74AHC1G14; 74AHCT1G14

Inverting Schmitt trigger

Rev. 06 — 18 May 2009 **Product data sheet**

1. General description

74AHC1G14 and 74AHCT1G14 are high-speed Si-gate CMOS devices. They provide an inverting buffer function with Schmitt trigger action. These devices are capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

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 °C to +125 °C

3. Applications

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74AHC1G14GW	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHCT1G14GW				
74AHC1G14GV	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74AHCT1G14GV				

founded by Philips

5. Marking

Table 2. Marking codes

Type number	Marking code
74AHC1G14GW	AF
74AHCT1G14GW	CF
74AHC1G14GV	A14
74AHCT1G14GV	C14

6. Functional diagram

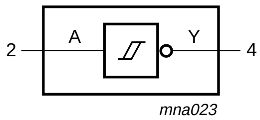


Fig 1. Logic symbol

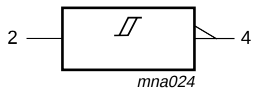


Fig 2. IEC logic symbol

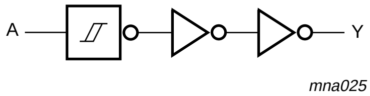


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

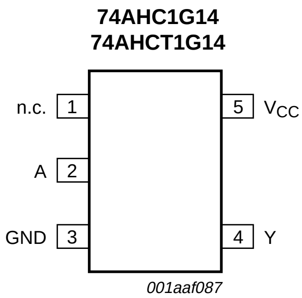


Fig 4. Pin configuration

7.2 Pin description

Table 3. Pin description

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

8. Functional description

Table 4. Function table
H = HIGH voltage level; L = LOW voltage level

Input	Output
A	**Y**
L	H
H	L

9. 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 both TSSOP5 and SC-74A packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.

10. Recommended operating conditions

Table 6. Recommended operating conditions
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	74AHC1G14			74AHCT1G14			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

11. 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 74AHC1G14										
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}								
		$I_O = -50$ 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	$V_I = V_{T+}$ or V_{T-}								
		$I_O = 50$ 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
For type 74AHCT1G14										
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}; $V_{CC} = 4.5$ 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	$V_I = V_{T+}$ or V_{T-}; $V_{CC} = 4.5$ 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

11.1 Transfer characteristics

Table 8. Transfer characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Figure 7 and Figure 8.

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 74AHC1G14										
V_{T+}	positive-going threshold voltage	V_{CC} = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
		V_{CC} = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
		V_{CC} = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V_{T-}	negative-going threshold voltage	V_{CC} = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
		V_{CC} = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
		V_{CC} = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V_H	hysteresis voltage	V_{CC} = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V_{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V_{CC} = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
For type 74AHCT1G14										
V_{T+}	positive-going threshold voltage	V_{CC} = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
		V_{CC} = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V_{T-}	negative-going threshold voltage	V_{CC} = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V_{CC} = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V_H	hysteresis voltage	V_{CC} = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V_{CC} = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

12. Dynamic characteristics

Table 9. Dynamic characteristics

GND = 0 V; $t_r = t_f \leq 3.0$ 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 74AHC1G14											
t_{pd}	propagation delay	A to Y;	[1]								
		V_{CC} = 3.0 V to 3.6 V	[2]								
		C_L = 15 pF		-	4.2	12.8	1.0	15.0	1.0	16.5	ns
		C_L = 50 pF		-	6.0	16.3	1.0	18.5	1.0	20.5	ns
		V_{CC} = 4.5 V to 5.5 V	[3]								
		C_L = 15 pF		-	3.2	8.6	1.0	10.0	1.0	11.0	ns
		C_L = 50 pF		-	4.6	10.6	1.0	12.0	1.0	13.5	ns
C_{PD}	power dissipation capacitance	per buffer; C_L = 50 pF; f = 1 MHz; V_I = GND to V_{CC}	[4]	-	12	-	-	-	-	-	pF
For type 74AHCT1G14											
t_{pd}	propagation delay	A to Y; V_{CC} = 4.5 V to 5.5 V	[1] [3]								
		C_L = 15 pF		-	4.1	7.0	1.0	8.0	1.0	9.0	ns
		C_L = 50 pF		-	5.9	8.5	1.0	10.0	1.0	11.0	ns
C_{PD}	power dissipation capacitance	per buffer; V_I = GND to V_{CC}	[4]	-	13	-	-	-	-	-	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:

