

74AHC1G14; 74AHCT1G14

Inverting Schmitt trigger

Rev. 8 — 13 January 2016

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 and benefits

- 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. 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	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74AHCT1G14GW				
74AHC1G14GV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74AHCT1G14GV				

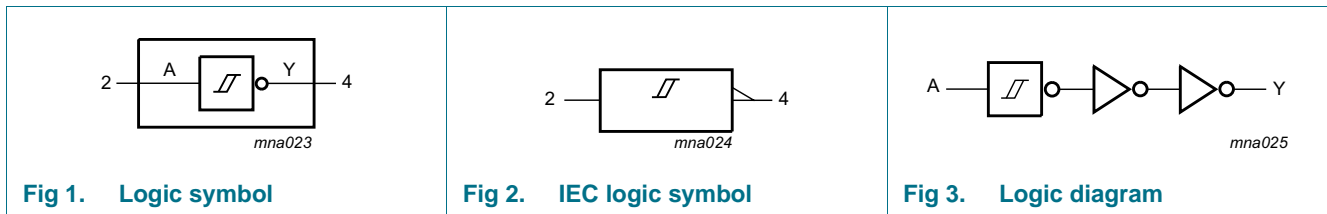
5. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74AHC1G14GW	AF
74AHCT1G14GW	CF
74AHC1G14GV	A14
74AHCT1G14GV	C14

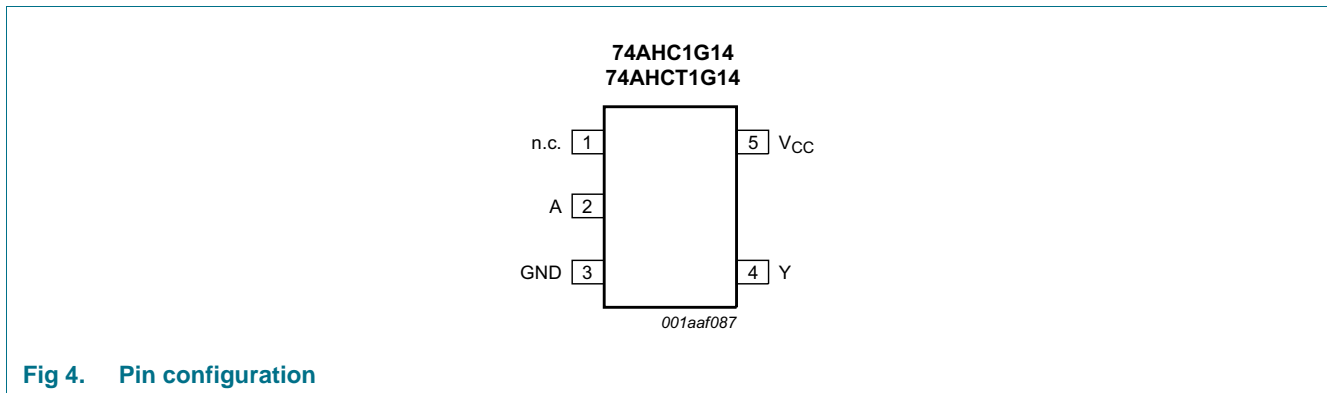
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

6. Functional diagram



7. Pinning information

7.1 Pinning



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

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

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

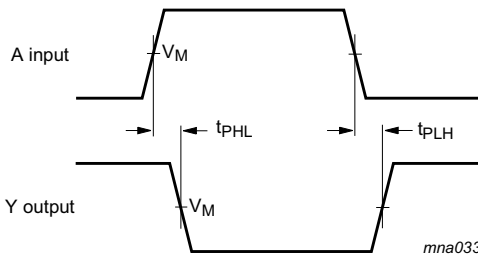
f_i = input frequency in MHz;

f_o = output frequency in MHz;

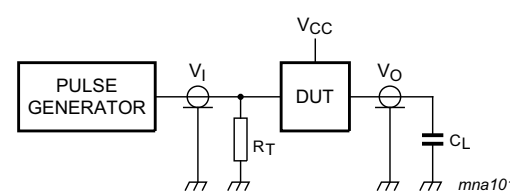
C_L = output load capacitance in pF;

V_{CC} = supply voltage in Volts.

