74AHC1G04; 74AHCT1G04

Inverter

Rev. 12 — 8 September 2023 Product data sheet

1. General description

The 74AHC1G04; 74AHCT1G04 is a single inverter. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

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 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 74AHC1G04: CMOS level
  - For 74AHCT1G04: TTL level
- Multiple package options
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
  - CDM: ANSI/ESDA/JEDEC JS-002 class C3 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
74AHC1G04GW 74AHCT1G04GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHC1G04GV 74AHCT1G04GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74AHC1G04GM 74AHCT1G04GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886

4. Marking

Table 2. Marking codes

Type number	Marking [1]
74AHC1G04GW	AC
74AHCT1G04GW	CC
74AHC1G04GV	A04
74AHCT1G04GV	C04
74AHC1G04GM	AC
74AHCT1G04GM	CC

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

5. Functional diagram

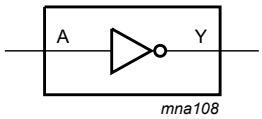


Fig. 1. Logic symbol

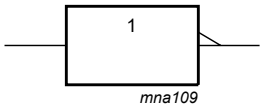


Fig. 2. IEC logic symbol

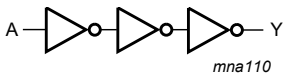
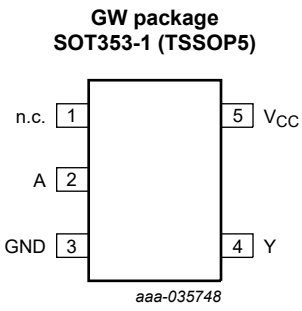
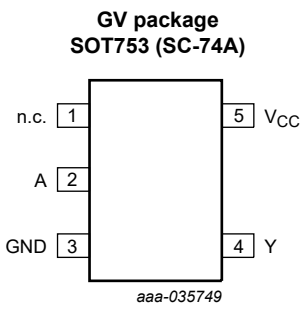


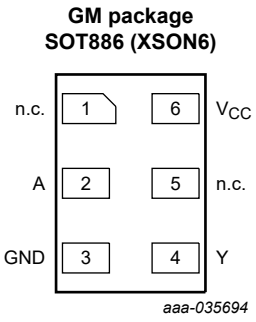
Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning







Transparent top view

6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT353-1 and SOT753	SOT886	
n.c.	1	1	not connected
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	**Y**
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 minimum 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.
For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

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

Symbol	Parameter	Conditions	74AHC1G04			74AHCT1G04			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
Δt/ΔV	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	
74AHC1G04										
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

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT1G04										
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
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

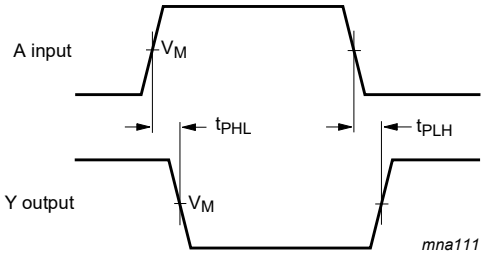
GND = 0 V; t_r = t_f = ≤ 3.0 ns. For test circuit see Fig. 5.

Symbol	Parameter	Conditions		25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
74AHC1G04											
t_{pd}	propagation delay	A to Y; see Fig. 4	[1]								
		V_{CC} = 3.0 V to 3.6 V; C_L = 15 pF	[2]	-	4.3	7.1	1.0	8.5	1.0	11.0	ns
		V_{CC} = 3.0 V to 3.6 V; C_L = 50 pF	[2]	-	6.1	10.6	1.0	12	1.0	14.5	ns
		V_{CC} = 4.5 V to 5.5 V; C_L = 15 pF	[3]	-	3.1	5.5	1.0	6.5	1.0	7.0	ns
		V_{CC} = 4.5 V to 5.5 V; C_L = 50 pF	[3]	-	4.5	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]	-	15	-	-	-	-	-	pF

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
74AHCT1G04										
t_{pd}	propagation delay	A to Y; see Fig. 4 [1]								
		V_{CC} = 4.5 V to 5.5 V; C_L = 15 pF [3]	-	3.4	6.7	1.0	7.5	1.0	8.5	ns
		V_{CC} = 4.5 V to 5.5 V; C_L = 50 pF [3]	-	4.9	7.7	1.0	8.5	1.0	10.0	ns
C_{PD}	power dissipation capacitance	per buffer; C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC} [4]	-	16	-	-	-	-	-	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).
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \Sigma (C_L \times V_{CC}^2 \times f_o)$ 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 V;
N = total load switching outputs; Σ
$(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11.1. Waveforms and test circuit

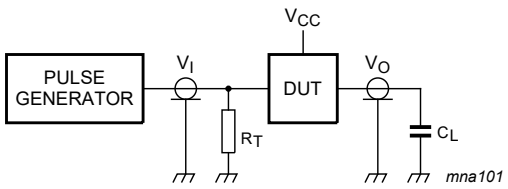


Measurement points are given in Table 9.

