

# 74AHC1G14; 74AHCT1G14

## Inverting Schmitt trigger

Rev. 9 — 3 April 2020

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
- 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				

## 5. Marking

Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
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

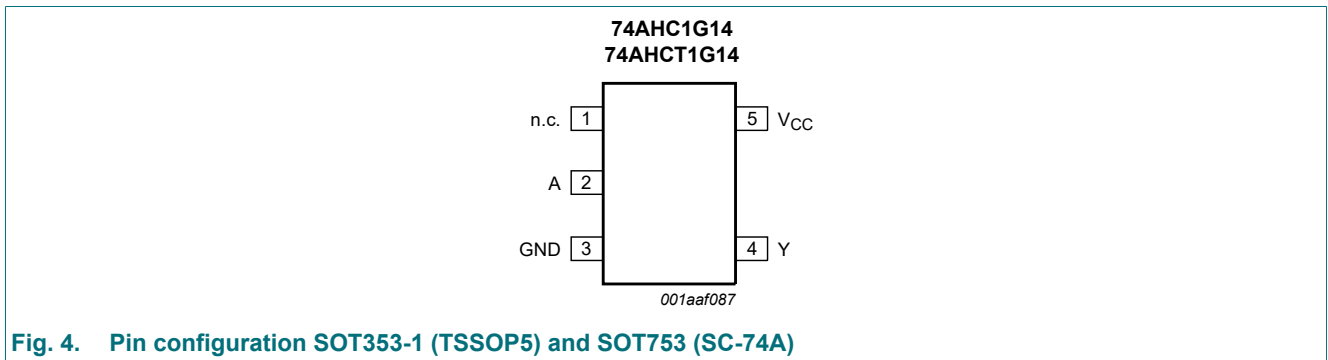


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

### 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 <sub>CC</sub>	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]	-	$\pm 20$	mA
$I_O$	output current	$-0.5$ V $< V_O < V_{CC} + 0.5$ V	-	$\pm 25$	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.

## 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	
<b>For type 74AHC1G14</b>										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	1.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 3.0 V	2.9	3.0	-	2.9	-	2.9	-	V
		I <sub>O</sub> = -50 µA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V	2.58	-	-	2.48	-	2.40	-	V
		I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V	3.94	-	-	3.8	-	3.70	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>								
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 3.0 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 50 µA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	10	-	40	µA
C <sub>I</sub>	input capacitance		-	1.5	10	-	10	-	10	pF
<b>For type 74AHCT1G14</b>										
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = -50 µA	4.4	4.5	-	4.4	-	4.4	-	V
		I <sub>O</sub> = -8.0 mA	3.94	-	-	3.8	-	3.70	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V								
		I <sub>O</sub> = 50 µA	-	0	0.1	-	0.1	-	0.1	V
		I <sub>O</sub> = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	10	-	40	µA
ΔI <sub>CC</sub>	additional supply current	per input pin; V <sub>I</sub> = 3.4 V; other inputs at V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
C <sub>I</sub>	input capacitance		-	1.5	10	-	10	-	10	pF

