

74AHC1G86; 74AHCT1G86

2-input EXCLUSIVE-OR gate

Rev. 05 — 4 July 2007

Product data sheet

1. General description

74AHC1G86 and 74AHCT1G86 are high-speed Si-gate CMOS devices. They provide a 2-input EXCLUSIVE-OR 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
- ESD protection:
 - ◆ HBM JESD22-A114E: exceeds 2000 V
 - ◆ MM JESD22-A115-A: exceeds 200 V
 - ◆ CDM JESD22-C101C: exceeds 1000 V
- Low power dissipation
- Balanced propagation delays
- SOT353-1 and SOT753 package options
- 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
74AHC1G86GW 74AHCT1G86GW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G86GV 74AHCT1G86GV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753

4. Marking

Table 2. Marking codes

Type number	Marking code
74AHC1G86GW	AH
74AHCT1G86GW	CH
74AHC1G86GV	A86
74AHCT1G86GV	C86

5. Functional diagram

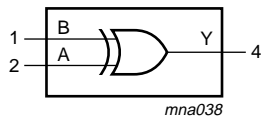


Fig 1. Logic symbol

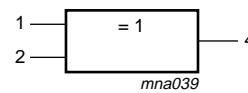


Fig 2. IEC logic symbol

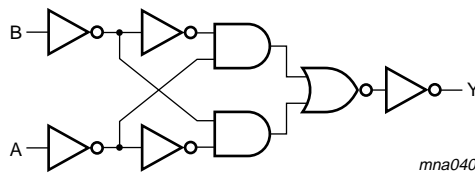


Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

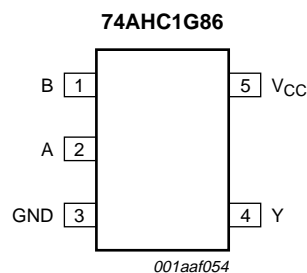


Fig 4. Pin configuration

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	L
L	H	H
H	L	H
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).

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 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	74AHC1G86			74AHCT1G86			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 74AHC1G86										
V_{IH}	HIGH-level input voltage	$V_{CC} = 2.0 \text{ V}$	1.5	-	-	1.5	-	1.5	-	V
		$V_{CC} = 3.0 \text{ V}$	2.1	-	-	2.1	-	2.1	-	V
		$V_{CC} = 5.5 \text{ V}$	3.85	-	-	3.85	-	3.85	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 2.0 \text{ V}$	-	-	0.5	-	0.5	-	0.5	V
		$V_{CC} = 3.0 \text{ V}$	-	-	0.9	-	0.9	-	0.9	V
		$V_{CC} = 5.5 \text{ V}$	-	-	1.65	-	1.65	-	1.65	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = -50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_O = -50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_O = -50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
	$I_O = -8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.8	-	3.70	-	V	
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}								
		$I_O = 50 \mu\text{A}$; $V_{CC} = 2.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu\text{A}$; $V_{CC} = 3.0 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 50 \mu\text{A}$; $V_{CC} = 4.5 \text{ V}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 4.0 \text{ mA}$; $V_{CC} = 3.0 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V
	$I_O = 8.0 \text{ mA}$; $V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V	
I_I	input leakage current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0 \text{ A}$; $V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μA
C_I	input capacitance		-	1.5	10	-	10	-	10	pF

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	
For type 74AHCT1G86										
V_{IH}	HIGH-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	2.0	-	-	2.0	-	2.0	-	V
V_{IL}	LOW-level input voltage	$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	-	-	0.8	-	0.8	-	0.8	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
		$I_O = -50 \mu\text{A}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_O = -8.0 \text{ mA}$	3.94	-	-	3.8	-	3.70	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
		$I_O = 50 \mu\text{A}$	-	0	0.1	-	0.1	-	0.1	V
		$I_O = 8.0 \text{ mA}$	-	-	0.36	-	0.44	-	0.55	V
I_I	input leakage current	$V_I = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	1.0	-	2.0	μA
I_{CC}	supply current	$V_I = V_{CC} \text{ or GND}; I_O = 0 \text{ A}; V_{CC} = 5.5 \text{ V}$	-	-	1.0	-	10	-	40	μA
ΔI_{CC}	additional supply current	per input pin; $V_I = 3.4 \text{ V};$ other inputs at V_{CC} or GND; $I_O = 0 \text{ A}; V_{CC} = 5.5 \text{ V}$	-	-	1.35	-	1.5	-	1.5	mA
C_I	input capacitance		-	1.5	10	-	10	-	10	pF

