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Kind regards,

Team Nexperia

# 74HC1G14; 74HCT1G14

## Inverting Schmitt trigger

Rev. 6 — 27 December 2012

Product data sheet

## 1. General description

74HC1G14 and 74HCT1G14 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 HC device has CMOS input switching levels and supply voltage range 2 V to 6 V.

The HCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

The standard output currents are half of those of the 74HC14 and 74HCT14.

## 2. Features and benefits

- Symmetrical output impedance
- High noise immunity
- 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
74HC1G14GW 74HCT1G14GW	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HC1G14GV 74HCT1G14GV	$-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$	SC-74A	plastic surface-mounted package; 5 leads	SOT753



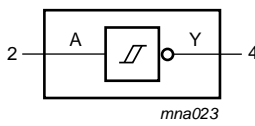
## 5. Marking

Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
74HC1G14GW	HF
74HCT1G14GW	TF
74HC1G14GV	H14
74HCT1G14GV	T14

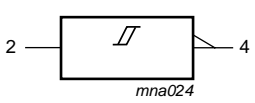
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram



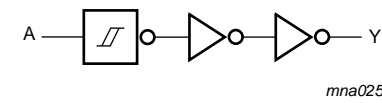
*mna023*

**Fig 1. Logic symbol**



*mna024*

**Fig 2. IEC logic symbol**



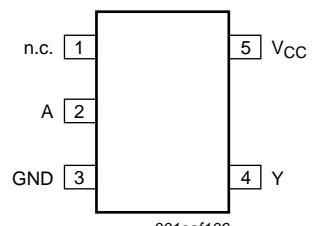
*mna025*

**Fig 3. Logic diagram**

## 7. Pinning information

### 7.1 Pinning

**74HC1G14**  
**74HCT1G14**



*001aaf106*

**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 <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). Voltages are referenced to GND (ground = 0 V). [\[1\]](#)

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+7.0	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < -0.5 V or V <sub>I</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < -0.5 V or V <sub>O</sub> > V <sub>CC</sub> + 0.5 V	-	±20	mA
I <sub>O</sub>	output current	-0.5 V < V <sub>O</sub> < V <sub>CC</sub> + 0.5 V	-	±12.5	mA
I <sub>CC</sub>	supply current		-	25	mA
I <sub>GND</sub>	ground current		-25	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	<a href="#">[2]</a> -	200	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] Above 55 °C, the value of P<sub>tot</sub> derates linearly with 2.5 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

Symbol	Parameter	Conditions	74HC1G14			74HCT1G14			Unit
			Min	Typ	Max	Min	Typ	Max	
V <sub>CC</sub>	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
V <sub>I</sub>	input voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	+25	+125	-40	+25	+125	°C

## 11. Static characteristics

**Table 7. Static characteristics**

Voltages are referenced to GND (ground = 0 V). All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

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

**For type 74HC1G14**

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> = -20 μA; V <sub>CC</sub> = 2.0 V	1.9	2.0	-	1.9	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	V
		I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 6.0 V	5.9	6.0	-	5.9	-	V
		I <sub>O</sub> = -2.0 mA; V <sub>CC</sub> = 4.5 V	4.13	4.32	-	3.7	-	V
		I <sub>O</sub> = -2.6 mA; V <sub>CC</sub> = 6.0 V	5.63	5.81	-	5.2	-	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> = 20 μA; V <sub>CC</sub> = 2.0 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 6.0 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 2.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.33	-	0.4	V
		I <sub>O</sub> = 2.6 mA; V <sub>CC</sub> = 6.0 V	-	0.16	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 6.0 V	-	-	1.0	-	1.0	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> = 6.0 V	-	-	10	-	20	μA
C <sub>I</sub>	input capacitance		-	1.5	-	-	-	pF
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 2.0 V	0.7	1.09	1.5	0.7	1.5	V
		V <sub>CC</sub> = 4.5 V	1.7	2.36	3.15	1.7	3.15	V
		V <sub>CC</sub> = 6.0 V	2.1	3.12	4.2	2.1	4.2	V
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 2.0 V	0.3	0.60	0.9	0.3	0.9	V
		V <sub>CC</sub> = 4.5 V	0.9	1.53	2.0	0.9	2.0	V
		V <sub>CC</sub> = 6.0 V	1.2	2.08	2.6	1.2	2.6	V
V <sub>H</sub>	hysteresis voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		V <sub>CC</sub> = 2.0 V	0.2	0.48	1.0	0.2	1.0	V
		V <sub>CC</sub> = 4.5 V	0.4	0.83	1.4	0.4	1.4	V
		V <sub>CC</sub> = 6.0 V	0.6	1.04	1.6	0.6	1.6	V

