

# 74HC1G14; 74HCT1G14

## Inverting Schmitt trigger

Rev. 7 — 17 January 2022

Product data sheet

## 1. General description

The 74HC1G14; 74HCT1G14 is a single inverter with Schmitt-trigger input. Inputs include clamp diodes. This enables the use of current limiting resistors to interface inputs to voltages in excess of  $V_{CC}$ . Schmitt trigger inputs transform slowly changing input signals into sharply defined jitter-free output signals.

## 2. Features and benefits

- Wide supply voltage range from 2.0 V to 6.0 V
- Symmetrical output impedance
- High noise immunity
- CMOS low power dissipation
- Unlimited input rise and fall times
- Balanced propagation delays
- Latch-up performance exceeds 100 mA per JESD 78 Class II Level B
- Input levels:
  - For 74HC1G14: CMOS level
  - For 74HCT1G14: TTL level
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - HBM JESD22-A114-A exceeds 2000 V
  - MM JESD22-A115-1 exceeds 200 V
- Specified from -40 °C to +85° C and -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
74HC1G14GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74HCT1G14GW				
74HC1G14GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74HCT1G14GV				

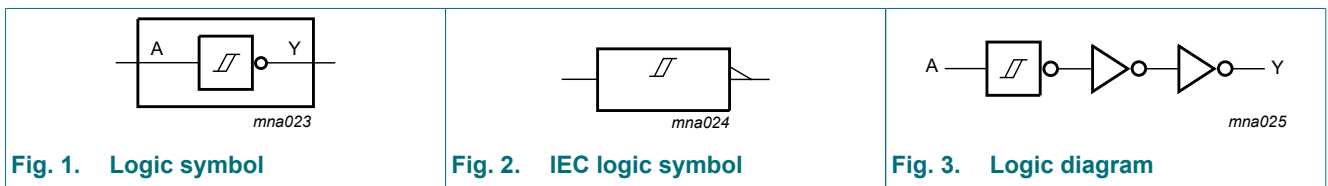
## 5. Marking

Table 2. Marking codes

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

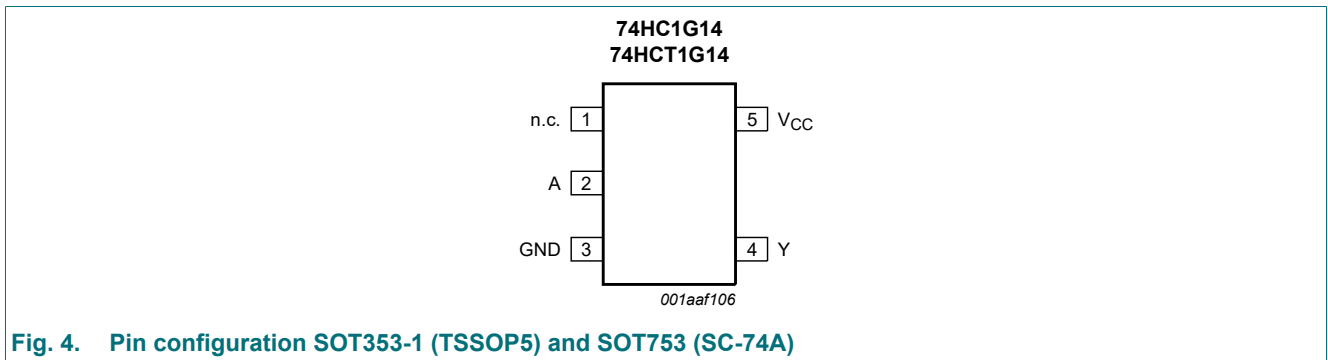
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram



## 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 <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).*

Symbol	Parameter	Conditions	Min	Max	Unit
$V_{CC}$	supply voltage		-0.5	+7.0	V
$I_{IK}$	input clamping current	$V_I < -0.5\text{ V}$ or $V_I > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_{OK}$	output clamping current	$V_O < -0.5\text{ V}$ or $V_O > V_{CC} + 0.5\text{ V}$	-	$\pm 20$	mA
$I_O$	output current	$-0.5\text{ V} < V_O < V_{CC} + 0.5\text{ V}$ [1]	-	$\pm 12.5$	mA
$I_{CC}$	supply current		-	25	mA
$I_{GND}$	ground current		-25	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40\text{ °C}$ to $+125\text{ °C}$ [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	74HC1G14			74HCT1G14			Unit
			Min	Typ	Max	Min	Typ	Max	
$V_{CC}$	supply voltage		2.0	5.0	6.0	4.5	5.0	5.5	V
$V_I$	input voltage		0	-	$V_{CC}$	0	-	$V_{CC}$	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). All typical values are measured at  $T_{amb} = 25\text{ °C}$ .

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>74HC1G14</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> = -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="#">Fig. 7</a> and <a href="#">Fig. 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="#">Fig. 7</a> and <a href="#">Fig. 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="#">Fig. 7</a> and <a href="#">Fig. 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

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>74HCT1G14</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> = -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
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	-	-	10	-	20	μA
ΔI <sub>CC</sub>	additional supply current	per input; V <sub>CC</sub> = 4.5 V to 5.5 V; V <sub>I</sub> = V <sub>CC</sub> - 2.1 V; I <sub>O</sub> = 0 A	-	-	500	-	850	μA
C <sub>I</sub>	input capacitance		-	1.5	-	-	-	pF
V <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Fig. 7</a> and <a href="#">Fig. 8</a>						
		V <sub>CC</sub> = 4.5 V	1.2	1.55	1.9	1.2	1.9	V
		V <sub>CC</sub> = 5.5 V	1.4	1.80	2.1	1.4	2.1	V
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Fig. 7</a> and <a href="#">Fig. 8</a>						
		V <sub>CC</sub> = 4.5 V	0.5	0.76	1.2	0.5	1.2	V
		V <sub>CC</sub> = 5.5 V	0.6	0.90	1.4	0.6	1.4	V
V <sub>H</sub>	hysteresis voltage	see <a href="#">Fig. 7</a> and <a href="#">Fig. 8</a>						
		V <sub>CC</sub> = 4.5 V	0.4	0.80	-	0.4	-	V
		V <sub>CC</sub> = 5.5 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 Fig. 6.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
<b>74HC1G14</b>								
$t_{pd}$	propagation delay	A to Y; see Fig. 5 [1]						
		$V_{CC} = 2.0\text{ V}$ ; $C_L = 50\text{ pF}$	-	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	$V_I = GND\text{ to }V_{CC}$ [2]	-	20	-	-	-	pF
<b>74HCT1G14</b>								
$t_{pd}$	propagation delay	A to Y; see Fig. 5 [1]						
		$V_{CC} = 4.5\text{ V}$ ; $C_L = 50\text{ pF}$	-	17	43	-	51	ns
		$V_{CC} = 5.0\text{ V}$ ; $C_L = 15\text{ pF}$	-	15	-	-	-	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND\text{ to }V_{CC} - 1.5\text{ V}$ [2]	-	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  $P_D$  ( $\mu\text{W}$ ).

