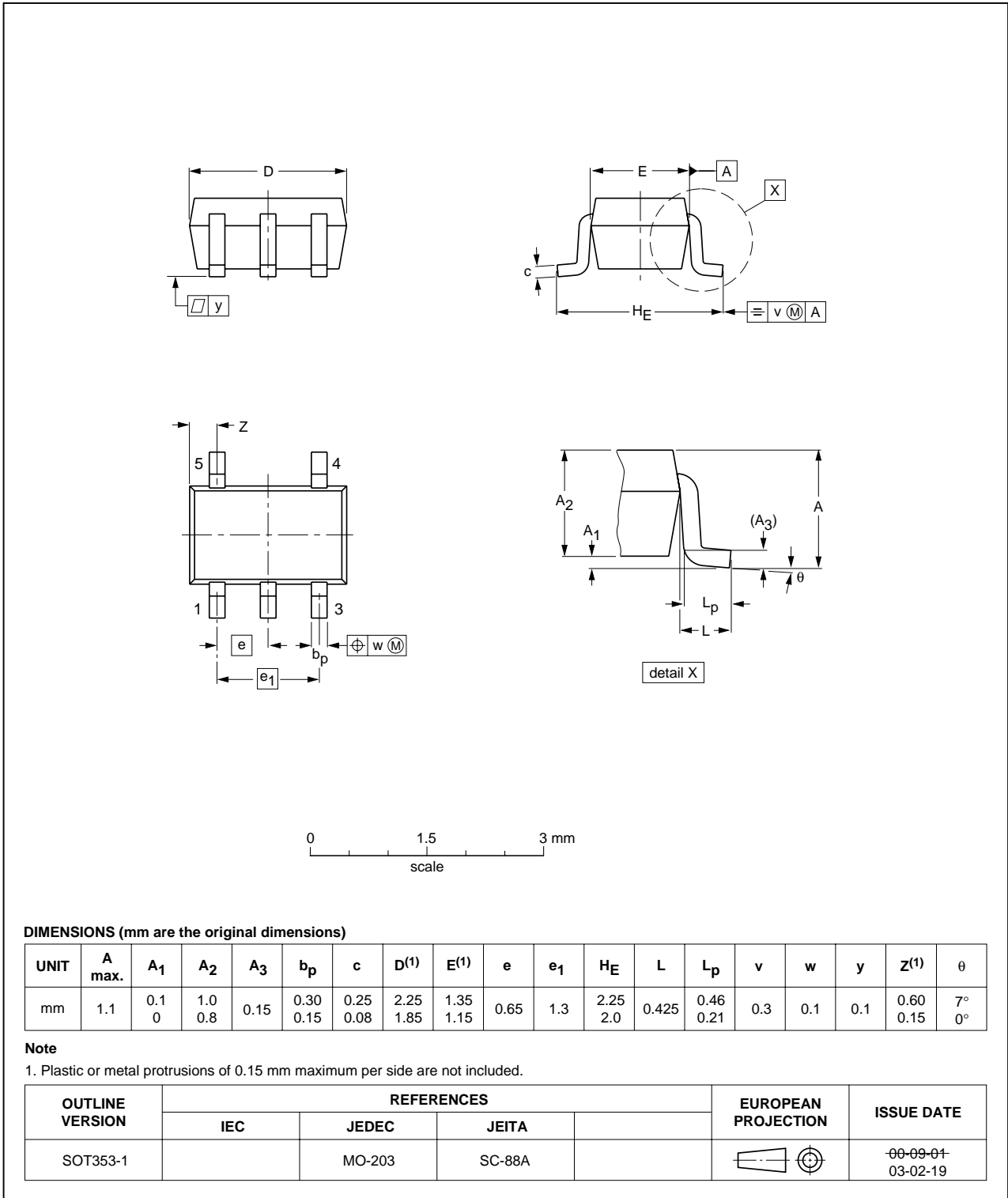


Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

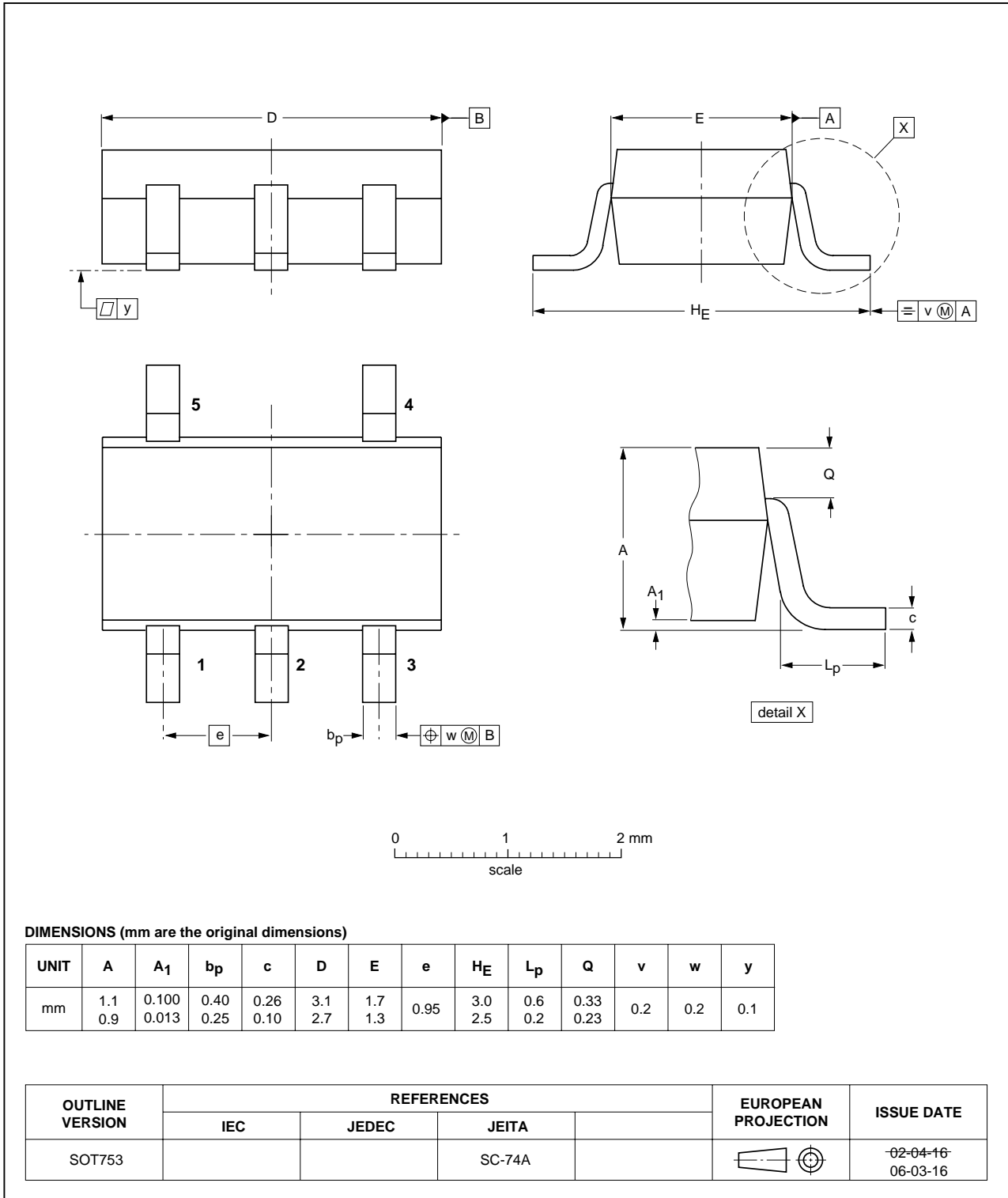


Fig 8. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 10. Abbreviations

| Acronym | Description |
|---------|-----------------------------|
| CDM | Charged Device Model |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MM | Machine Model |
| TTL | Transistor-Transistor Logic |

15. Revision history

Table 11. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|--------------------|--------------|--|---------------|------------------|
| 74AHC_AHCT1G02_6 | 20070530 | Product data sheet | - | 74AHC_AHCT1G02_5 |
| 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 Section 3 and Section 13. Quick reference data and Soldering sections removed. | | |
| 74AHC_AHCT1G02_5 | 20020527 | Product specification | - | 74AHC_AHCT1G02_4 |
| 74AHC_AHCT1G02_4 | 20020215 | Product specification | - | 74AHC_AHCT1G02_3 |
| 74AHC_AHCT1G02_3 | 20010131 | Product specification | - | 74AHC_AHCT1G02_2 |
| 74AHC_AHCT1G02_2 | 19990127 | Product specification | - | 74AHC_AHCT1G02_1 |
| 74AHC_AHCT1G02_N_1 | 19981125 | Preliminary specification | - | - |

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16.1 Data sheet status

| Document status ^{[1][2]} | Product status ^[3] | Definition |
|-----------------------------------|-------------------------------|---|
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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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