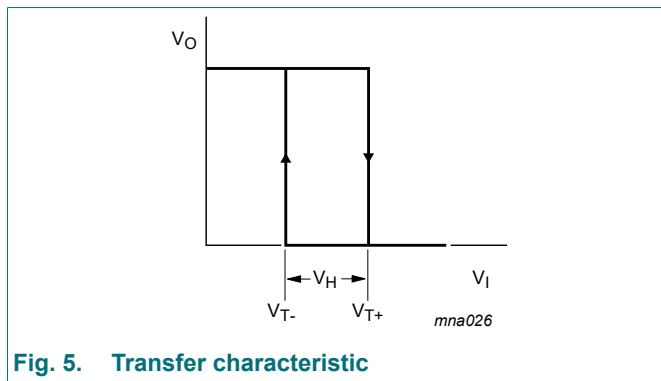
### 11.1. Transfer characteristics

**Table 8. Transfer characteristics**

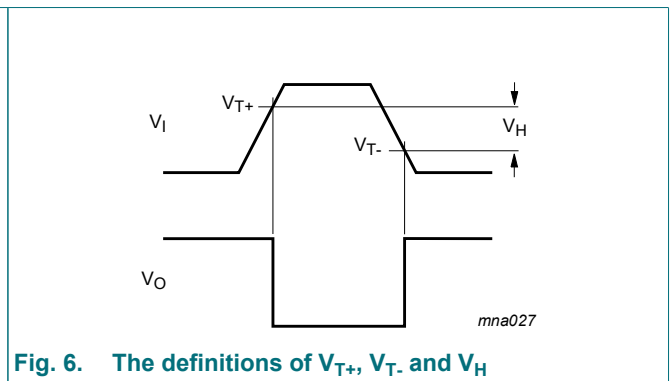
At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See Fig. 5 and Fig. 6.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>For type 74AHC1G14</b>										
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 3.0 V	-	-	2.2	-	2.2	-	2.2	V
		V <sub>CC</sub> = 4.5 V	-	-	3.15	-	3.15	-	3.15	V
		V <sub>CC</sub> = 5.5 V	-	-	3.85	-	3.85	-	3.85	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 3.0 V	0.9	-	-	0.9	-	0.9	-	V
		V <sub>CC</sub> = 4.5 V	1.35	-	-	1.35	-	1.35	-	V
		V <sub>CC</sub> = 5.5 V	1.65	-	-	1.65	-	1.65	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 3.0 V	0.3	-	1.2	0.3	1.2	0.25	1.2	V
		V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.5	-	1.6	0.5	1.6	0.45	1.6	V
<b>For type 74AHCT1G14</b>										
V <sub>T+</sub>	positive-going threshold voltage	V <sub>CC</sub> = 4.5 V	-	-	2.0	-	2.0	-	2.0	V
		V <sub>CC</sub> = 5.5 V	-	-	2.0	-	2.0	-	2.0	V
V <sub>T-</sub>	negative-going threshold voltage	V <sub>CC</sub> = 4.5 V	0.5	-	-	0.5	-	0.5	-	V
		V <sub>CC</sub> = 5.5 V	0.6	-	-	0.6	-	0.6	-	V
V <sub>H</sub>	hysteresis voltage	V <sub>CC</sub> = 4.5 V	0.4	-	1.4	0.4	1.4	0.35	1.4	V
		V <sub>CC</sub> = 5.5 V	0.4	-	1.6	0.4	1.6	0.35	1.6	V

