

74AHC1G09

2-input AND gate with open-drain output

Rev. 3 — 11 January 2022

Product data sheet

1. General description

The 74AHC1G09 is a single 2-input AND gate with open-drain output. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

2. Features

- Wide supply voltage range from 2.0 to 5.5 V
- Overvoltage tolerant inputs to 5.5 V
- High noise immunity
- CMOS low power dissipation
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level A
- CMOS input levels
- 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 °C to +85 °C and from -40 °C to +125 °C.

3. Ordering information

Table 1. Ordering information

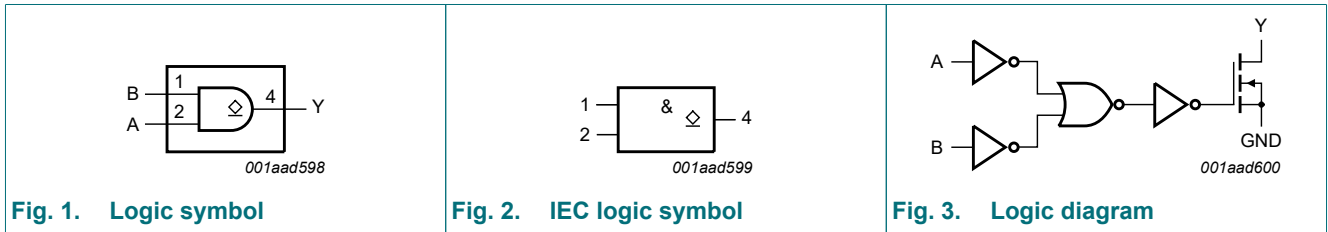
Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G09GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G09GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking

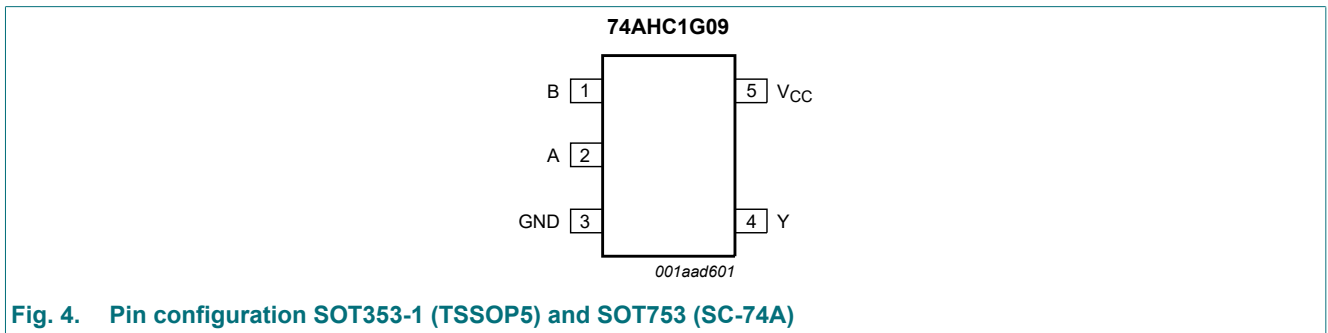
Type number	Marking code
74AHC1G09GW	A9
74AHC1G09GV	A09

5. Functional diagram



6. Pinning information

6.1. Pinning



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; Z = high-impedance OFF-state.

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

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 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 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
$\Delta t/\Delta V$	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

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 Fig. 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 Fig. 5 [1]								
		V _{CC} = 3.0 V to 3.6 V [2]								
		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 [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	1.5	8.0	1.5	8.5	ns
C _{PD}	power dissipation capacitance	C _L = 50 pF; f _i = 1 MHz; [4] 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.