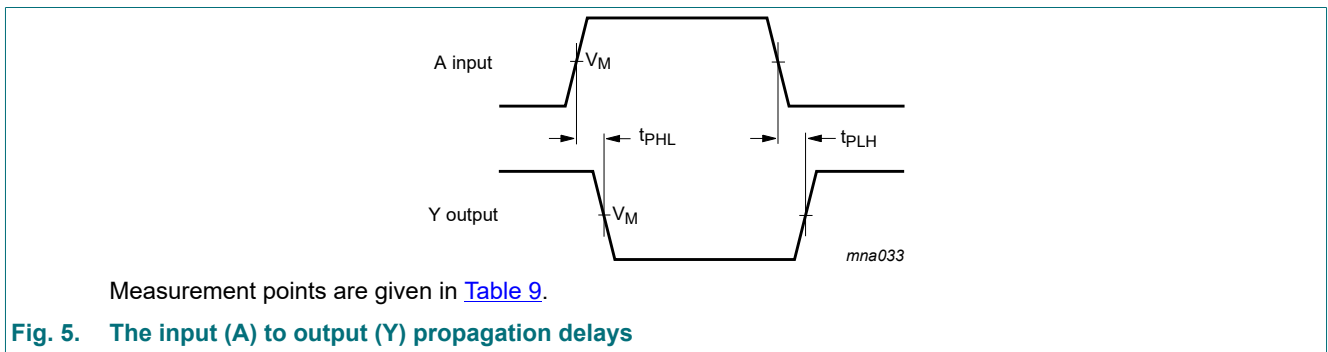
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$  where:

$f_i$  = input frequency in MHz;  $f_o$  = output frequency in MHz

$C_L$  = output load capacitance in pF;  $V_{CC}$  = supply voltage in Volts

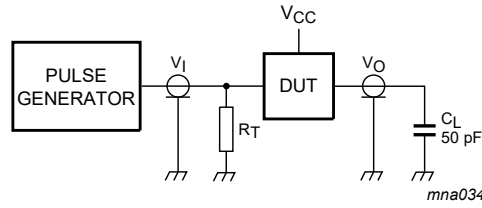
$\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of outputs

### 12.1. Waveforms and test circuit



**Table 9. Measurement points**

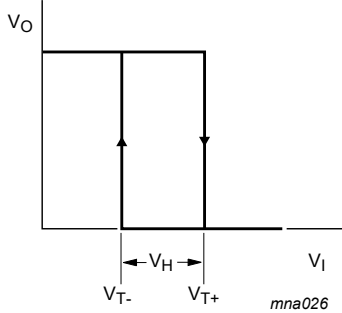
Type number	Input		Output
	$V_I$	$V_M$	$V_M$
74HC1G14	GND to $V_{CC}$	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
74HCT1G14	GND to 3.0 V	1.5 V	$0.5 \times V_{CC}$



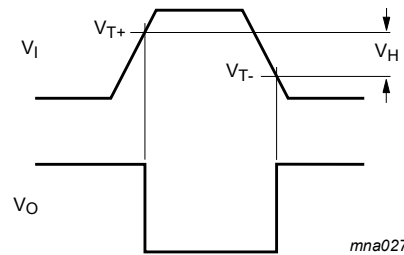
Test data is given in [Table 8](#). Definitions for test circuit:  
 $C_L$  = Load capacitance including jig and probe capacitance.  
 $R_T$  = Termination resistance should be equal to output impedance  $Z_o$  of the pulse generator.

**Fig. 6. Test circuit for measuring switching times**

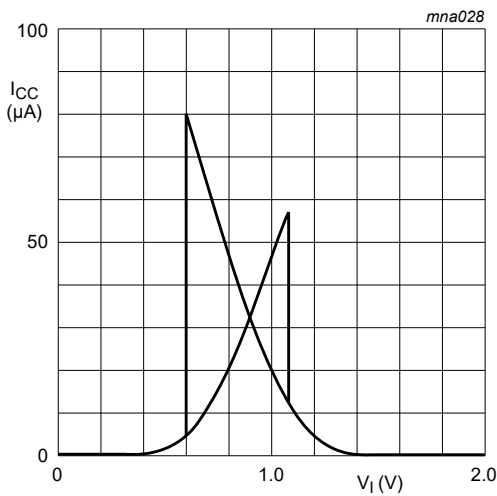
### 12.2. Transfer characteristics waveforms



