

74AHC1G09

2-input AND gate with open-drain output

Rev. 02 — 18 December 2007

Product data sheet

1. General description

The 74AHC1G09 is a high-speed Si-gate CMOS device.

The 74AHC1G09 provides the 2-input AND function with open-drain output.

The output of the 74AHC1G09 is an open drain and can be connected to other open-drain outputs to implement active-LOW, wired-OR or active-HIGH wired-AND functions. For digital operation this device must have a pull-up resistor to establish a logic HIGH level.

2. Features

- High noise immunity
- Low power dissipation
- 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 $+85\text{ }^{\circ}\text{C}$ and from $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$.

3. Ordering information

Table 1. Ordering information

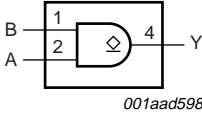
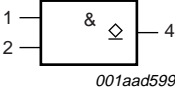
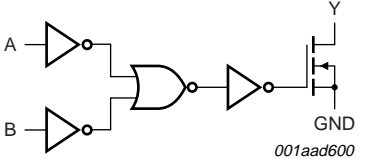
| Type number | Package | | | |
|-------------|---|--------|--|----------|
| | Temperature range | Name | Description | Version |
| 74AHC1G09GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74AHC1G09GV | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |

4. Marking

Table 2. Marking

| Type number | Marking code |
|-------------|--------------|
| 74AHC1G09GW | A9 |
| 74AHC1G09GV | A09 |

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

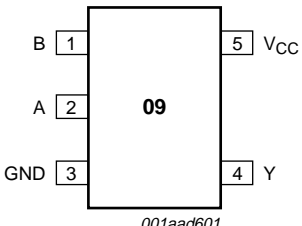


Fig 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

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^[1]

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

[1] H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

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 |
| V _I | input voltage | | [1] -0.5 | +7.0 | V |
| V _O | output voltage | active mode | [1] -0.5 | +7.0 | V |
| | | high-impedance mode | [1] -0.5 | +7.0 | V |
| I _{IK} | input clamping current | V _I < -0.5 V | [1] - | -20 | mA |
| I _{OK} | output clamping current | V _O < -0.5 V | [1] - | ±20 | mA |
| I _O | output current | V _O > -0.5 V | - | 25 | mA |
| I _{CC} | supply current | | - | ±75 | mA |
| I _{GND} | GND current | | - | ±75 | mA |
| T _{stg} | storage temperature | | -65 | +150 | °C |
| P _{tot} | total power dissipation | T _{amb} = -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 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 operations

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|------------------|-------------------------------------|----------------------------------|-----|-----|-----------------|------|
| V _{CC} | supply voltage | | 2.0 | 5.0 | 5.5 | V |
| V _I | input voltage | | 0 | - | 5.5 | V |
| V _O | output voltage | active mode | 0 | - | V _{CC} | V |
| | | high-impedance mode | 0 | - | 6.0 | V |
| T _{amb} | ambient temperature | | -40 | +25 | +125 | °C |
| Δt/ΔV | input transition rise and fall rate | V _{CC} = 3.0 V to 3.6 V | - | - | 100 | ns/V |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 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 | |
| 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 |

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 | |
| 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 _{OZ} | OFF-state output current | V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND; V _{CC} = 5.5 V | - | - | ±0.25 | | ±2.5 | | ±10.0 | μA |
| I _{CC} | supply current | V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V | - | - | 1.0 | - | 10 | - | 20 | μA |
| C _I | input capacitance | | - | 1.5 | 10 | - | 10 | - | 10 | pF |

11. Dynamic characteristics

Table 8. Dynamic characteristics
 GND = 0 V; 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 | |
| t _{pd} | propagation delay | A and B to Y; see Figure 5 | | | | | | | | |
| | | V _{CC} = 3.0 V to 3.6 V | | | | | | | | |
| | | C _L = 15 pF | - | 4.6 | 7.5 | 1.0 | 8.5 | 1.0 | 9.0 | ns |
| | | C _L = 50 pF | - | 6.5 | 11.0 | 1.5 | 12.0 | 1.5 | 12.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | | | | | | | | |
| | | 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 | 1.5 | 8.0 | 1.5 | 8.5 | ns |
| C _{PD} | power dissipation capacitance | C _L = 50 pF; f _i = 1 MHz; V _I = GND to V _{CC} | - | 5 | - | - | - | - | - | pF |

[1] t_{pd} is the same as t_{pZL} and t_{pLZ}.

[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 in μW).

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

f_i = input frequency in MHz;

f_o = output frequency in MHz;

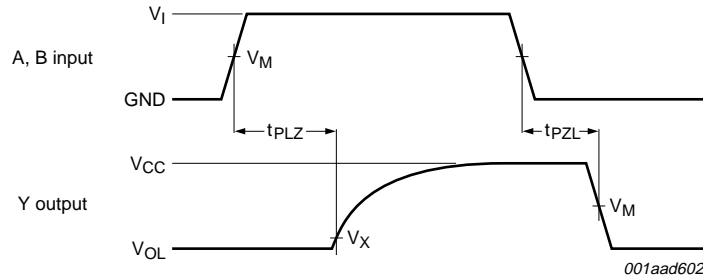
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

(C_L × V_{CC}² × f_o) = dissipation due to the output if the combination of the pull up voltage and resistance results in V_{CC} at the output.