11. Dynamic characteristics

Table 8. Dynamic characteristics
 $GND = 0 \text{ V}; t_r = t_f = \leq 3.0 \text{ ns}$. For waveform see [Figure 5](#). 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 74AHC1G86										
t_{pd}	propagation delay	A and B to Y [1]								
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ [2]								
		$C_L = 15 \text{ pF}$	-	4.0	11.0	1.0	13.0	1.0	14.0	ns
		$C_L = 50 \text{ pF}$	-	5.8	14.5	1.0	16.5	1.0	18.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$ [3]								
		$C_L = 15 \text{ pF}$	-	3.4	6.8	1.0	8.0	1.0	8.5	ns
C_{PD}	power dissipation capacitance	$C_L = 50 \text{ pF}; f = 1 \text{ MHz}; V_I = \text{GND to } V_{CC}$ [4]	-	9	-	-	-	-	-	pF

Table 8. Dynamic characteristics ...continued

$GND = 0\text{ V}$; $t_r = t_f = \leq 3.0\text{ ns}$. For waveform see [Figure 5](#). 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 74AHCT1G86										
t_{pd}	propagation delay	A and B to Y	[1]							
		$V_{CC} = 4.5\text{ V to }5.5\text{ V}$	[3]							
		$C_L = 15\text{ pF}$	-	3.5	6.9	1.0	8.0	1.0	9.0	ns
		$C_L = 50\text{ pF}$	-	5.0	7.9	1.0	9.0	1.0	10.5	ns
C_{PD}	power dissipation capacitance	per buffer; $C_L = 50\text{ pF}$; $f = 1\text{ MHz}$; $V_I = GND\text{ to }V_{CC}$	[4]							
			-	11	-	-	-	-	-	pF

- [1] t_{pd} is the same as t_{PLH} and t_{PHL} .
- [2] Typical values are measured at $V_{CC} = 3.3\text{ V}$.
- [3] Typical values are measured at $V_{CC} = 5.0\text{ V}$.
- [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

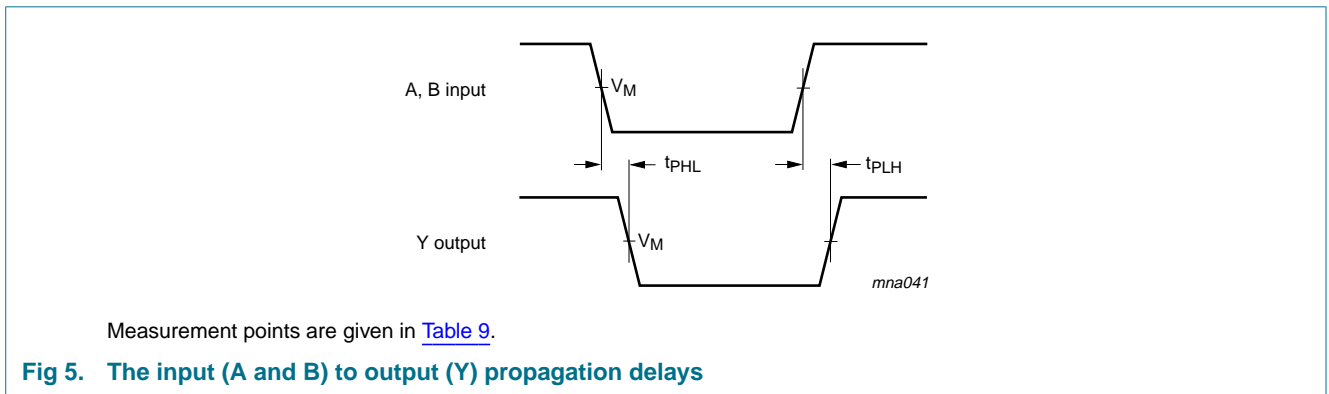
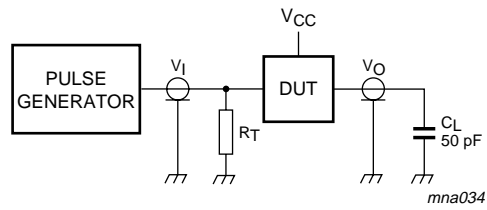