11.1. Waveform and test circuit

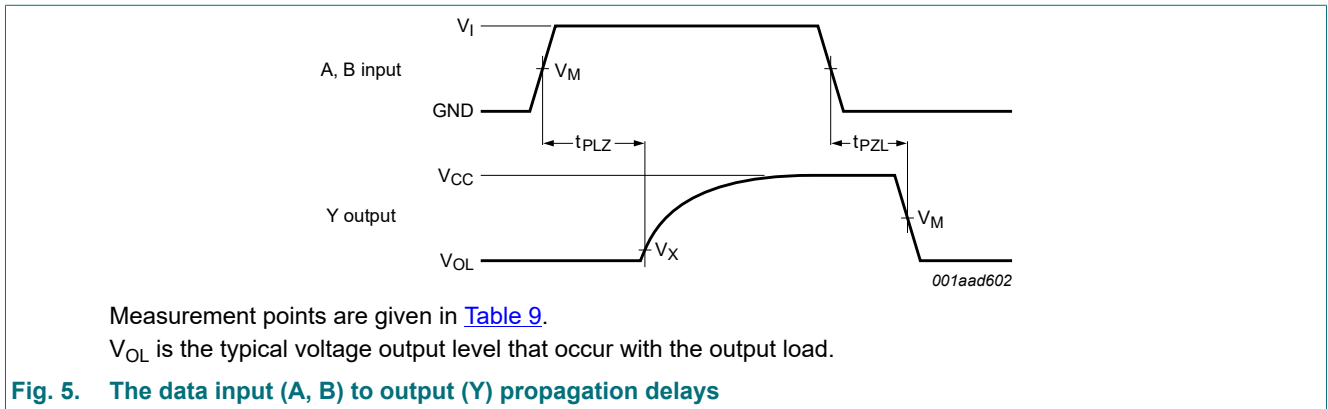


Table 9. Measurement points

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

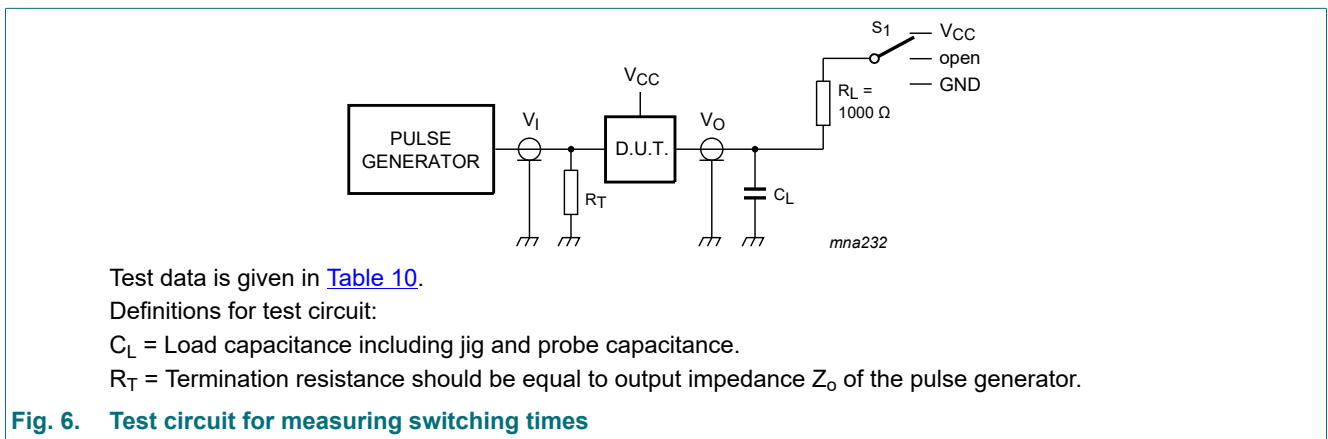


Table 10. Test data

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}	≤ 3.0 ns	1000Ω	15 pF	GND	V_{CC}	open
GND to V_{CC}	≤ 3.0 ns	1000Ω	50 pF	GND	V_{CC}	open