Fig. 4. Input (A) to output (Y) propagation delays

Table 9. Measurement point

Type	Input	Input	Output
	V_I	V_M	V_M
74AHC1G04	GND to V_{CC}	0.5 × V_{CC}	0.5 × V_{CC}
74AHCT1G04	GND to 3.0 V	1.5 V	0.5 × V_{CC}

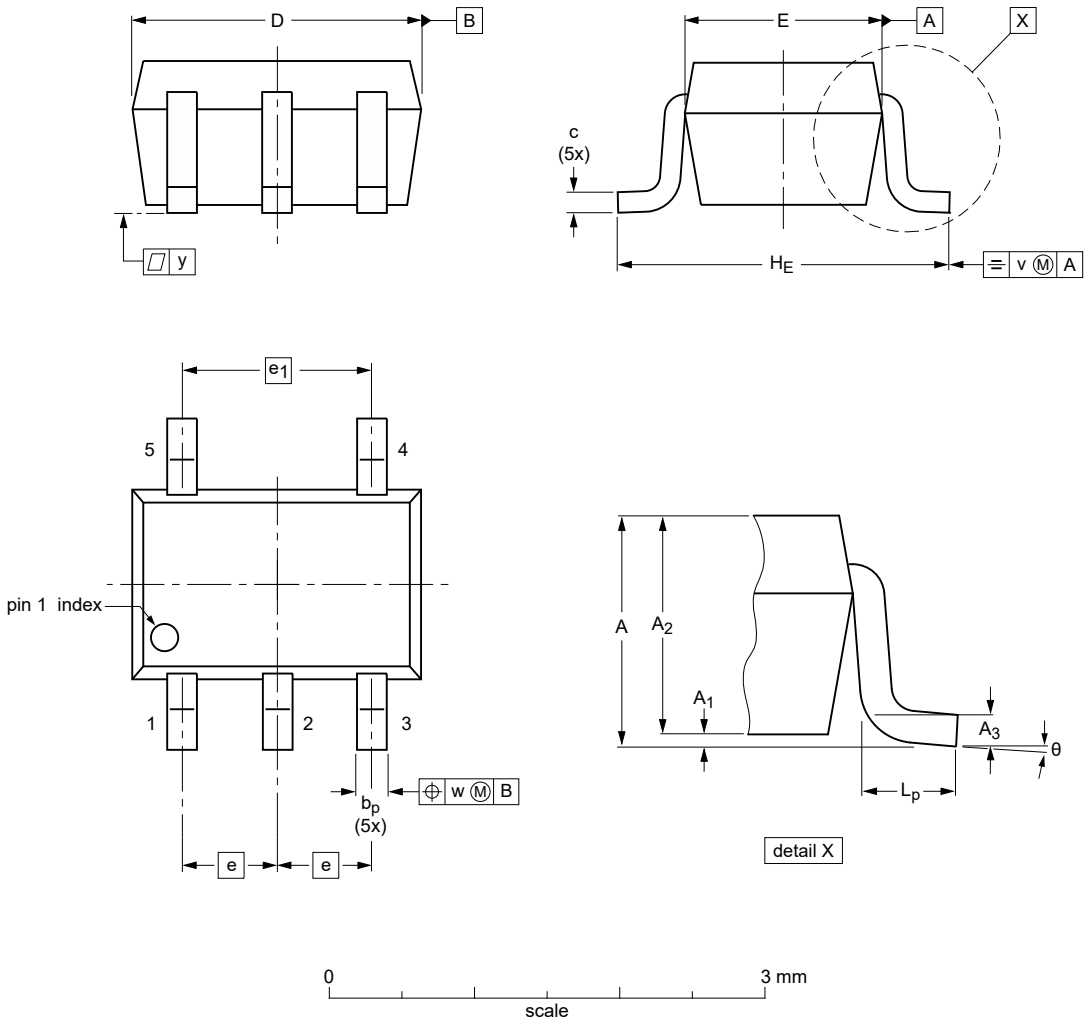


Test data is given in Table 8. Definitions for test circuit:
C_L = Load capacitance including jig and probe capacitance.
R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

Fig. 5. 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**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L_p	v	w	y	θ
mm	max	1.1	0.1	1.0	0.15	0.30	0.25	2.2	1.35	0.65	1.3	2.4	0.46	0.3	0.1	0.1	8°
	min	0.8	0	0.8		0.15	0.08	1.8	1.15			1.8	0.26				0°