13. Waveforms



The test data is given in [Table 10](#)



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.

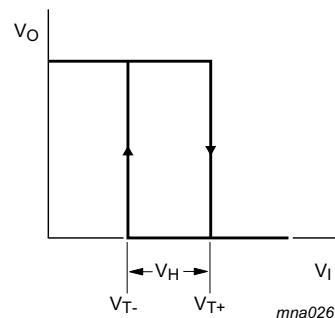
Fig 5. The input (A) to output (Y) propagation delays

Fig 6. Test circuit for measuring 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



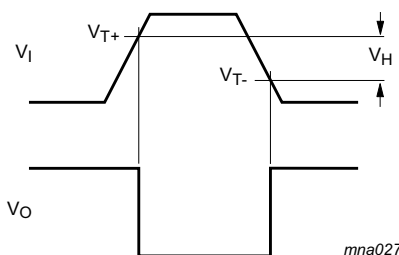


Fig 7. Transfer characteristic

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

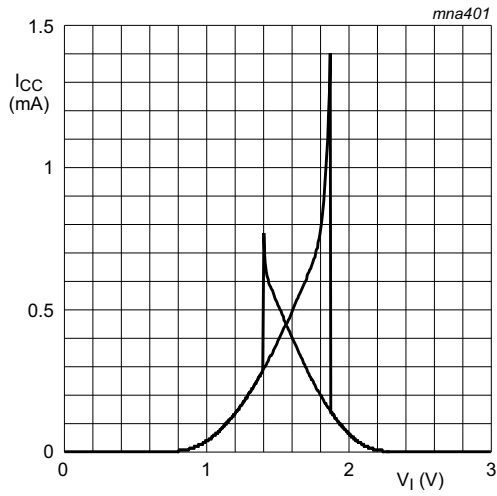


Fig 9. Typical 74AHC1G14 transfer characteristics; $V_{CC} = 3.0\text{ V}$

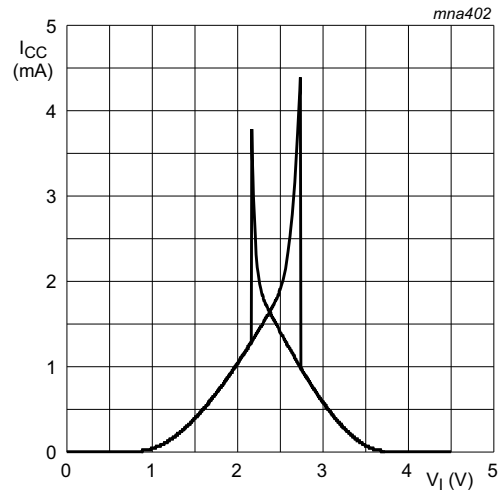


Fig 10. Typical 74AHC1G14 transfer characteristics; $V_{CC} = 4.5\text{ V}$

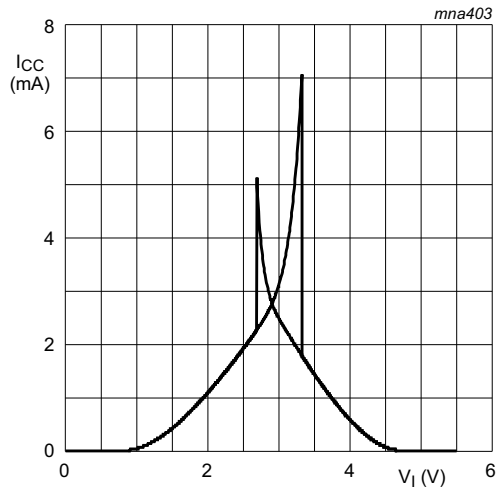


Fig 11. Typical 74AHC1G14 transfer characteristics; $V_{CC} = 5.5\text{ V}$