12. Package outline

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

SOT353-1

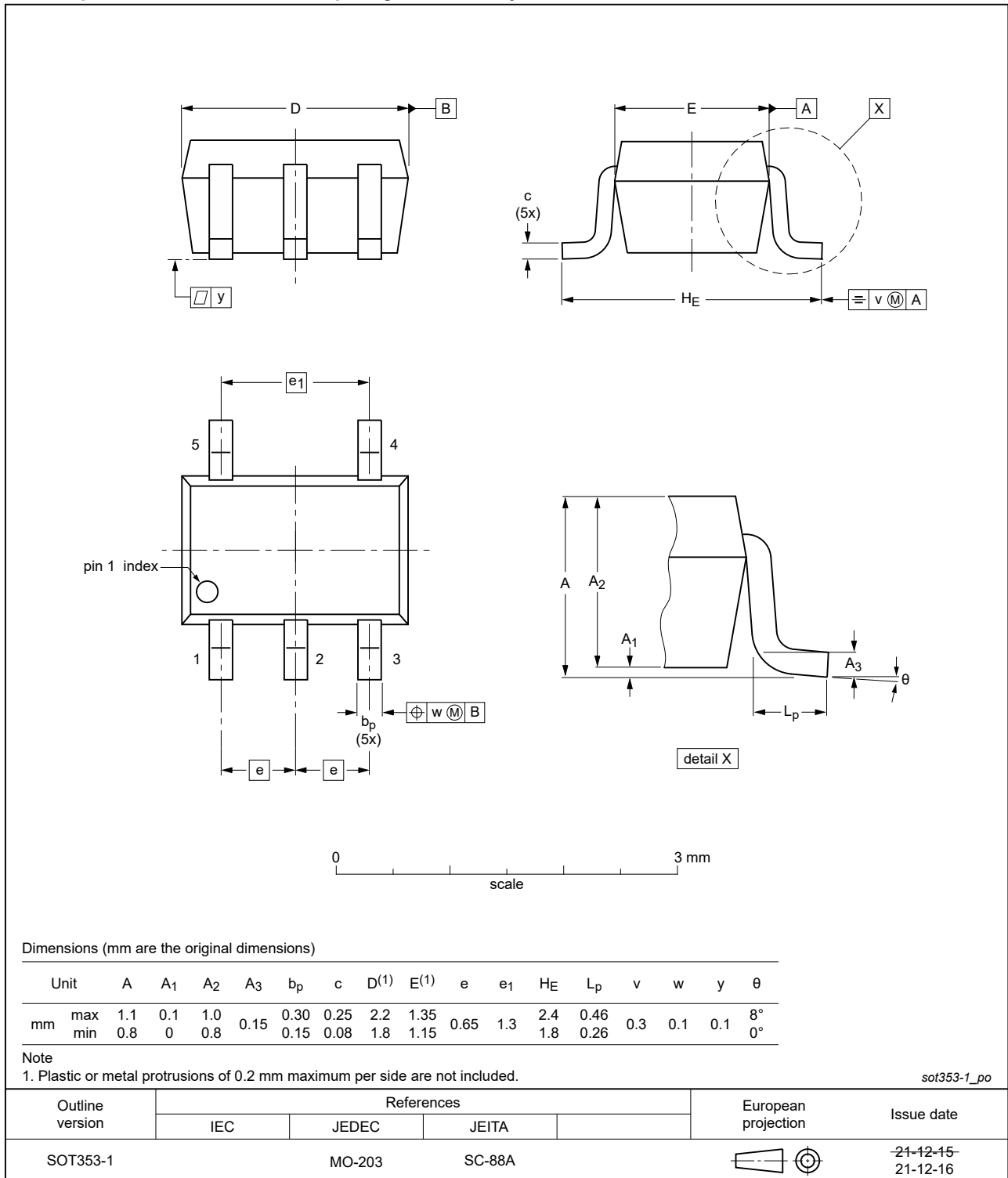


Fig. 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

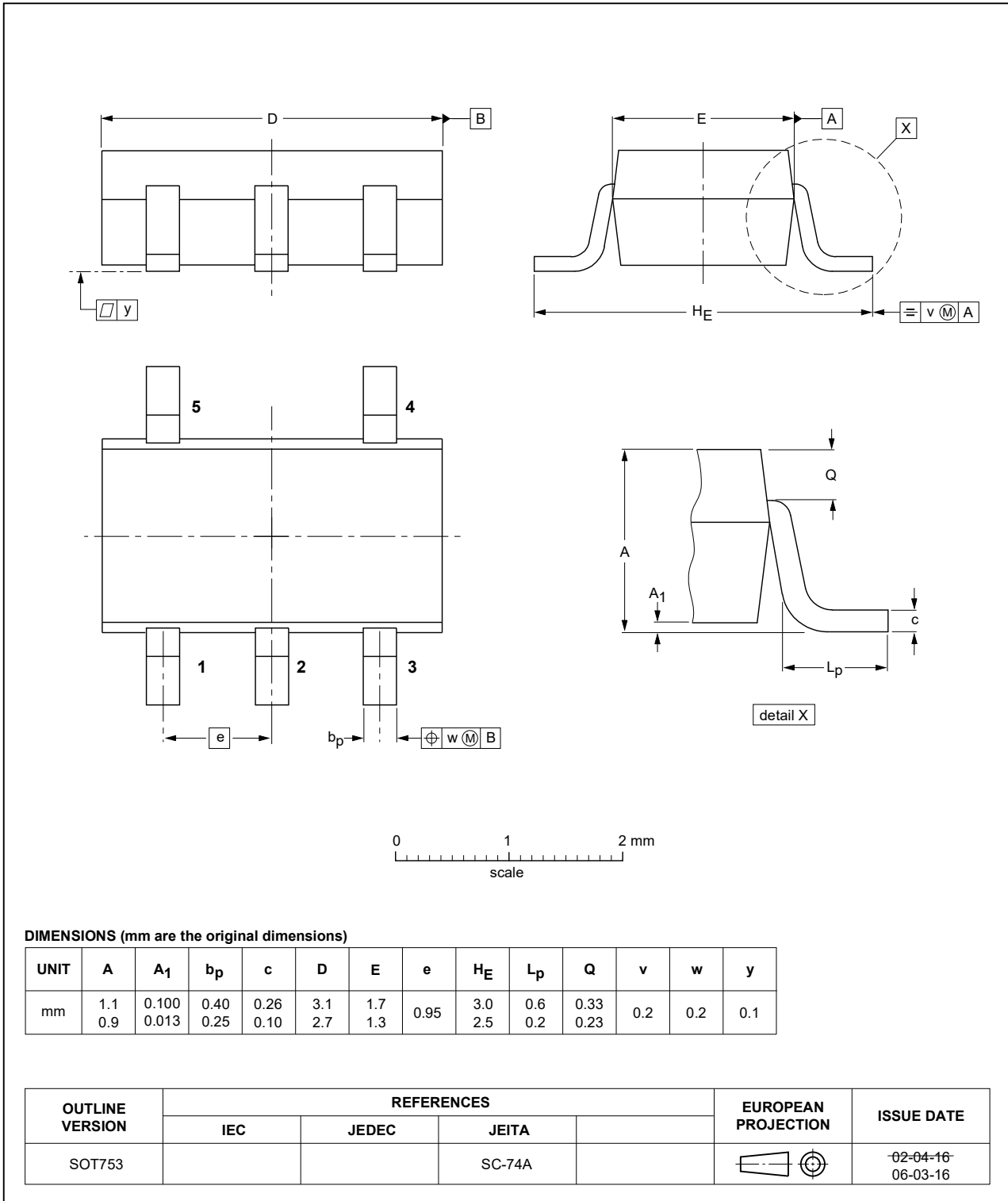


Fig. 8. Package outline SOT753 (SC-74A)

13. Abbreviations

Table 11. Abbreviations

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

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC1G09 v.3	20220111	Product data sheet	-	74AHC1G09 v.2
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. SOT353-1 (TSSOP5) package outline drawing has changed. Section 8: Derating values for P_{tot} total power dissipation updated. 			
74AHC1G09 v.2	20071218	Product data sheet	-	74AHC1G09 v.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 12. Quick reference data section removed. 			
74AHC1G09 v.1	20050926	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".
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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	4
11.1. Waveform and test circuit.....	5
12. Package outline	6
13. Abbreviations	8
14. Revision history	8
15. Legal information	9

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