**For type 74HCT1G14**

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> = -20 μA; V <sub>CC</sub> = 4.5 V	4.4	4.5	-	4.4	-	V
		I <sub>O</sub> = -2.0 mA; V <sub>CC</sub> = 4.5 V	4.13	4.32	-	3.7	-	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> = 20 μA; V <sub>CC</sub> = 4.5 V	-	0	0.1	-	0.1	V
		I <sub>O</sub> = 2.0 mA; V <sub>CC</sub> = 4.5 V	-	0.15	0.33	-	0.4	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = V <sub>CC</sub> or GND; V <sub>CC</sub> = 5.5 V	-	-	1.0	-	1.0	μA

**Table 7. Static characteristics ...continued**

Voltages are referenced to GND (ground = 0 V). All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ .

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
$I_{CC}$	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\text{ A}$ ; $V_{CC} = 5.5\text{ V}$	-	-	10	-	20	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per input; $V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$ ; $V_I = V_{CC} - 2.1\text{ V}$ ; $I_O = 0\text{ A}$	-	-	500	-	850	$\mu\text{A}$
$C_I$	input capacitance		-	1.5	-	-	-	pF
$V_{T+}$	positive-going threshold voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		$V_{CC} = 4.5\text{ V}$	1.2	1.55	1.9	1.2	1.9	V
		$V_{CC} = 5.5\text{ V}$	1.4	1.80	2.1	1.4	2.1	V
$V_{T-}$	negative-going threshold voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		$V_{CC} = 4.5\text{ V}$	0.5	0.76	1.2	0.5	1.2	V
		$V_{CC} = 5.5\text{ V}$	0.6	0.90	1.4	0.6	1.4	V
$V_H$	hysteresis voltage	see <a href="#">Figure 7</a> and <a href="#">Figure 8</a>						
		$V_{CC} = 4.5\text{ V}$	0.4	0.80	-	0.4	-	V
		$V_{CC} = 5.5\text{ V}$	0.4	0.90	-	0.4	-	V

## 12. Dynamic characteristics

**Table 8. Dynamic characteristics**

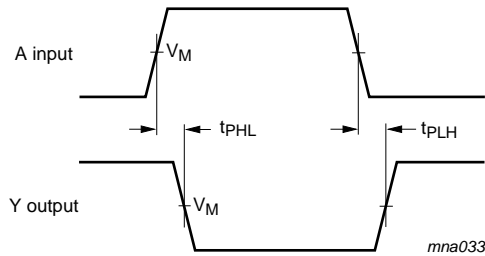
$GND = 0\text{ V}$ ;  $t_r = t_f \leq 6.0\text{ ns}$ ; All typical values are measured at  $T_{amb} = 25\text{ }^{\circ}\text{C}$ . For test circuit see [Figure 6](#)

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>For type 74HC1G14</b>								
$t_{pd}$	propagation delay	A to Y; see <a href="#">Figure 5</a>	<a href="#">[1]</a>					
		$V_{CC} = 2.0\text{ V}$ ; $C_L = 50\text{ pF}$	-	25	155	-	190	ns
		$V_{CC} = 4.5\text{ V}$ ; $C_L = 50\text{ pF}$	-	12	31	-	38	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	10	-	-	-	ns
		$V_{CC} = 6.0\text{ V}$ ; $C_L = 50\text{ pF}$	-	11	26	-	32	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC}$	<a href="#">[2]</a>	20	-	-	-	pF
<b>For type 74HCT1G14</b>								
$t_{pd}$	propagation delay	A to Y; see <a href="#">Figure 5</a>	<a href="#">[1]</a>					
		$V_{CC} = 4.5\text{ V}$ ; $C_L = 50\text{ pF}$	-	17	43	-	51	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	15	-	-	-	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND$ to $V_{CC} - 1.5\text{ V}$	<a href="#">[2]</a>	22	-	-	-	pF

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

[2]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu\text{W}$ ).  
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  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  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

### 13. Waveforms

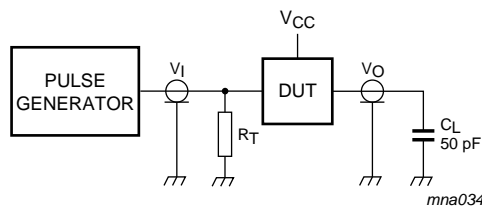


Measurement points are given in [Table 9](#).