12. Waveforms

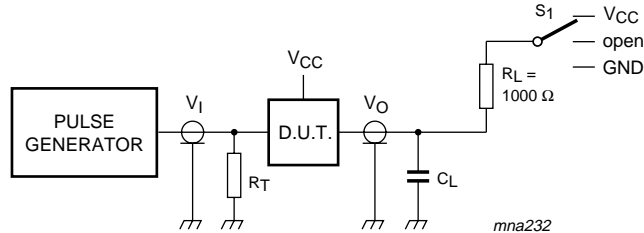


Measurement points are given in [Table 9](#).
 V_{OL} is the typical voltage output level that occur with the output load.

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

Table 9. Measurement points

| Input | Output | |
|-------------|-------------|------------------|
| V_M | V_M | V_X |
| $0.5V_{CC}$ | $0.5V_{CC}$ | $V_{OL} + 0.3 V$ |



Test data is given in [Table 10](#).
 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 circuit for switching times

Table 10. Test data

| Input | | Load | | S_1 | | |
|-----------------|-----------------------|---------------|-----------------|--------------------|--------------------|--------------------|
| V_I | t_r, t_f | R_L | C_L | t_{PHZ}, t_{PZH} | t_{PLZ}, t_{PZL} | t_{PLH}, t_{PHL} |
| GND to V_{CC} | $\leq 3.0 \text{ ns}$ | 1000Ω | 15 pF | GND | V_{CC} | open |
| GND to V_{CC} | $\leq 3.0 \text{ ns}$ | 1000Ω | 50 pF | GND | V_{CC} | open |