Note

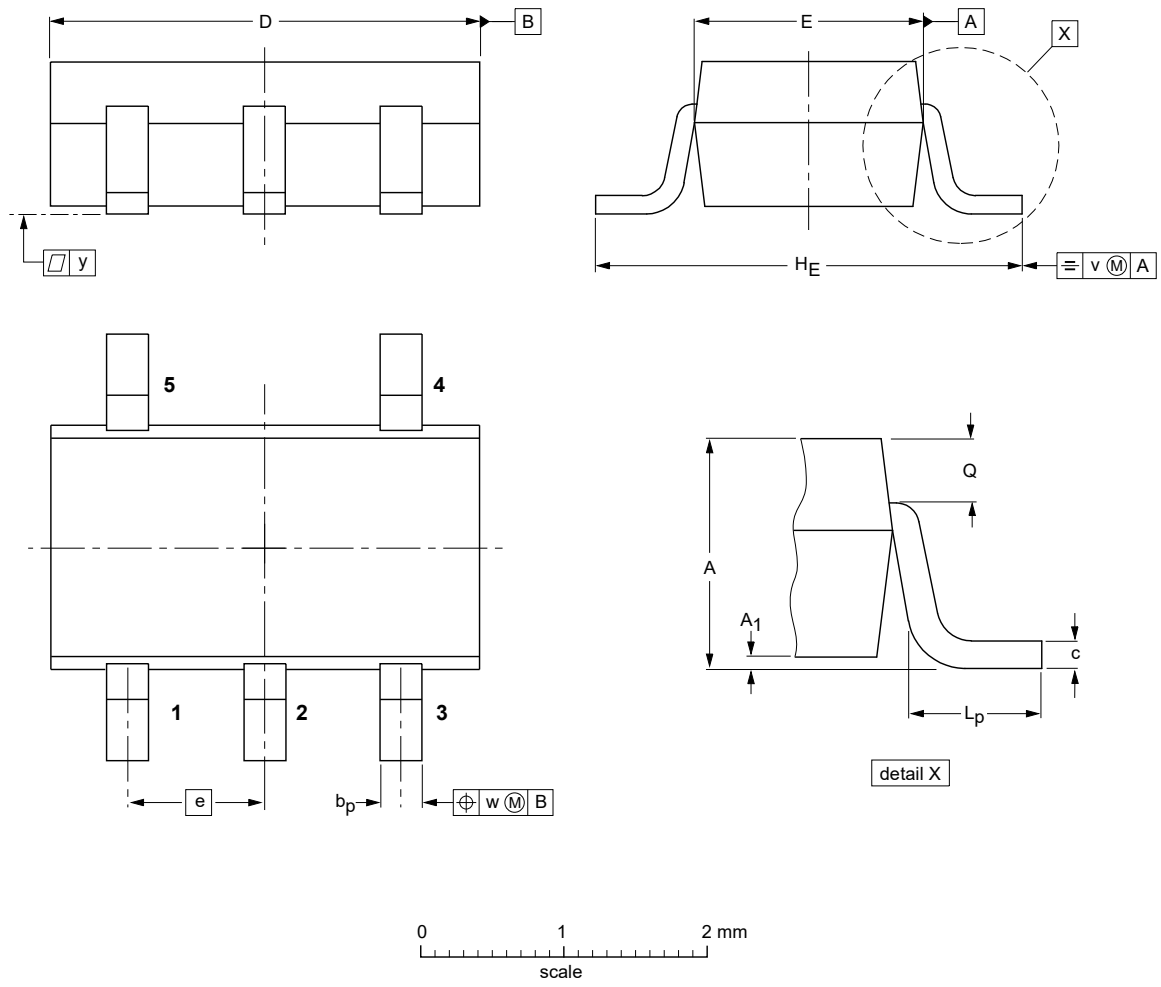
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot353-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~21-12-15~~ 21-12-16