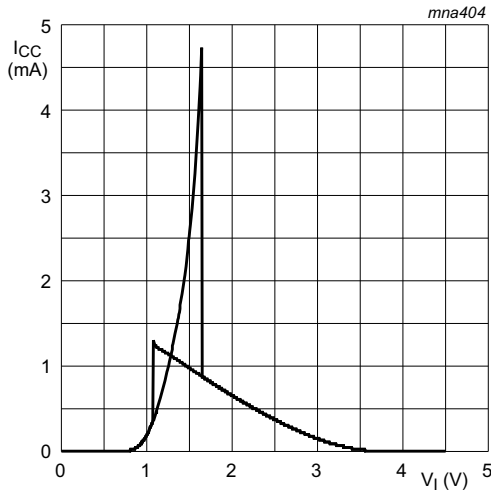


Fig 12. Typical 74AHCT1G14 transfer characteristics;
 $V_{CC} = 4.5 \text{ V}$

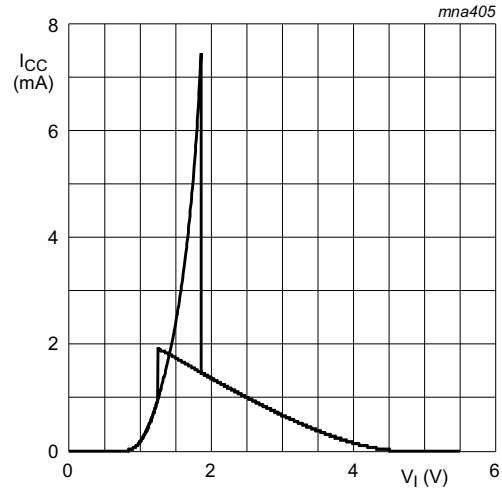


Fig 13. Typical 74AHCT1G14 transfer characteristics;
 $V_{CC} = 5.5 \text{ V}$

14. Application information

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

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

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 %;

$\Delta I_{CC(\text{AV})}$ = 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.

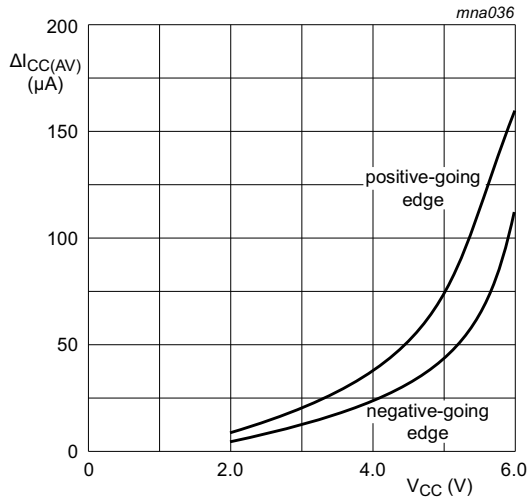


Fig 14. Average additional I_{CC} for 74AHC1G14 Schmitt trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$

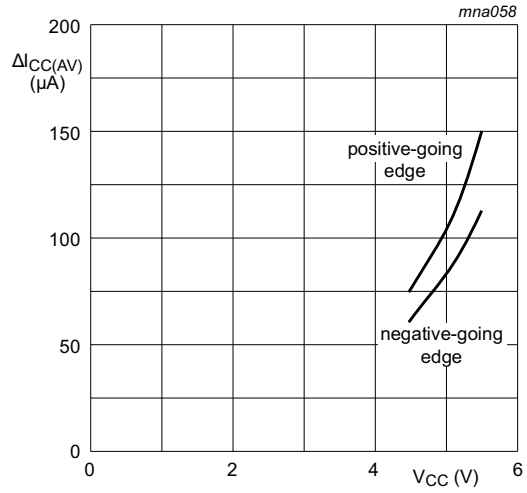
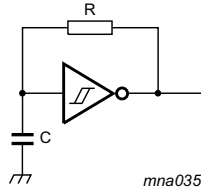