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

**Table 9. Measurement points**

Type number	Input		Output
	$V_I$	$V_M$	$V_M$
74HC1G14	GND to $V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74HCT1G14	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$



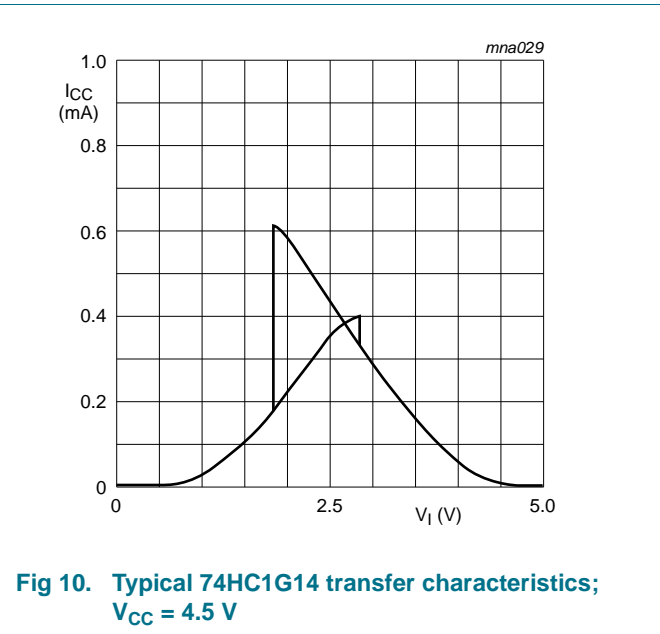
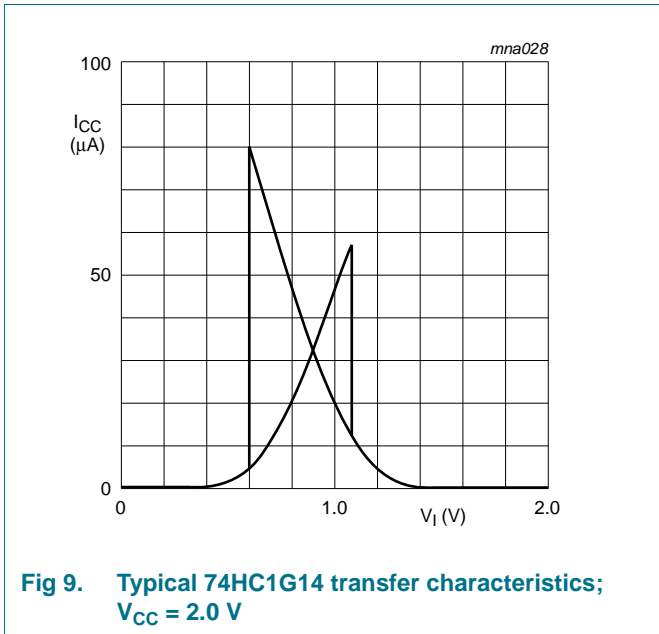
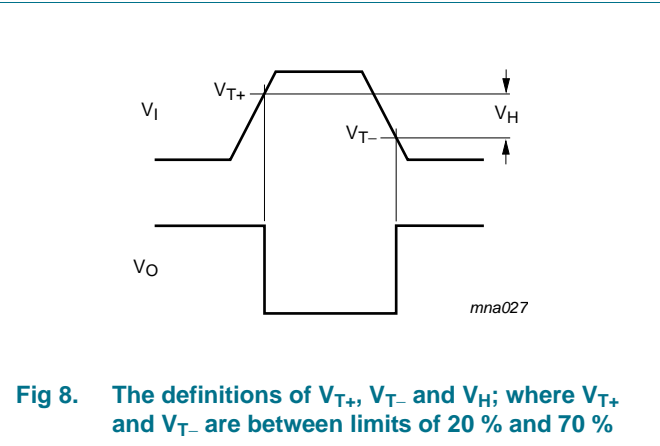
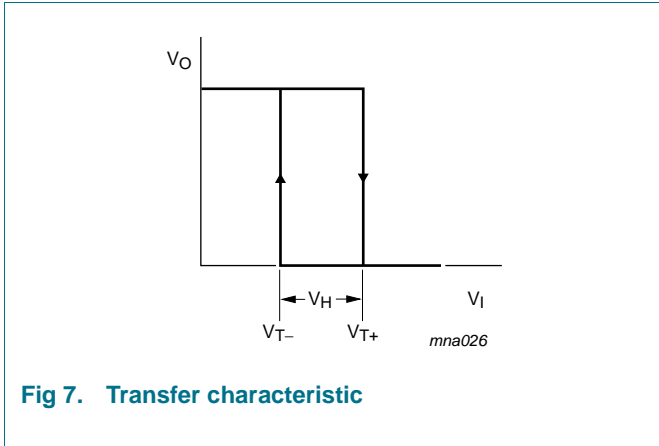
Test data is given in [Table 8](#). Definitions for test circuit:

$C_L$  = Load capacitance including jig and probe capacitance.

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

**Fig 6. Load circuitry for switching times**

## 14. Transfer characteristics waveforms





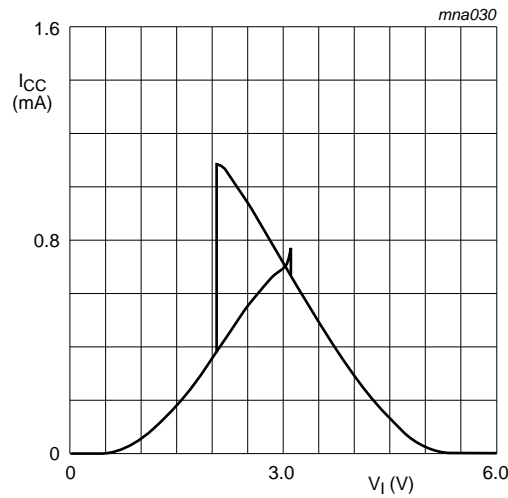


Fig 11. Typical 74HC1G14 transfer characteristics; V<sub>CC</sub> = 6.0 V

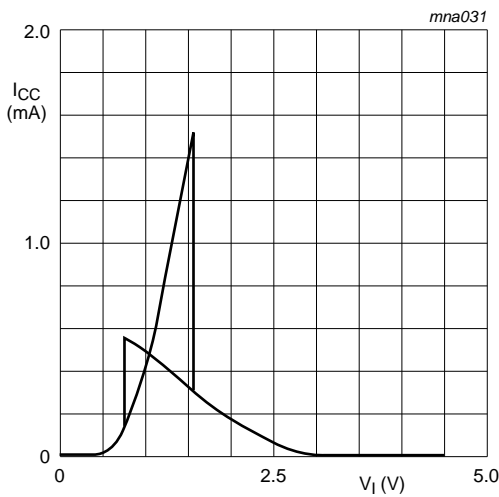


Fig 12. Typical 74HCT1G14 transfer characteristics; V<sub>CC</sub> = 4.5 V

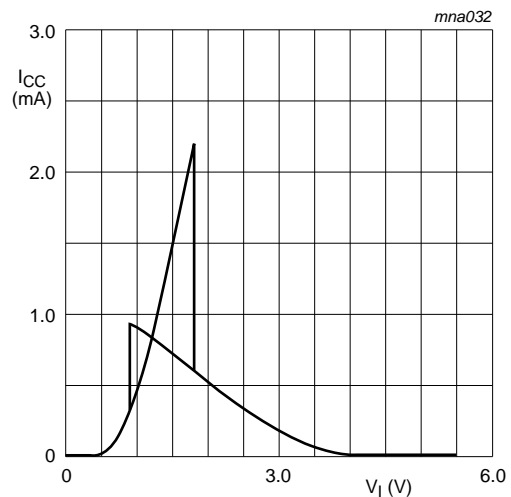


Fig 13. Typical 74HCT1G14 transfer characteristics; V<sub>CC</sub> = 5.5 V

## 15. Application information

The slow input rise and fall times cause additional power dissipation, this 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)