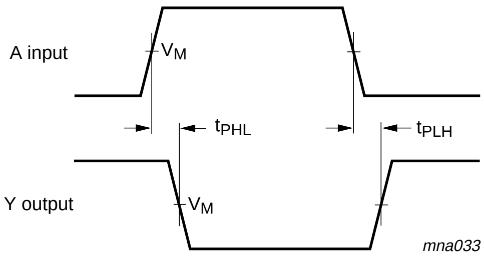
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

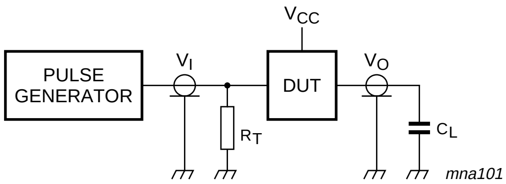
V_{CC} = supply voltage in Volts.

13. Waveforms



The test data is given in Table 10

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



Test data is given in Table 9.

Definitions for test circuit:

C_L = Load capacitance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

Fig 6. Load circuitry for switching times

Table 10. Test data

Type number	Input		Output
	V_I	V_M	V_M
74AHC1G14	GND to V_{CC}	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74AHCT1G14	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$

13.1 Transfer characteristic waveforms

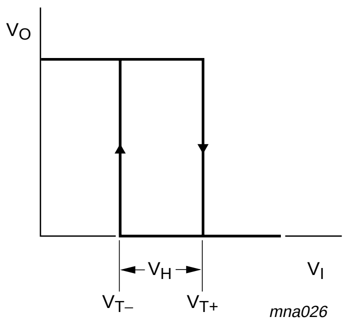


Fig 7. Transfer characteristic

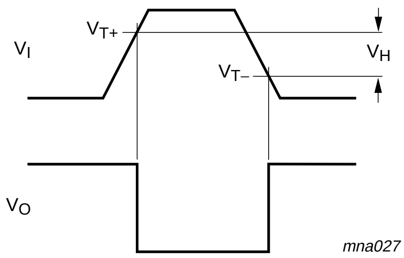


Fig 8. The definitions of V_{T+}, V_{T-} and V_H

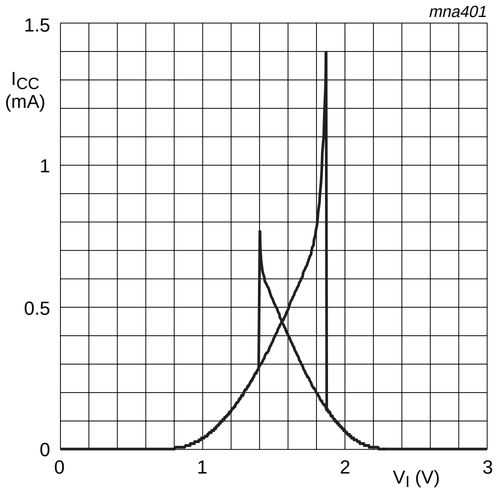


Fig 9. Typical 74AHC1G14 transfer characteristics; V_{CC} = 3.0 V

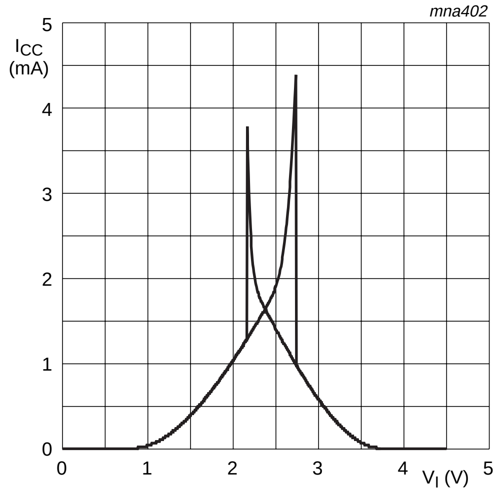


Fig 10. Typical 74AHC1G14 transfer characteristics; V_{CC} = 4.5 V

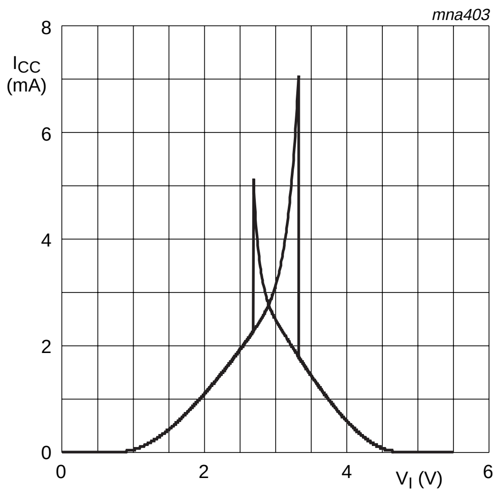


