

74AHC1G02; 74AHCT1G02

2-input NOR gate

Rev. 8 — 11 January 2022

Product data sheet

1. General description

The 74AHC1G02; 74AHCT1G02 is a single 2-input NOR gate. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

2. Features and benefits

- 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
- Symmetrical output impedance
- Balanced propagation delays
- Input levels:
 - For 74AHC1G02: CMOS level
 - For 74AHCT1G02: TTL level
- 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 +125 °C

3. Ordering information

Table 1. Ordering information

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

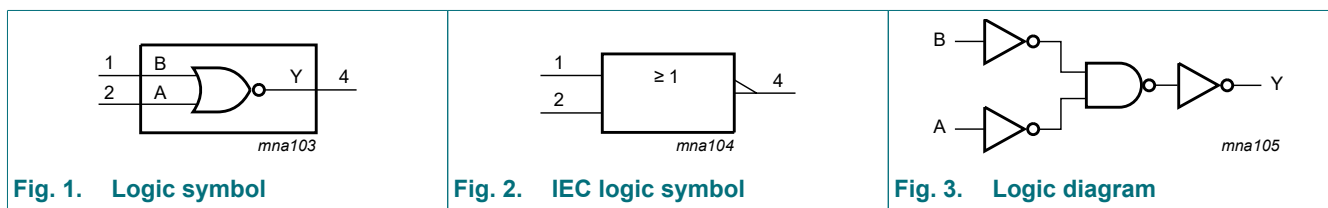
4. Marking

Table 2. Marking codes

Type number	Marking ^[1]
74AHC1G02GW	AB
74AHC1G02GV	A02
74AHCT1G02GW	CB
74AHCT1G02GV	C02

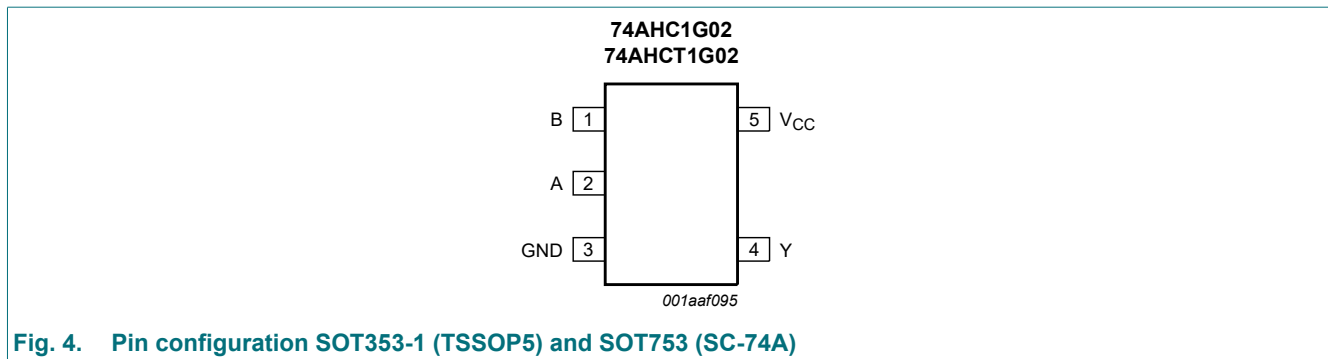
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

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.

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	$V_I < -0.5$ V	-20	-	mA
I_{OK}	output clamping current	$V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V [1]	-	±20	mA
I_O	output current	-0.5 V < V_O < $V_{CC} + 0.5$ 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	$T_{amb} = -40$ °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 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	$V_{CC} = 3.3$ V ± 0.3 V	-	-	100	-	-	-	ns/V
		$V_{CC} = 5.0$ V ± 0.5 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	
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
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
I _{CC}	supply current	V _I = V _{CC} or GND; I _O = 0 A; V _{CC} = 5.5 V	-	-	1.0	-	10	-	40	µA

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
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; $t_r = t_f = \leq 3.0$ ns. 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	
74AHC1G02										
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	-	4.4	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	$C_L = 50$ pF; $f = 1$ MHz; $V_I = GND$ to V_{CC} [4]	-	18	-	-	-	-	-	pF
74AHCT1G02										
t_{pd}	propagation delay	A and B to Y; see Fig. 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	$C_L = 50$ 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 (μ W).

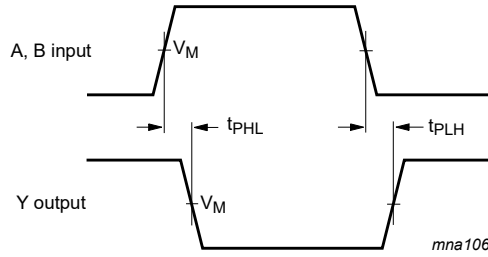
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma(C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz; f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volt.