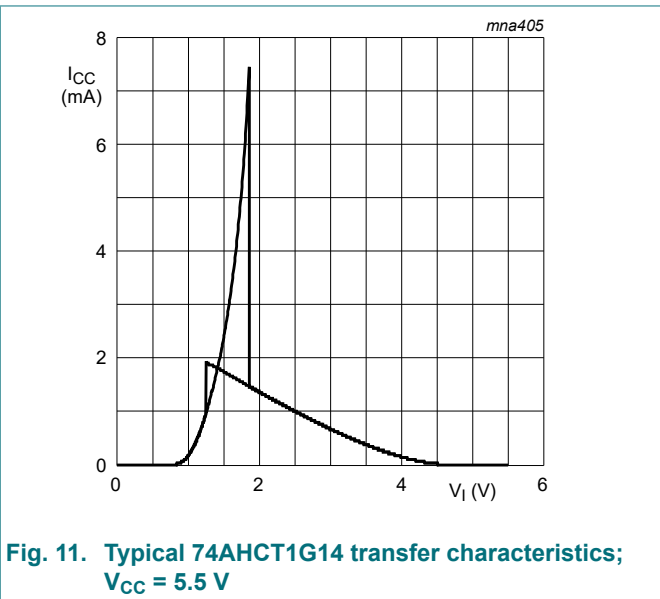
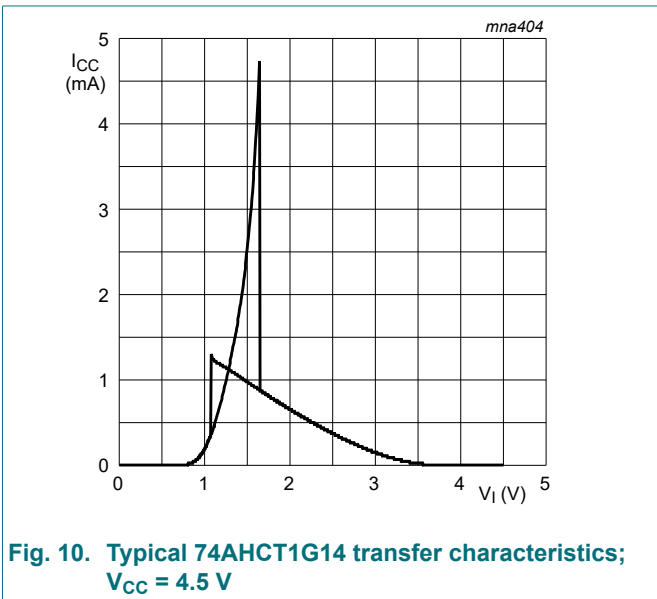
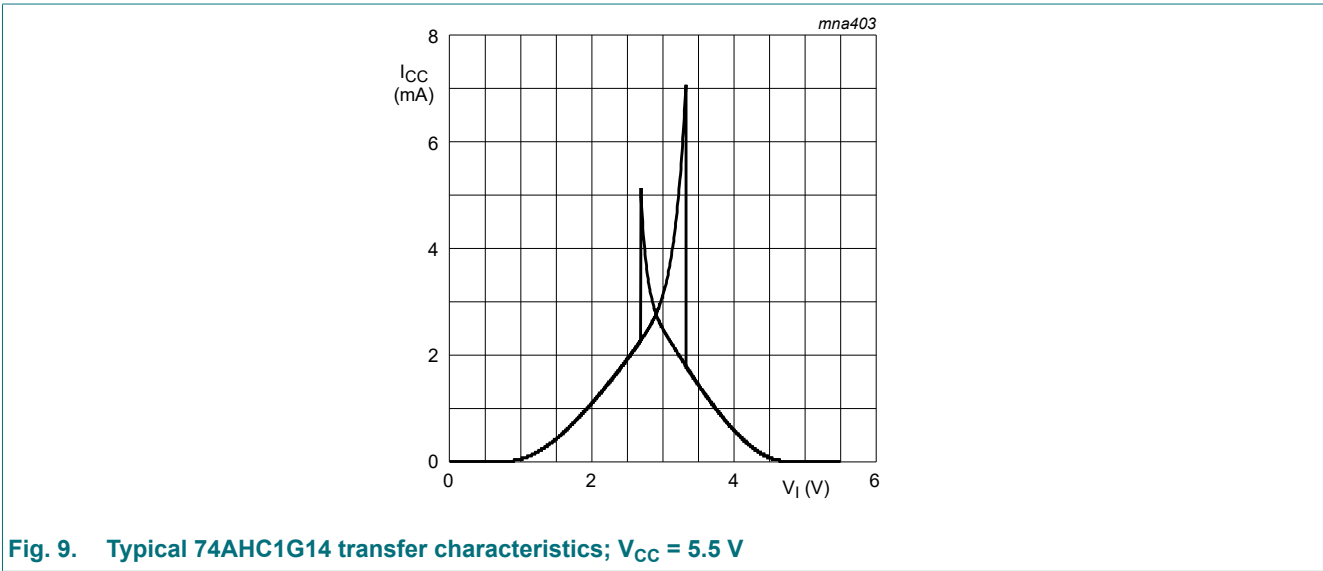
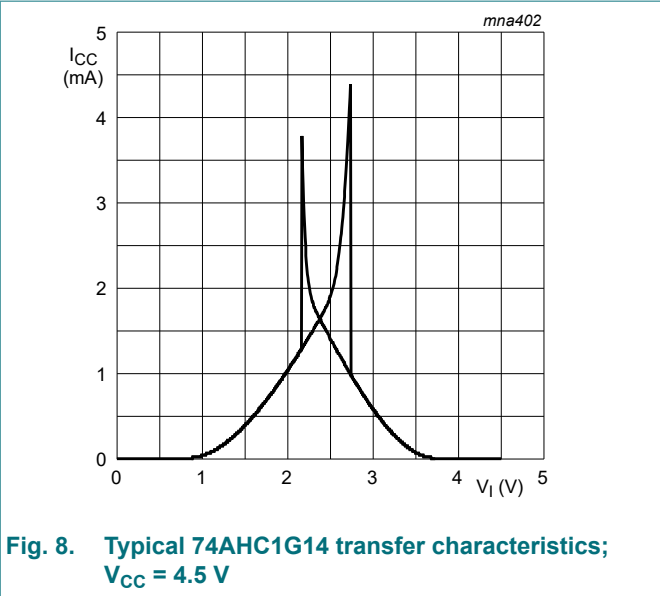
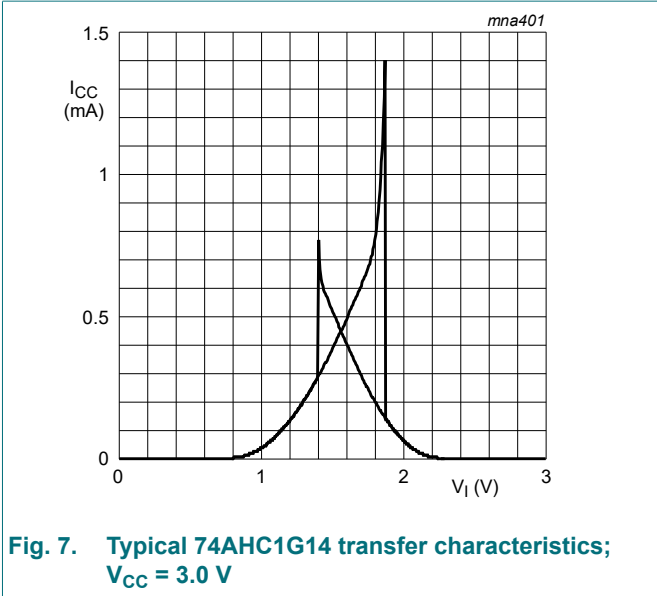
### 11.2. Transfer characteristic waveforms