Fig 11. Typical 74AHC1G14 transfer characteristics; V_{CC} = 5.5 V

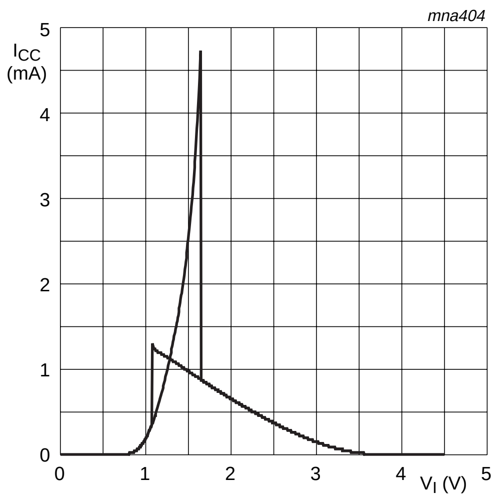


Fig 12. Typical 74AHCT1G14 transfer characteristics; V_{CC} = 4.5 V

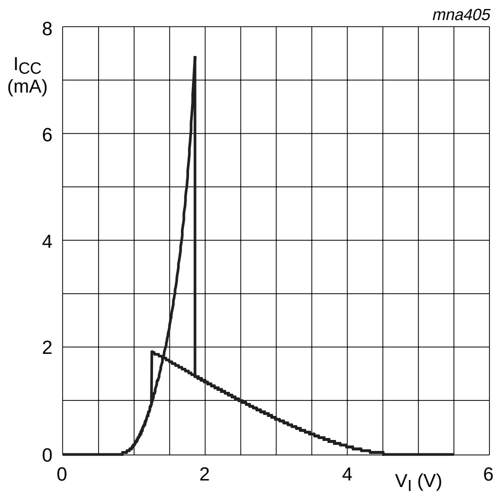


Fig 13. Typical 74AHCT1G14 transfer characteristics; V_{CC} = 5.5 V

14. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

$P_{add} = f_i \times (t_r \times \Delta I_{CC(AV)} + t_f \times \Delta I_{CC(AV)}) \times V_{CC}$ where:

P_{add} = additional power dissipation (μW);

f_i = input frequency (MHz);

t_r = input rise time (ns); 10 % to 90 %;

t_f = input fall time (ns); 90 % to 10 %;

$\Delta I_{CC(AV)}$ = average additional supply current (μA).

Average additional I_{CC} differs with positive or negative input transitions, as shown in Figure 14 and Figure 15.

For 74AHC1G14 and 74AHCT1G14 used in relaxation oscillator circuit, see Figure 16.

Note to the application information:

1. All values given are typical unless otherwise specified.

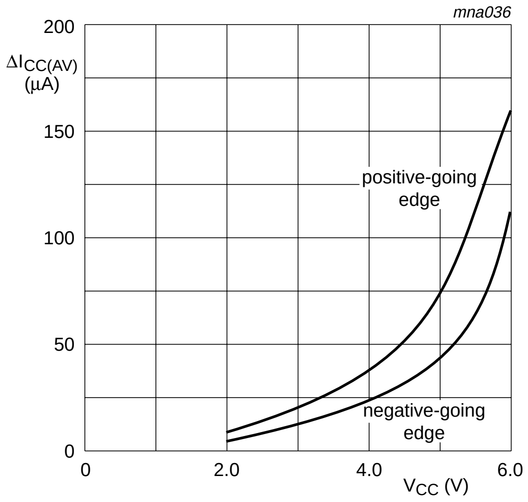


Fig 14. Average additional I_{CC} for 74AHC1G14 Schmitt trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