Fig. 6. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads **SOT753**



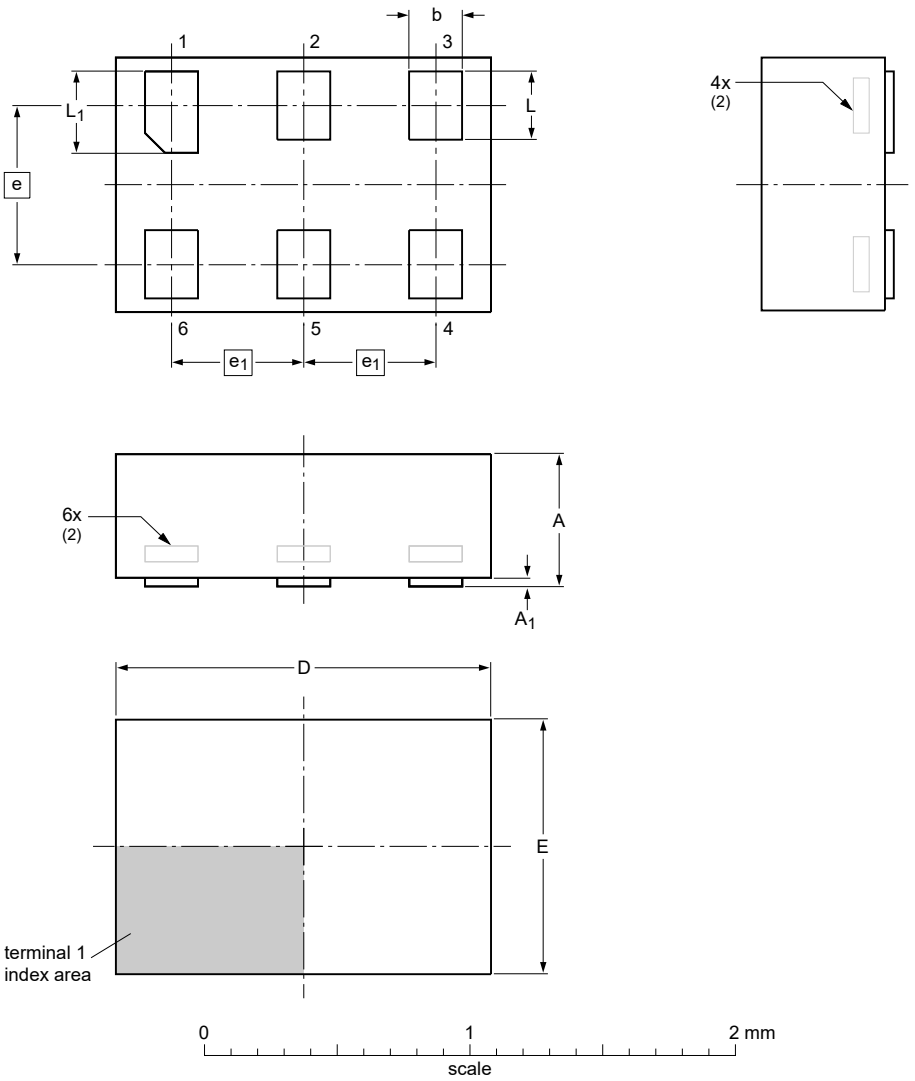
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

Fig. 7. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm SOT886



Dimensions (mm are the original dimensions)

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
	nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
	min			0.17	1.40	0.95			0.27	0.32

Notes
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

sot886_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT886		MO-252				~~04-07-22~~ 12-01-05

Fig. 8. Package outline SOT886 (XSON6)

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
TTL	Transistor-Transistor Logic

14. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G04 v.12	20230908	Product data sheet	-	74AHC_AHCT1G04 v.11
Modifications:	• Section 2: ESD specification updated according to the latest JEDEC standard.			
74AHC_AHCT1G04 v.11	20220111	Product data sheet	-	74AHC_AHCT1G04 v.10
Modifications:	• Section 1 and Section 2 updated. • Fig. 6: Package outline drawing SOT353-1 (TSSOP5) has changed.			
74AHC_AHCT1G04 v.10	20190924	Product data sheet	-	74AHC_AHCT1G04 v.9
Modifications:	• 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. • Table 5: Derating values for P_{tot} total power dissipation have been updated.			
74AHC_AHCT1G04 v.9	20150310	Product data sheet	-	74AHC_AHCT1G04 v.8
Modifications:	• Added type numbers 74AHC1G04GM and 74AHCT1G04GM.			
74AHC_AHCT1G04 v.8	20141106	Product data sheet	-	74AHC_AHCT1G04 v.7
Modifications:	• Section 4: table note added.			
74AHC_AHCT1G04 v.7	20070531	Product data sheet	-	74AHC_AHCT1G04 v.6
Modifications:	• 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 Table 1 and Section 12. • Quick reference data and Soldering sections removed.			
74AHC_AHCT1G04 v.6	20030904	Product specification	-	74AHC_AHCT1G04 v.5
74AHC_AHCT1G04 v.5	20020527	Product specification	-	74AHC_AHCT1G04 v.4
74AHC_AHCT1G04 v.4	20020215	Product specification	-	74AHC_AHCT1G04 v.3
74AHC_AHCT1G04 v.3	20010131	Product specification	-	74AHC_AHCT1G04 v.2
74AHC_AHCT1G04 v.2	19990127	Product specification	-	74AHC_AHCT1G04_N v.1
74AHC_AHCT1G04_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.
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 https://www.nexperia.com.

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