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

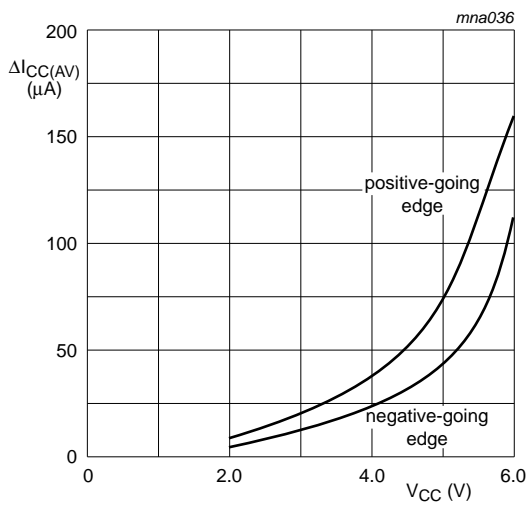
$t_f$  = fall time (ns); 90 % to 10 %

$\Delta I_{CC(AV)}$  = average additional supply current ( $\mu A$ )

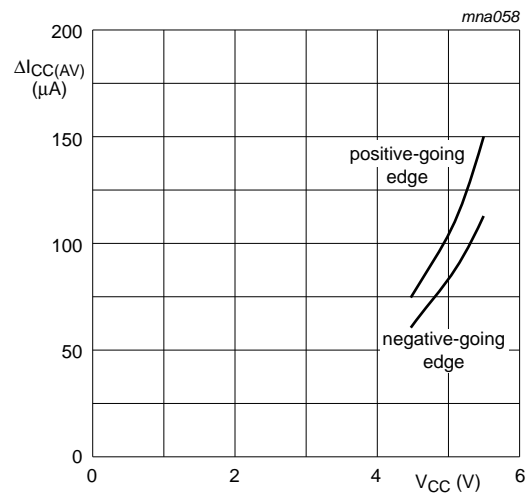
$\Delta I_{CC(AV)}$  differs with positive or negative input transitions, as shown in [Figure 14](#) and [Figure 15](#).

74HC1G14 and 74HCT1G14 used in relaxation oscillator circuit, see [Figure 16](#).

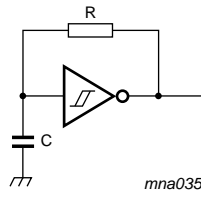
**Remark:** All values given are typical unless otherwise specified.



**Fig 14.**  $\Delta I_{CC(AV)}$  for 74HC1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$



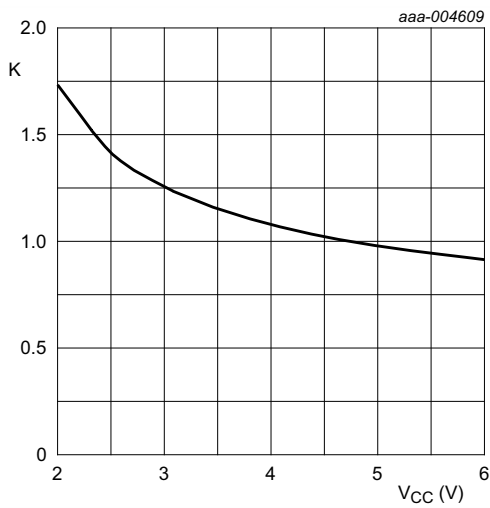
**Fig 15.**  $\Delta I_{CC(AV)}$  for 74HCT1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$



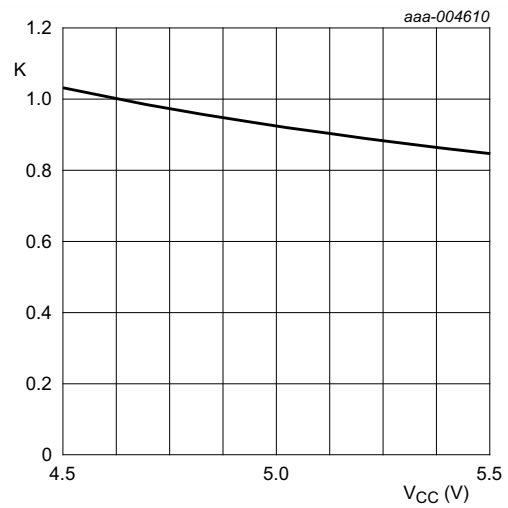
For 74HC1G14 and 74HCT1G14:  $f = \frac{1}{T} \approx \frac{1}{K \times RC}$