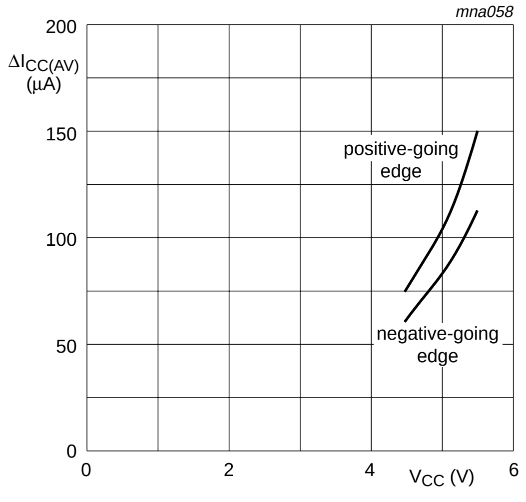
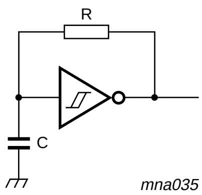


Fig 15. Average additional I_{CC} for 74AHCT1G14 Schmitt trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$



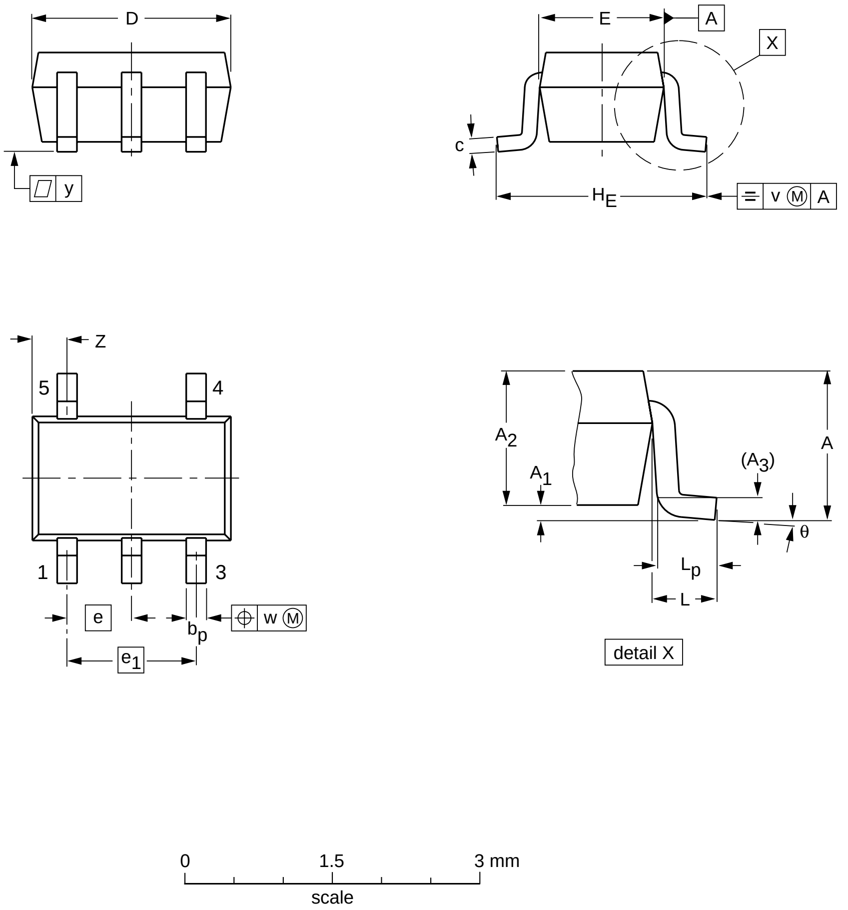
For 74AHC1G14: $f = \frac{1}{T} \approx \frac{1}{0.55 \times RC}$

For 74AHCT1G14: $f = \frac{1}{T} \approx \frac{1}{0.60 \times RC}$

Fig 16. Relaxation oscillator using the 74AHC1G14 and 74AHCT1G14

15. 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 max.	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L	L_p	v	w	y	$Z^{(1)}$	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