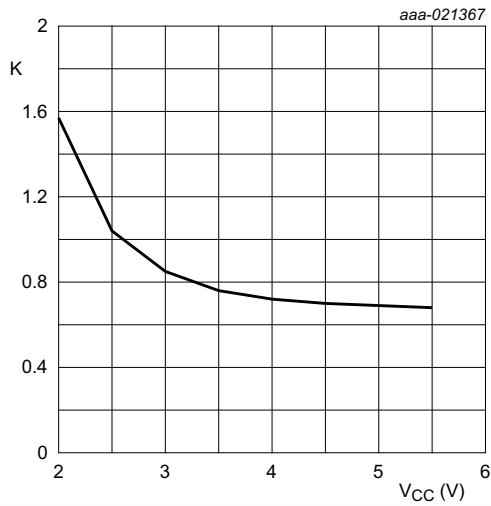
Fig 15. Average additional I_{CC} for 74AHCT1G14 Schmitt trigger devices; linear change of V_I between $0.1V_{CC}$ to $0.9V_{CC}$



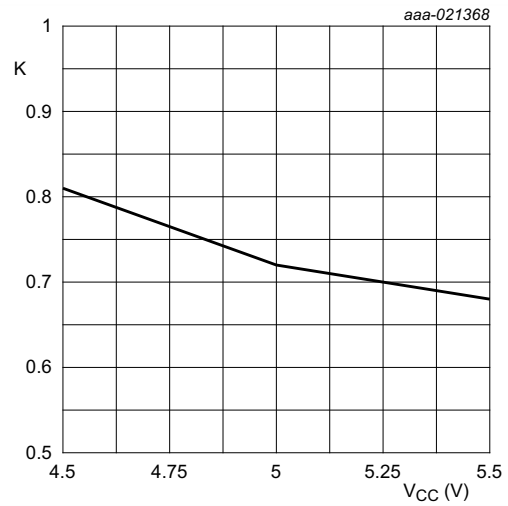
For 74AHC1G14 and 74AHCT1G14: $f = \frac{1}{T} \approx \frac{1}{K \times RC}$

For K-factor, see [Figure 17](#)