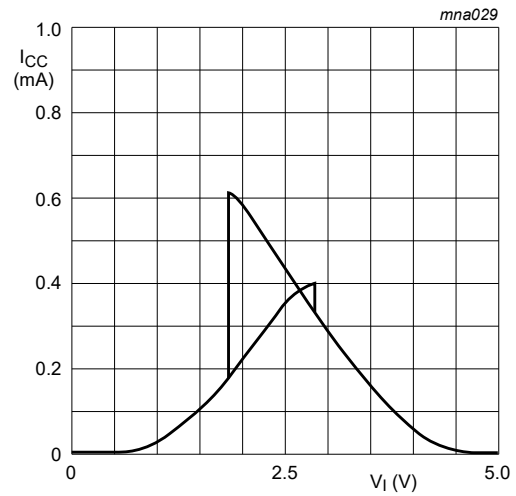
**Fig. 7. Transfer characteristic**



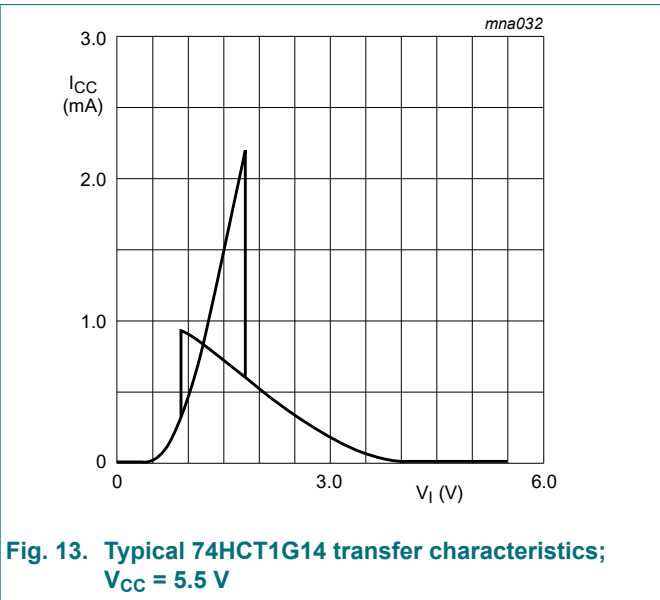
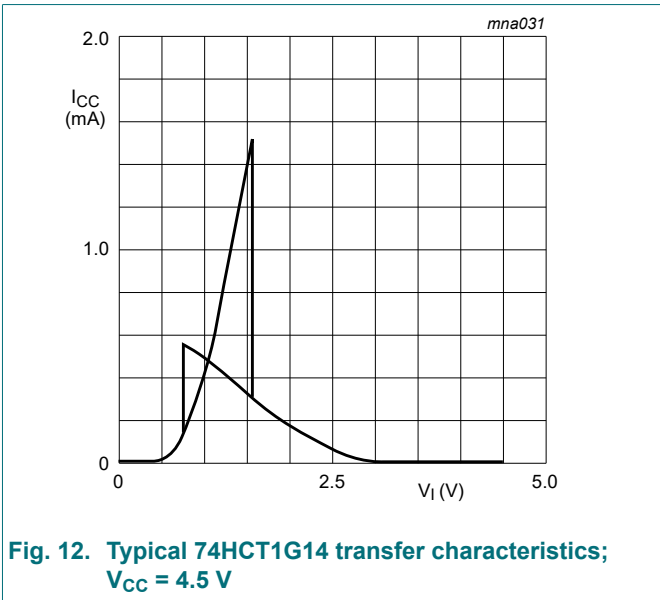
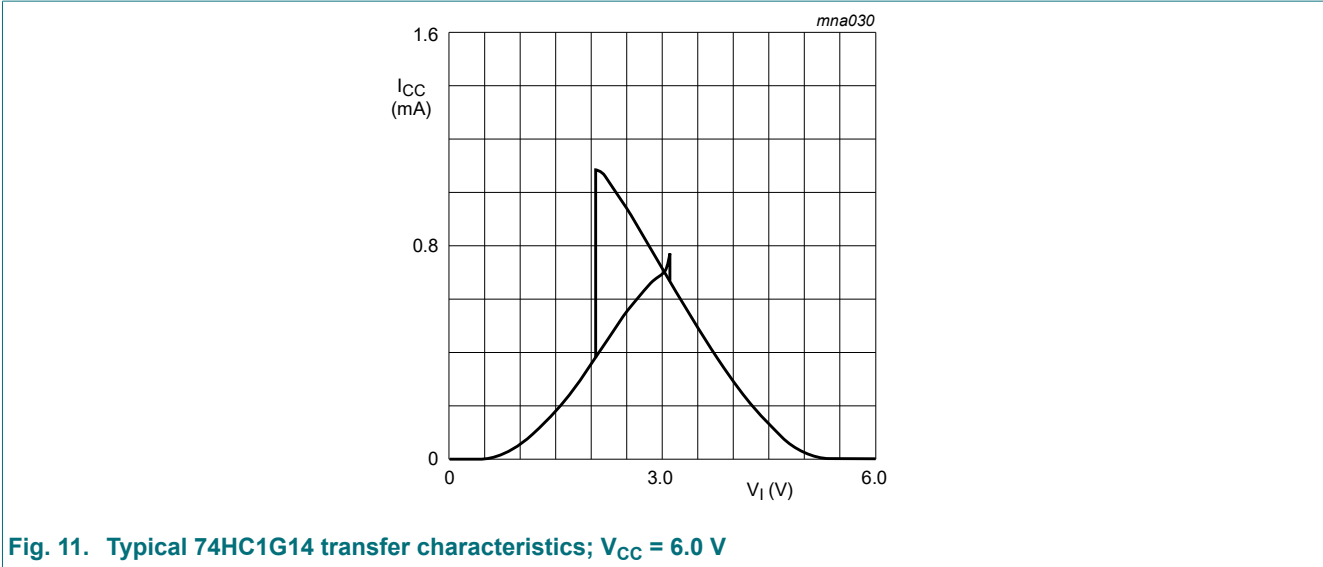
**Fig. 8. The definitions of  $V_{T+}$ ,  $V_{T-}$  and  $V_H$ ; where  $V_{T+}$  and  $V_{T-}$  are between limits of 20 % and 70 %**