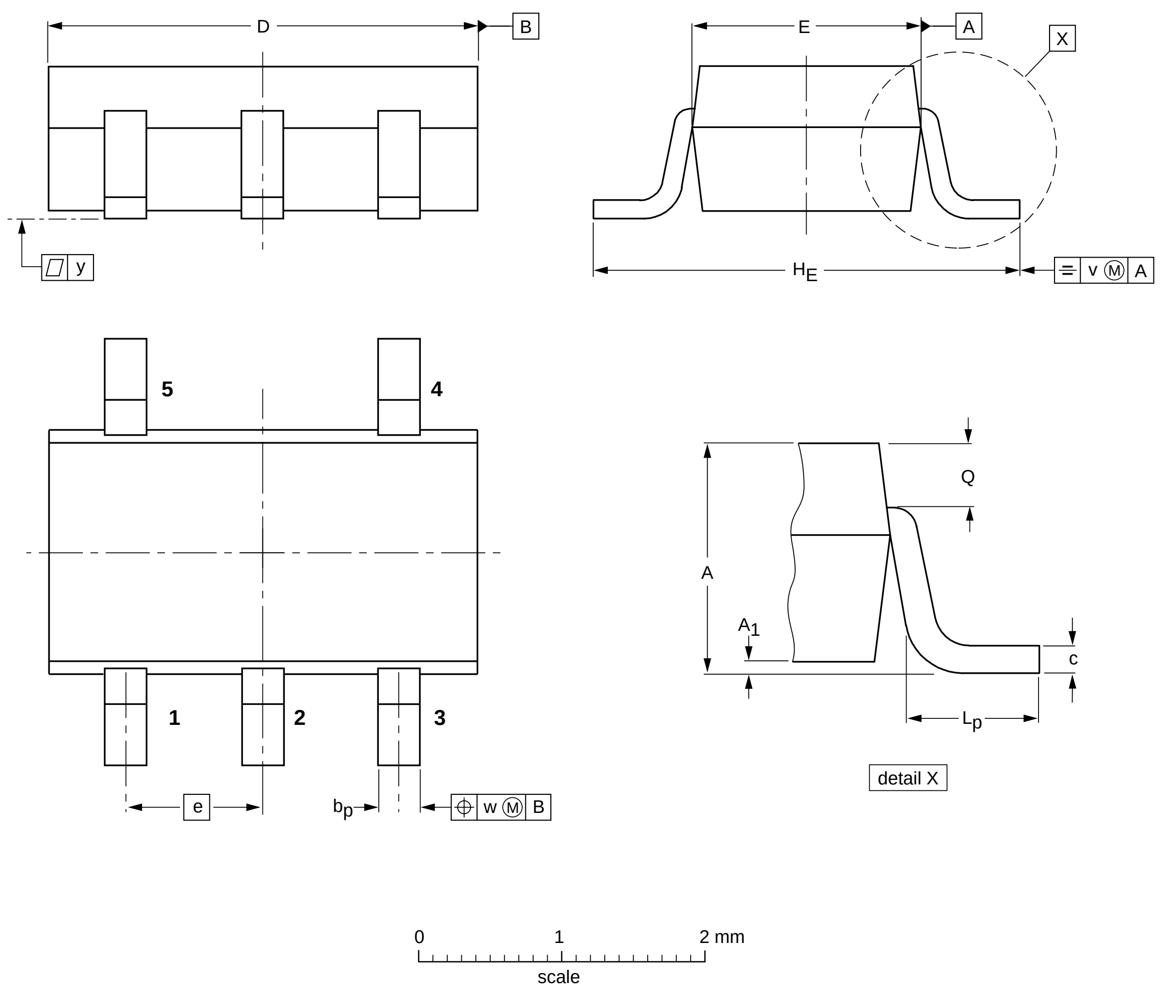
Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~00-09-01~~ 03-02-19

Fig 17. 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 18. Package outline SOT753 (SC-74A)

16. Abbreviations

Table 11. 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

17. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G14_6	20090518	Product data sheet	-	74AHC_AHCT1G14_5
Modifications:	• Table 7: the conditions for HIGH-level output voltage and LOW-level output voltage have been changed.			
74AHC_AHCT1G14_5	20070629	Product data sheet	-	74AHC_AHCT1G14_4
74AHC_AHCT1G14_4	20020528	Product specification	-	74AHC_AHCT1G14_3
74AHC_AHCT1G14_3	20020218	Product specification	-	74AHC_AHCT1G14_2
74AHC_AHCT1G14_2	20010222	Product specification	-	74AHC_AHCT1G14_1
74AHC_AHCT1G14_1	19990805	Product specification	-	-

18. Legal information

18.1 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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