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



K-factor for 74AHC1G14



K-factor for 74AHCT1G14

Fig 17. Typical K-factor for relaxation oscillator

15. Package outline

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

SOT353-1

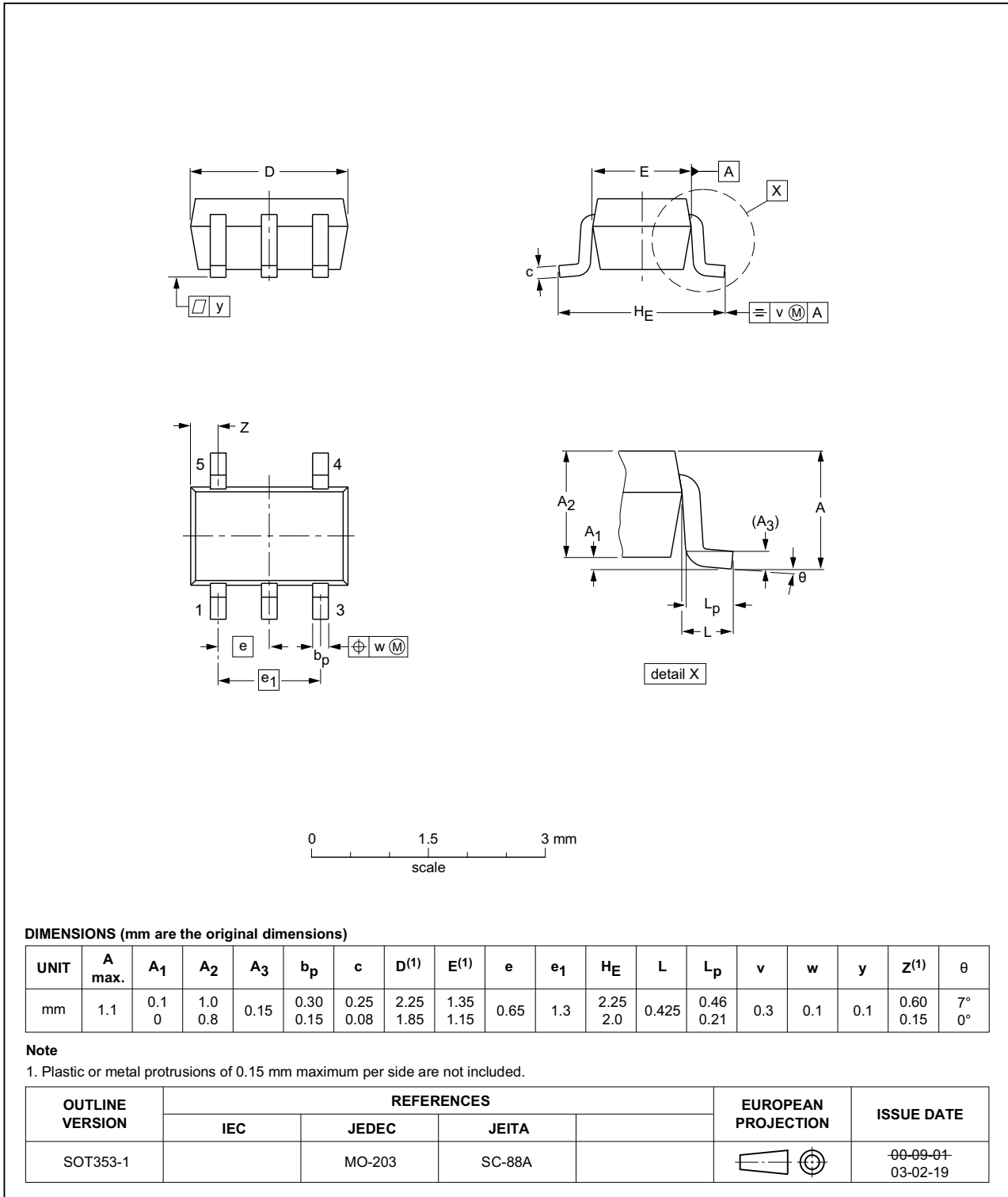


Fig 18. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

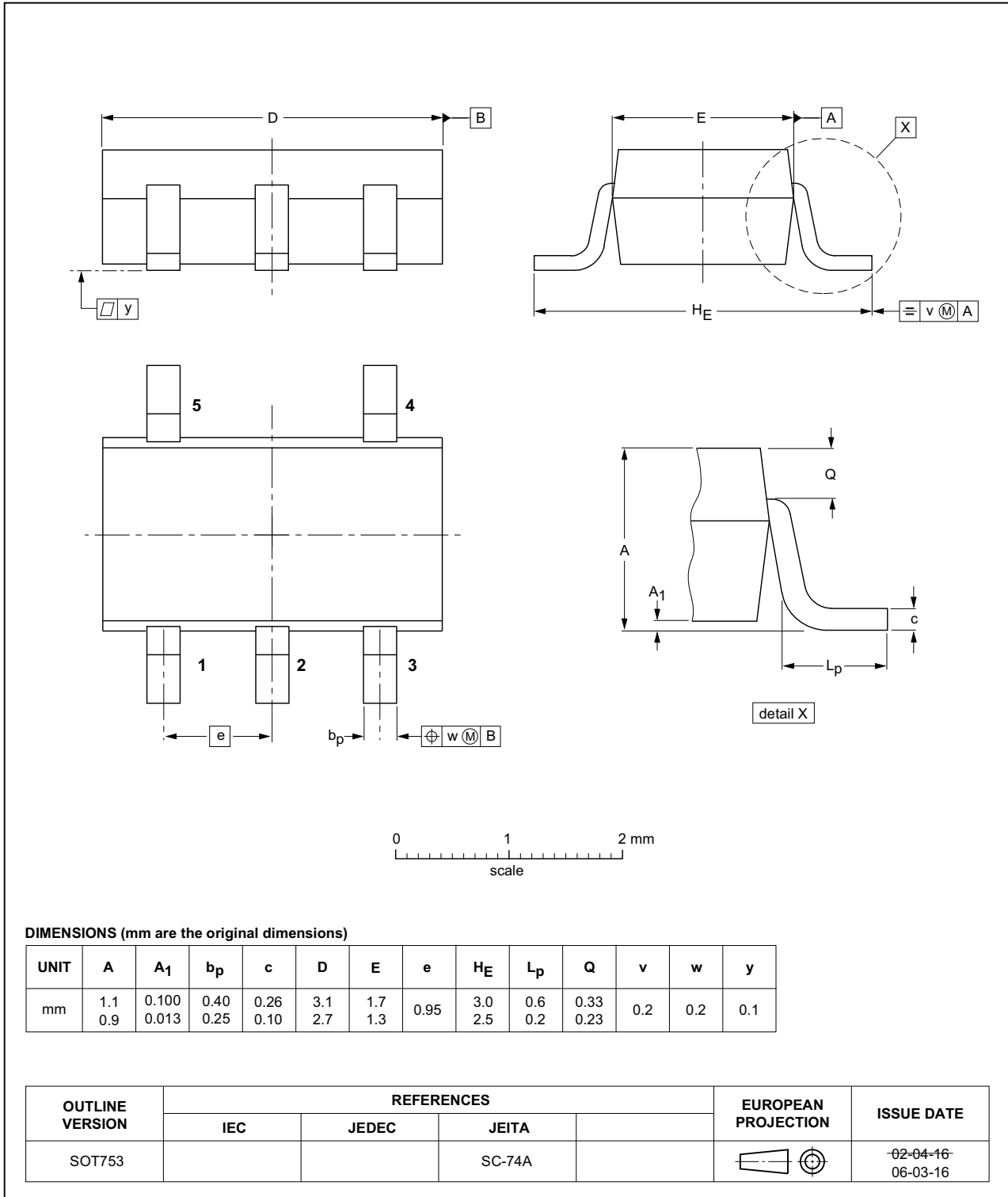


Fig 19. Package outline SOT753 (SC-74A)

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 v.8	20160113	Product data sheet	-	74AHC_AHCT1G14 v.7
Modifications:	<ul style="list-style-type: none"> Figure 17 added (typical K-factor for relaxation oscillator). 			
74AHC_AHCT1G14 v.7	20141118	Product data sheet	-	74AHC_AHCT1G14 v.6
Modifications:	<ul style="list-style-type: none"> Section 5: table note added. 			
74AHC_AHCT1G14 v.6	20090518	Product data sheet	-	74AHC_AHCT1G14 v.5
Modifications:	<ul style="list-style-type: none"> Table 7: the conditions for HIGH-level output voltage and LOW-level output voltage have been changed. 			
74AHC_AHCT1G14 v.5	20070629	Product data sheet	-	74AHC_AHCT1G14 v.4
74AHC_AHCT1G14 v.4	20020528	Product specification	-	74AHC_AHCT1G14 v.3
74AHC_AHCT1G14 v.3	20020218	Product specification	-	74AHC_AHCT1G14 v.2
74AHC_AHCT1G14 v.2	20010222	Product specification	-	74AHC_AHCT1G14 v.1
74AHC_AHCT1G14 v.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.nexperia.com>.

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For more information, please visit: <http://www.nexperia.com>

For sales office addresses, please send an email to: salesaddresses@nexperia.com

20. Contents

1	General description	1
2	Features and benefits	1
3	Applications	1
4	Ordering information	1
5	Marking	2
6	Functional diagram	2
7	Pinning information	2
7.1	Pinning	2
7.2	Pin description	2
8	Functional description	3
9	Limiting values	3
10	Recommended operating conditions	3
11	Static characteristics	4
11.1	Transfer characteristics	5
12	Dynamic characteristics	6
13	Waveforms	7
13.1	Transfer characteristic waveforms	7
14	Application information	9
15	Package outline	12
16	Abbreviations	14
17	Revision history	14
18	Legal information	15
18.1	Data sheet status	15
18.2	Definitions	15
18.3	Disclaimers	15
18.4	Trademarks	16
19	Contact information	16
20	Contents	17

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