**Fig. 5. Transfer characteristic**



**Fig. 6. The definitions of V<sub>T+</sub>, V<sub>T-</sub> and V<sub>H</sub>**



## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f \leq 3.0\text{ ns}$ . For waveform see Fig. 12. For test circuit see Fig. 13.

Symbol	Parameter	Conditions	25 °C			-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	Min	Max	
<b>For type 74AHC1G14</b>										
$t_{pd}$	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
		$C_L = 50\text{ pF}$	-	4.6	10.6	1.0	12.0	1.0	13.5	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]	-	12	-	-	-	-	-	pF
<b>For type 74AHCT1G14</b>										
$t_{pd}$	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
		$C_L = 50\text{ pF}$	-	5.9	8.5	1.0	10.0	1.0	11.0	ns
$C_{PD}$	power dissipation capacitance	per buffer; [4]	-	13	-	-	-	-	-	pF

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[2] Typical values are measured at  $V_{CC} = 3.3\text{ V}$ .

[3] Typical values are measured at  $V_{CC} = 5.0\text{ V}$ .

[4]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in Volts.

12.1. Waveform and test circuit

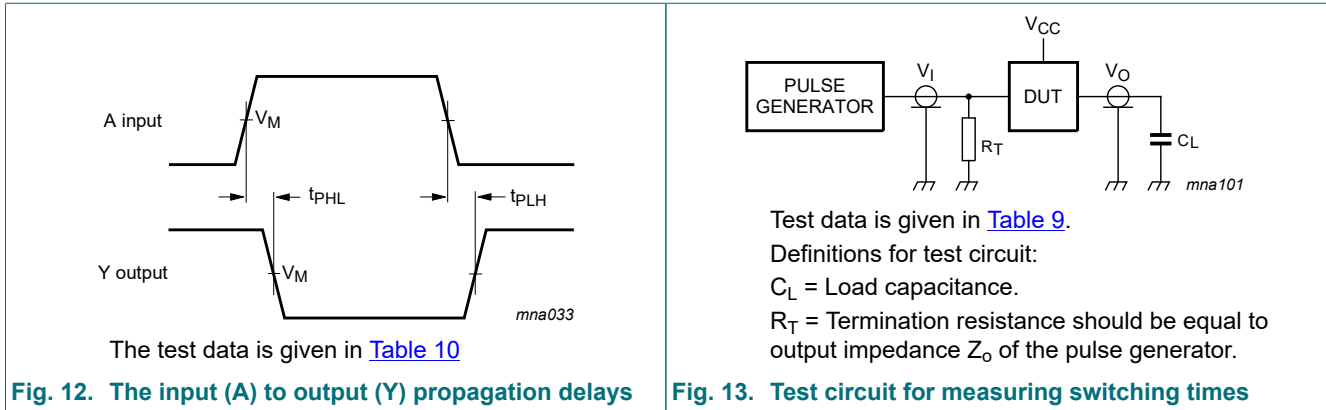


Fig. 12. The input (A) to output (Y) propagation delays

Fig. 13. 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. 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 ( $\mu W$ );
- $f_i$  = 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 ( $\mu A$ ).