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

**Fig 16. Relaxation oscillator using 74HC1G14 and 74HCT1G14**



K-factor for 74HC1G14



K-factor for 74HCT1G14

**Fig 17. Typical K-factor for relaxation oscillator**

16. Package outline

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

SOT353-1

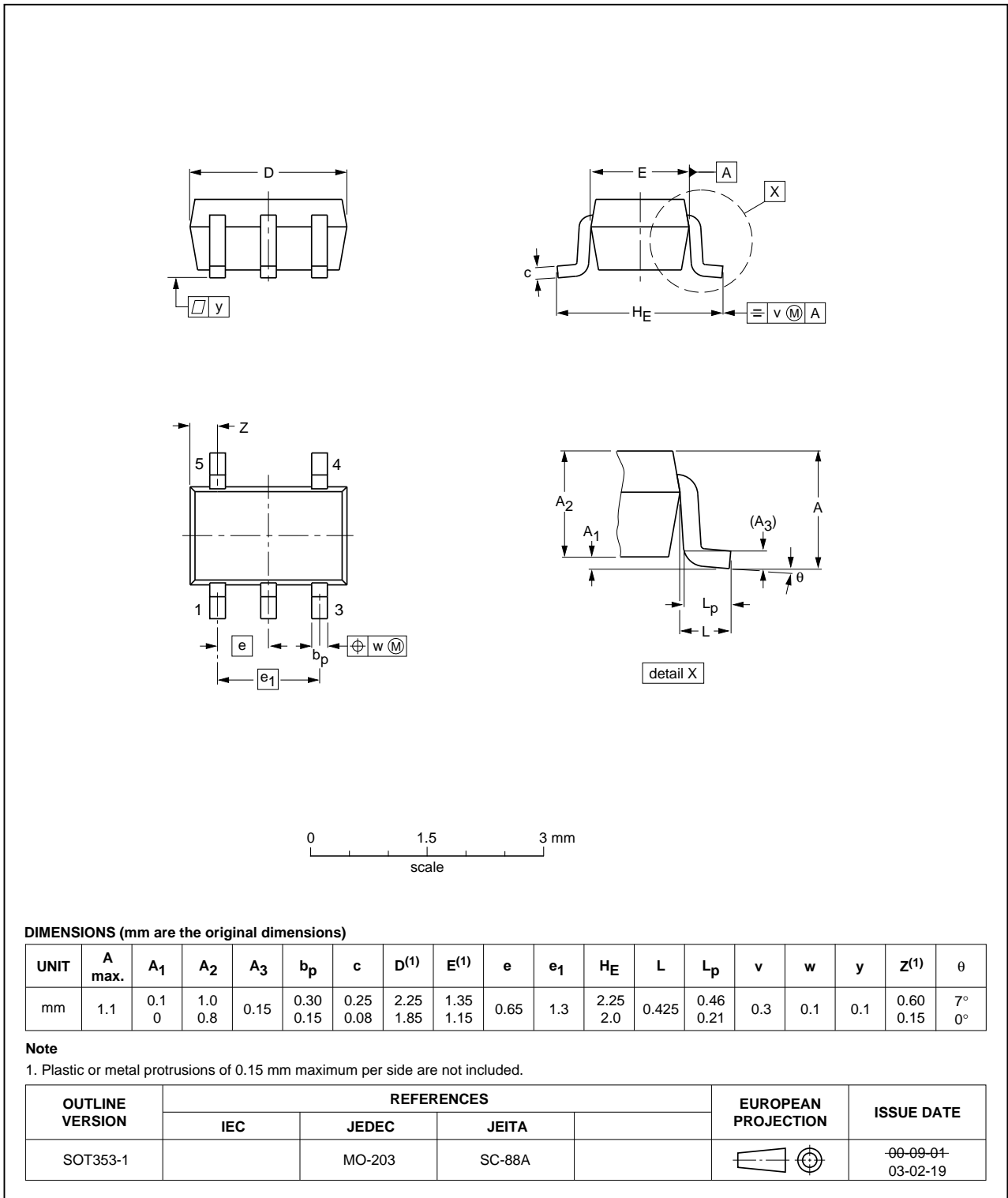


Fig 18. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

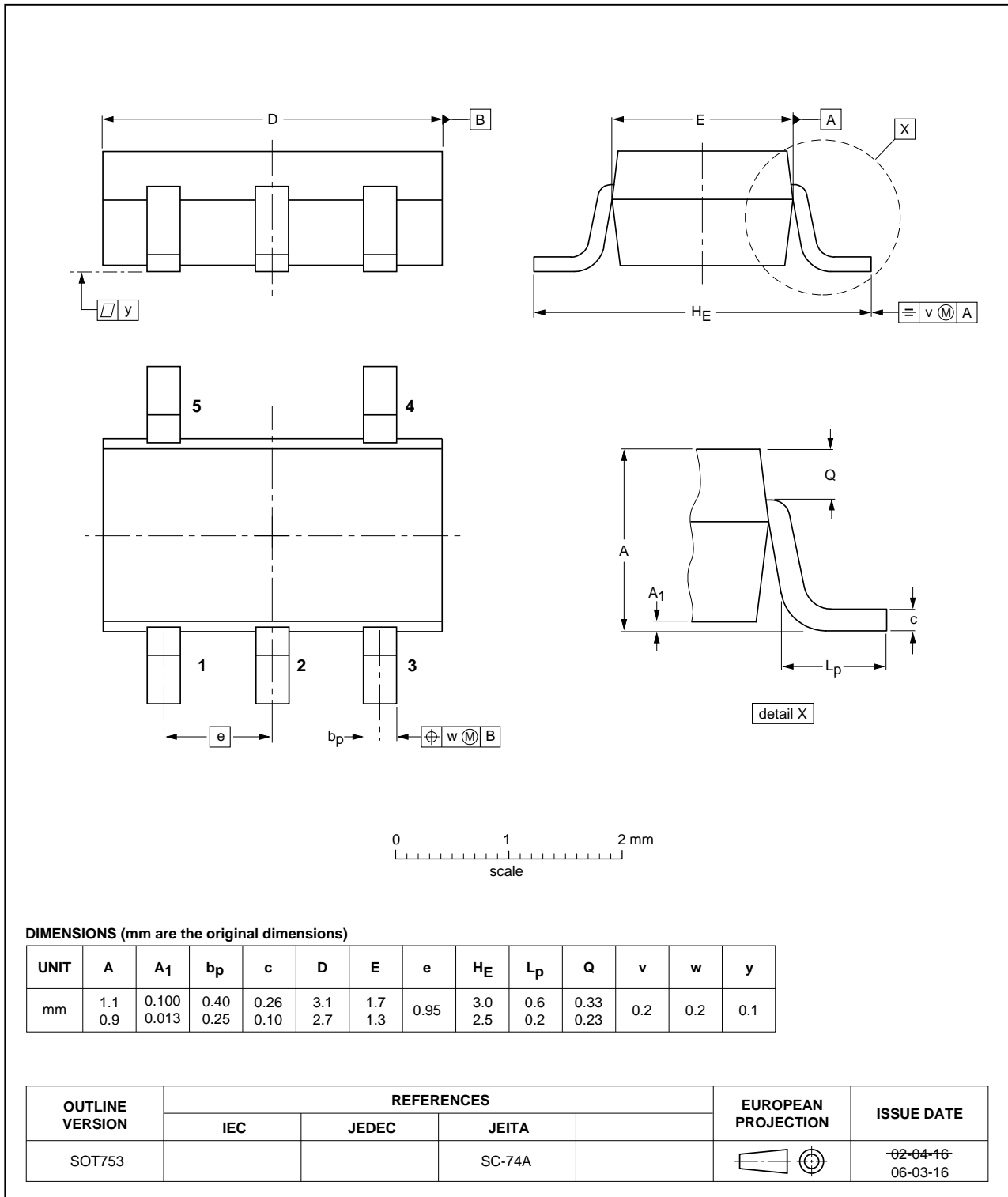


Fig 19. Package outline SOT753 (SC-74A)

## 17. Abbreviations

Table 10. Abbreviations

Acronym	Description
DUT	Device Under Test
TTL	Transistor-Transistor Logic

## 18. Revision history

Table 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G14 v.6	20121227	Product data sheet	-	74HC_HCT1G14 v.5
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Table 3</a>: Pin number Y output changed from 5 to 4 (errata).</li></ul>			
74HC_HCT1G14 v.5	20120924	Product data sheet	-	74HC_HCT1G14 v.4
Modifications:	<ul style="list-style-type: none"><li>• <a href="#">Figure 17</a> added (typical K-factor for relaxation oscillator).</li><li>• Legal page updated.</li></ul>			
74HC_HCT1G14 v.4	20070717	Product data sheet	-	74HC_HCT1G14 v.3
74HC_HCT1G14 v.3	20020515	Product specification	-	74HC_HCT1G14 v.2
74HC_HCT1G14 v.2	20010302	Product specification	-	74HC_HCT1G14 v.1
74HC_HCT1G14 v.1	19980805	Product specification	-	-

## 19. Legal information

### 19.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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