11.1. Waveform and test circuit

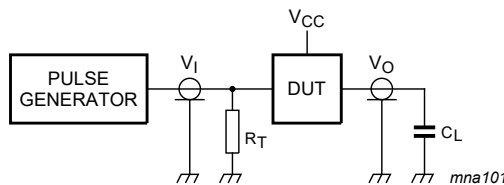


Measurement points are given in [Table 9](#).

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. Test circuit for measuring switching times

12. Package outline

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

SOT353-1

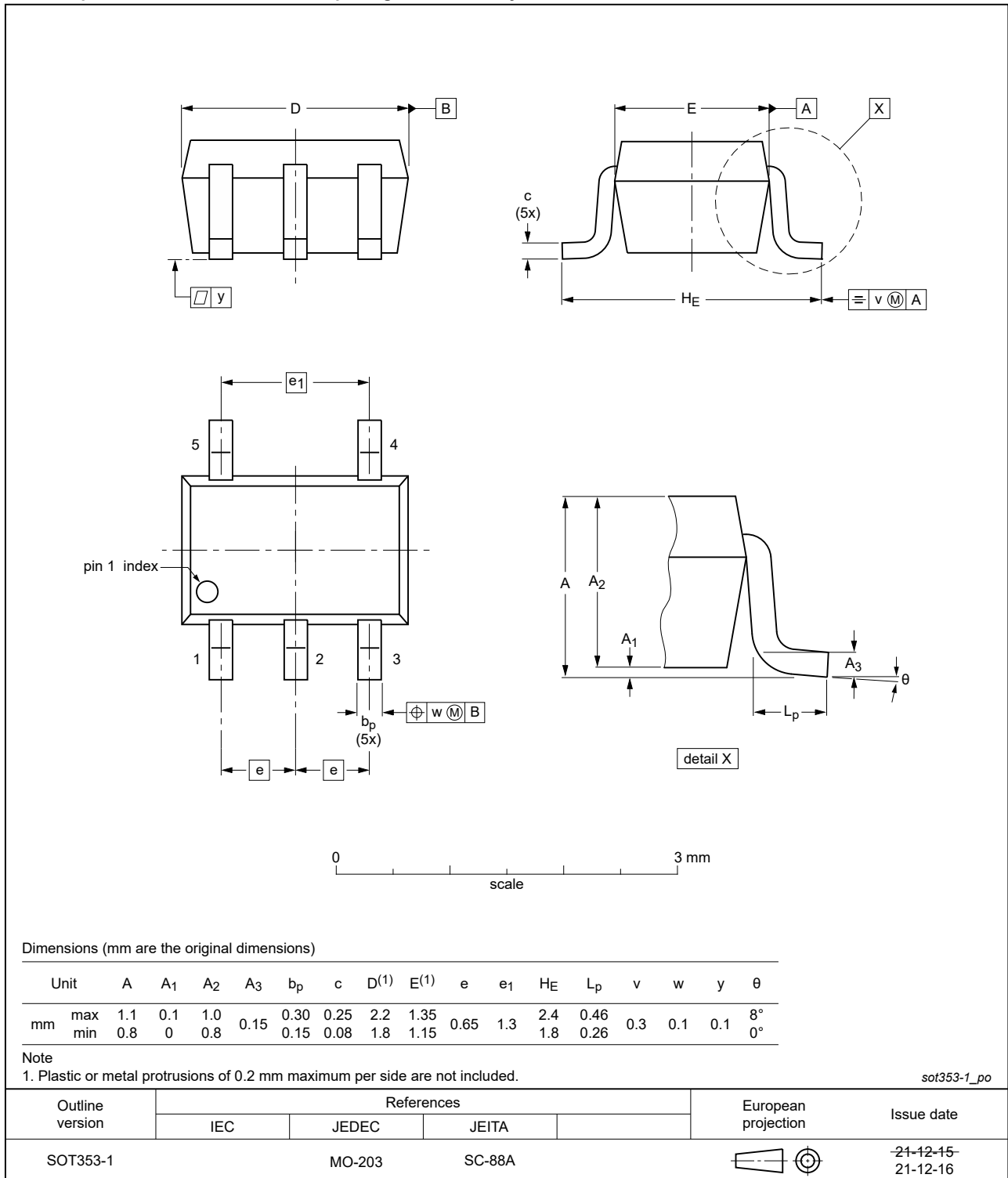


Fig. 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

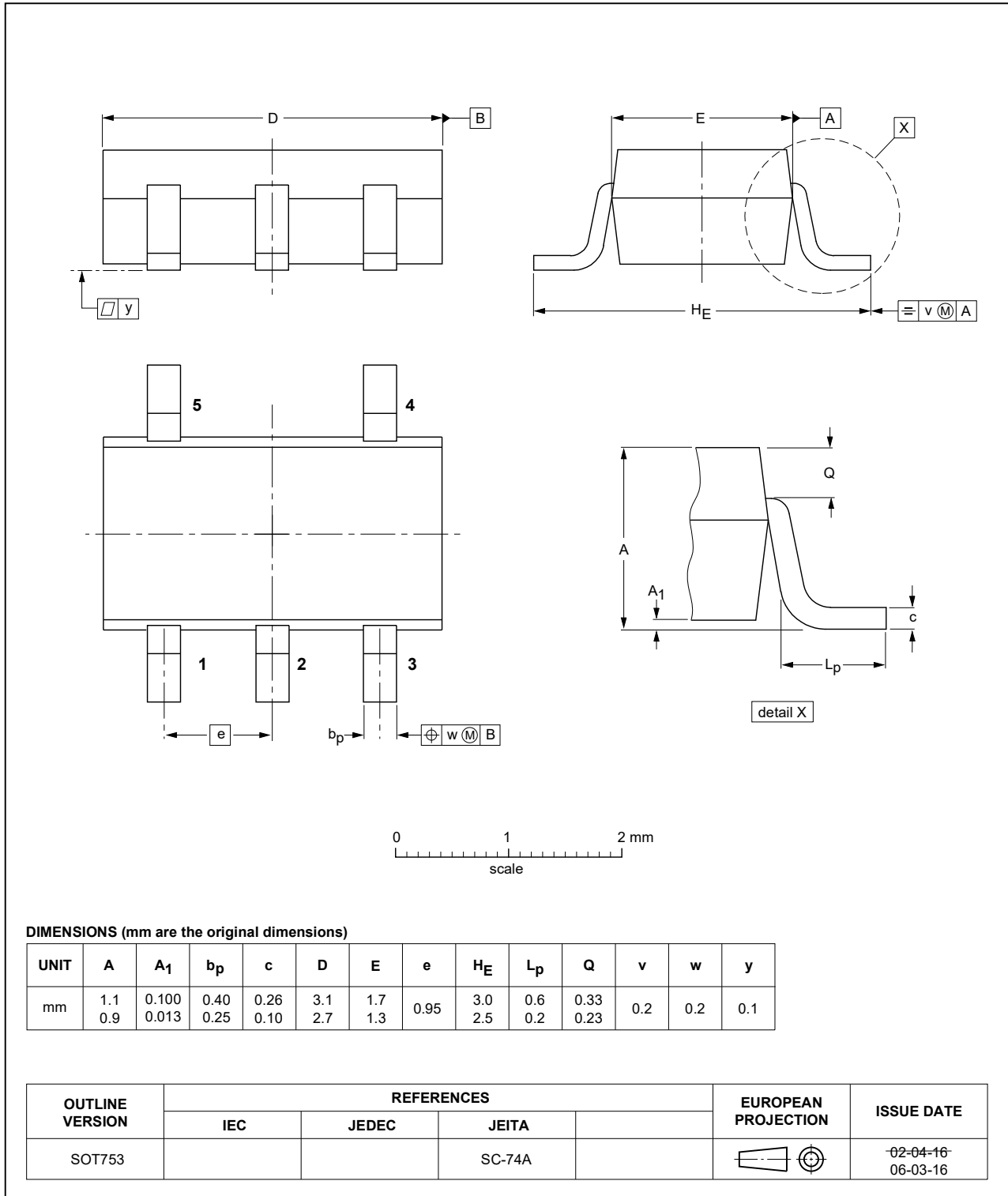


Fig. 8. Package outline SOT753 (SC-74A)

13. Abbreviations

Table 10. Abbreviations

Acronym	Description
CDM	Charged Device Model
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
74AHC_AHCT1G02 v.8	20220111	Product data sheet	-	74AHC_AHCT1G02 v.7
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. Fig. 7SOT353-1 (TSSOP5) package outline drawing has changed. Section 8: Derating values for P_{tot} total power dissipation updated. 			
74AHC_AHCT1G02 v.7	20141106	Product data sheet	-	74AHC_AHCT1G02 v.6
Modifications:	<ul style="list-style-type: none"> Section 4: table note added. 			
74AHC_AHCT1G02 v.6	20070530	Product data sheet	-	74AHC_AHCT1G02 v.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 12. Quick reference data and Soldering sections removed. 			
74AHC_AHCT1G02 v.5	20020527	Product specification	-	74AHC_AHCT1G02 v.4
74AHC_AHCT1G02 v.4	20020215	Product specification	-	74AHC_AHCT1G02 v.3
74AHC_AHCT1G02 v.3	20010131	Product specification	-	74AHC_AHCT1G02 v.2
74AHC_AHCT1G02 v.2	19990127	Product specification	-	74AHC_AHCT1G02_N v.1
74AHC_AHCT1G02_N v.1	19981125	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.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
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- [2] The term 'short data sheet' is explained in section "Definitions".
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