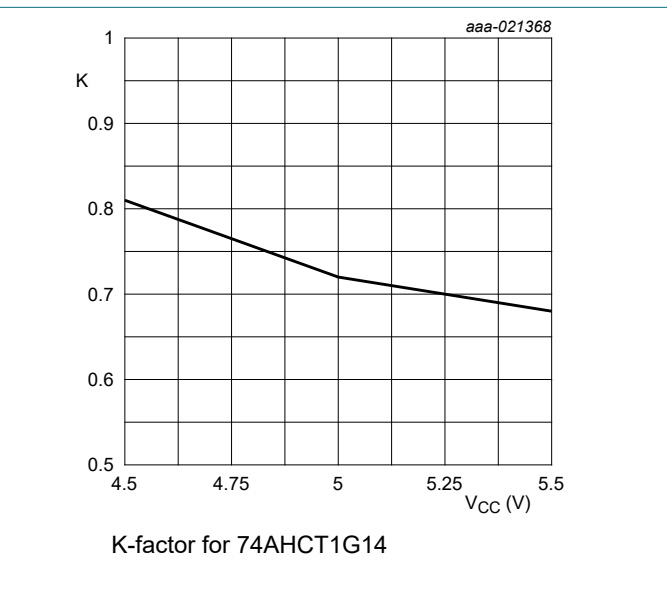
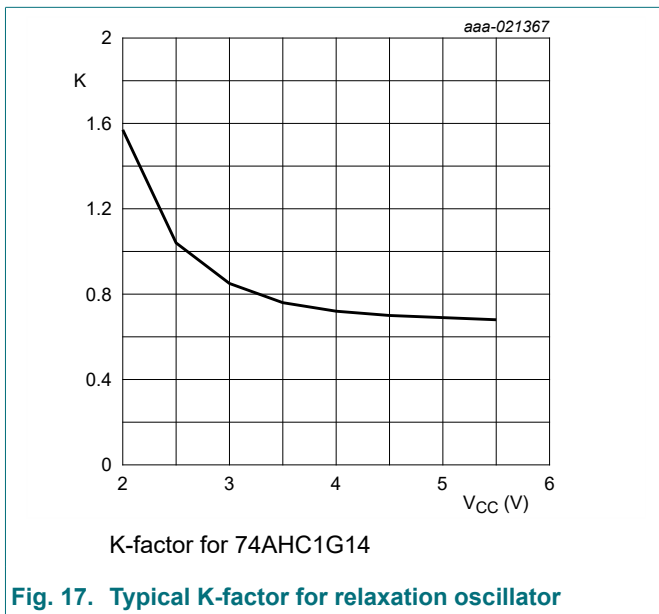
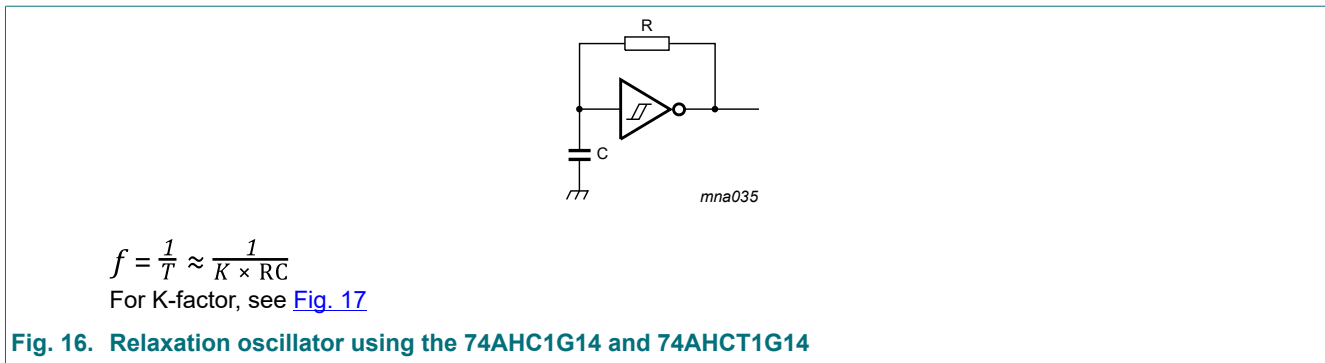
Average additional  $I_{CC}$  differs with positive or negative input transitions, as shown in [Fig. 14](#) and [Fig. 15](#).

For 74AHC1G14 and 74AHCT1G14 used in relaxation oscillator circuit, see [Fig. 16](#).

Note to the application information:

- All values given are typical unless otherwise specified.