13. Package outline

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

SOT353-1

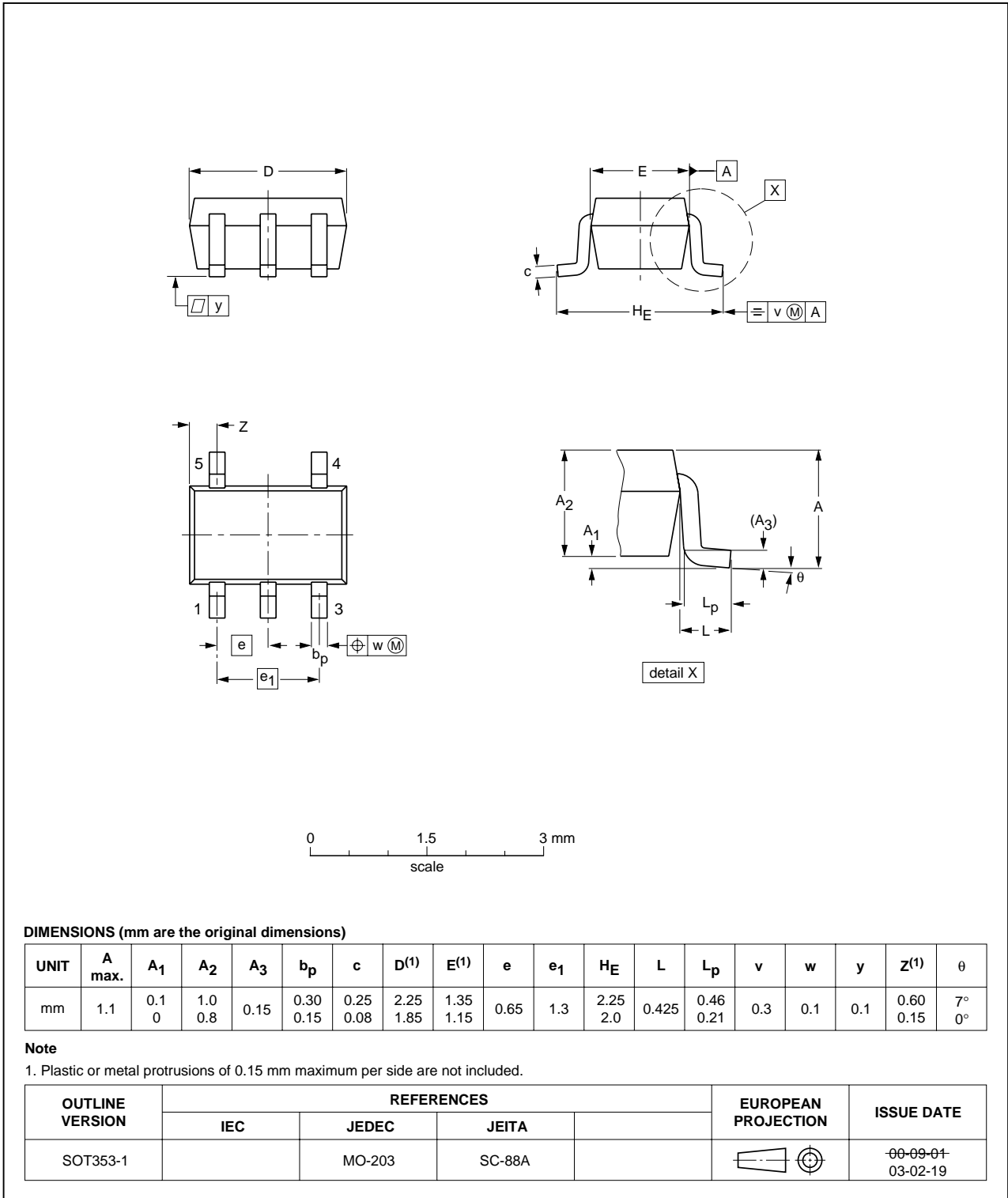


Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

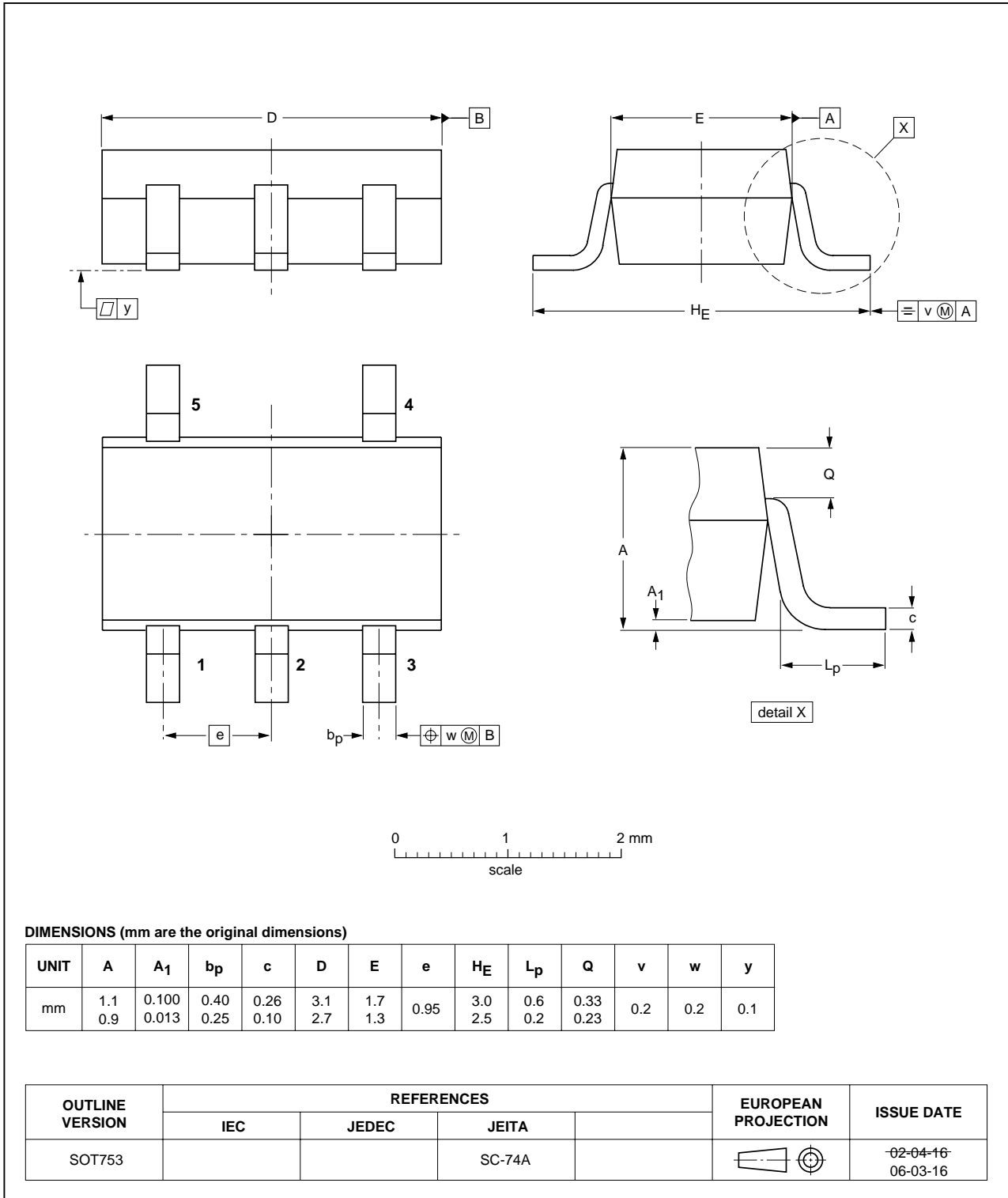


Fig 8. Package outline SOT753 (SC-74A)

14. Abbreviations

Table 11. Abbreviations

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

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--------------|--------------------|---------------|---|
| 74AHC1G09_2 | 20071218 | Product data sheet | - | 74AHC1G09_1 |
| 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 SOT753 added to Section 3, Section 4 and Section 13.• Quick reference data section removed. |
| 74AHC1G09_1 | 20050926 | Product data sheet | - | - |

16. Legal information

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. |
| 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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