Table 9. Measurement points

Type	Input		Output
	V_I	V_M	V_M
74AHC1G86	GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT1G86	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 the 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

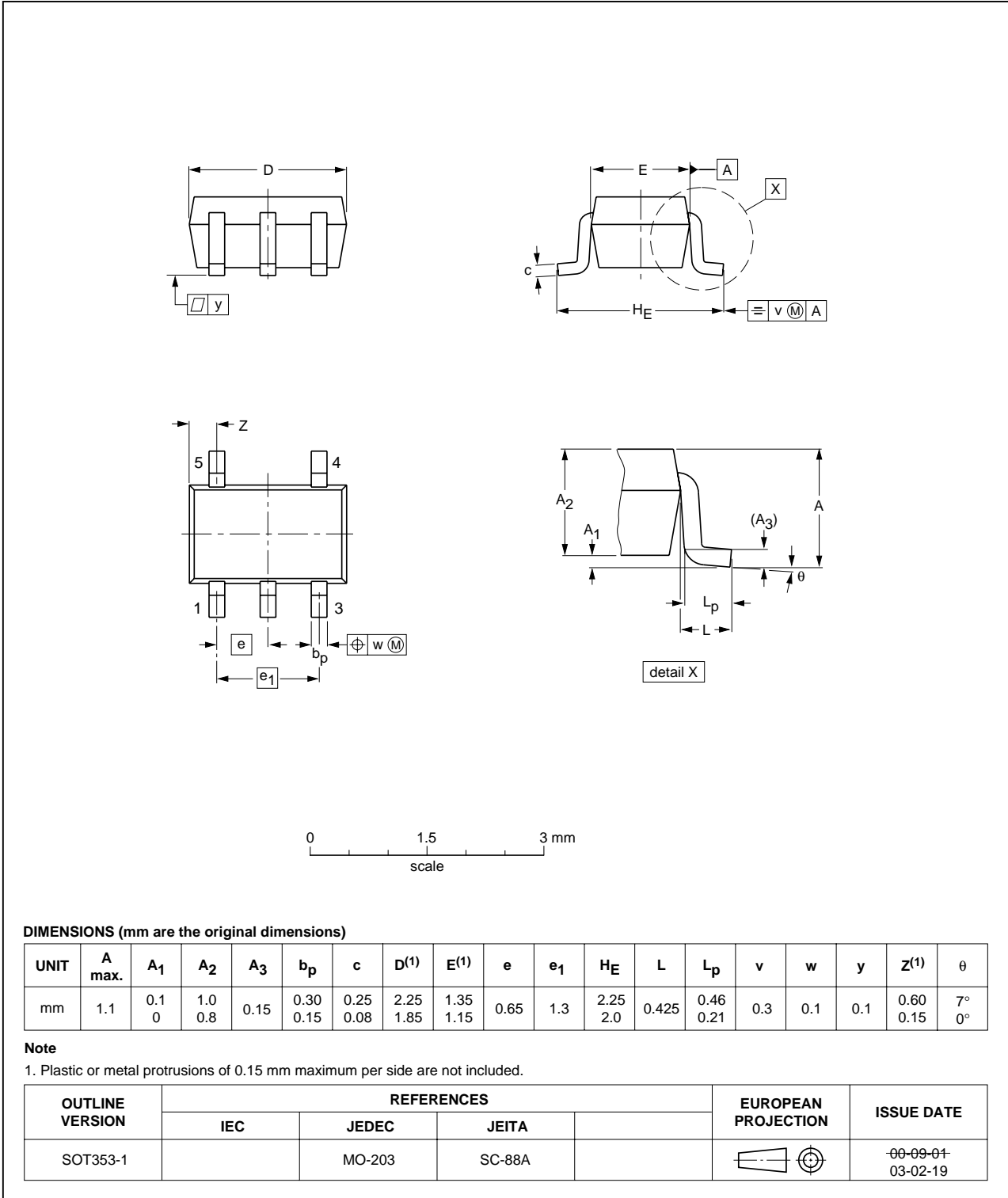


Fig 7. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

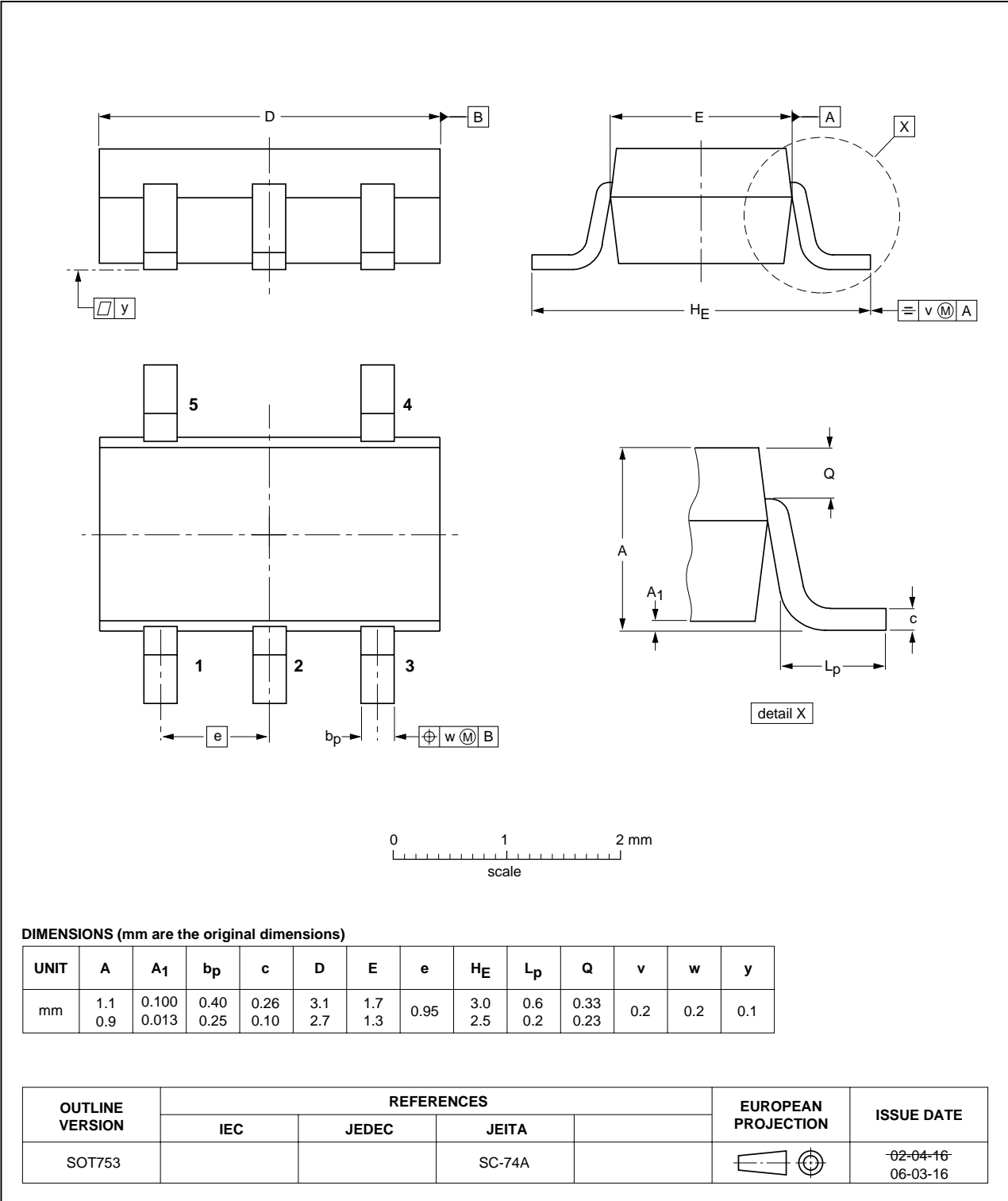


Fig 8. Package outline SOT753 (SC-74A)

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_AHCT1G86_5	20070704	Product data sheet	-	74AHC_AHCT1G86_4
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_AHCT1G86_4	20020606	Product specification	-	74AHC_AHCT1G86_3
74AHC_AHCT1G86_3	20020218	Product specification	-	74AHC_AHCT1G86_2
74AHC_AHCT1G86_2	20010406	Product specification	-	74AHC1G_AHCT1G86_1
74AHC1G_AHCT1G86_1	19990920	Product specification	-	-

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.
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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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