14. Package outline

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

SOT353-1

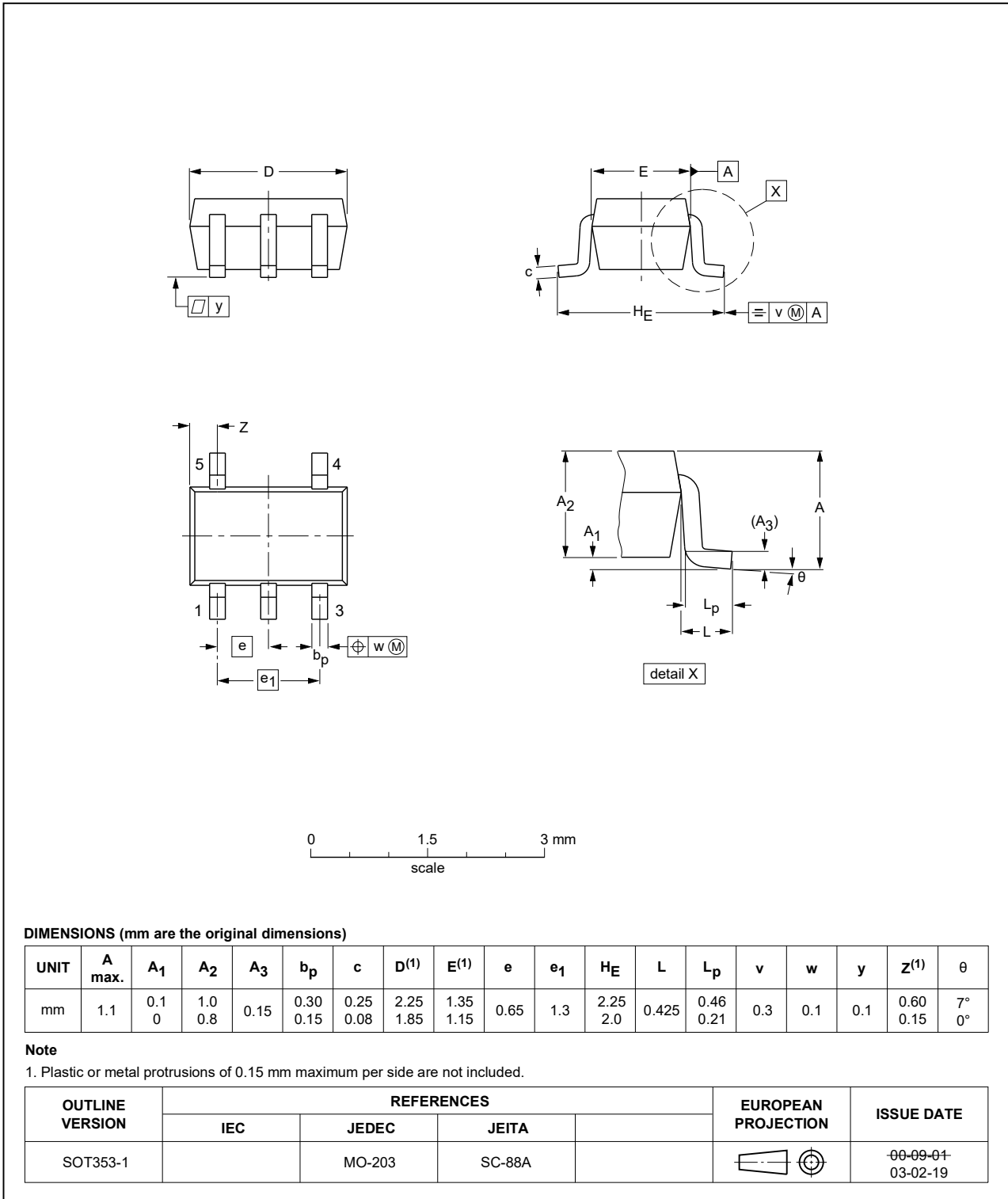


Fig. 18. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



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

## 15. 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

## 16. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AHC_AHCT1G14 v.9	20200403	Product data sheet	-	74AHC_AHCT1G14 v.8
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li><a href="#">Table 5</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74AHC_AHCT1G14 v.8	20160113	Product data sheet	-	74AHC_AHCT1G14 v.7
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Fig. 17</a> added (typical K-factor for relaxation oscillator).</li> </ul>			
74AHC_AHCT1G14 v.7	20141118	Product data sheet	-	74AHC_AHCT1G14 v.6
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 2</a>: table note added.</li> </ul>			
74AHC_AHCT1G14 v.6	20090518	Product data sheet	-	74AHC_AHCT1G14 v.5
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 7</a>: the conditions for HIGH-level output voltage and LOW-level output voltage have been changed.</li> </ul>			
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	-	-

## 17. 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".
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For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

moschip.ru

moschip.ru\_4

moschip.ru\_6

moschip.ru\_9