**Fig. 9. Typical 74HC1G14 transfer characteristics;  $V_{CC} = 2.0\text{ V}$**



**Fig. 10. Typical 74HC1G14 transfer characteristics;  $V_{CC} = 4.5\text{ V}$**



### 13. 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 [Fig. 14](#) and [Fig. 15](#).

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

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



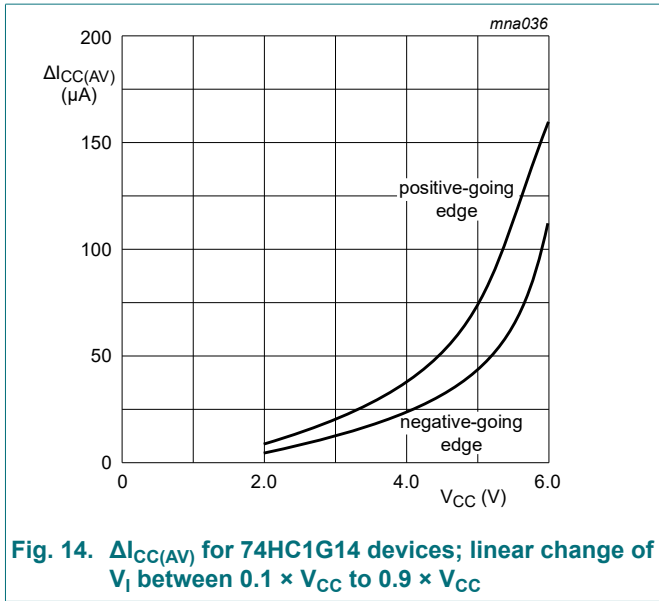


Fig. 14.  $\Delta I_{CC(AV)}$  for 74HC1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$

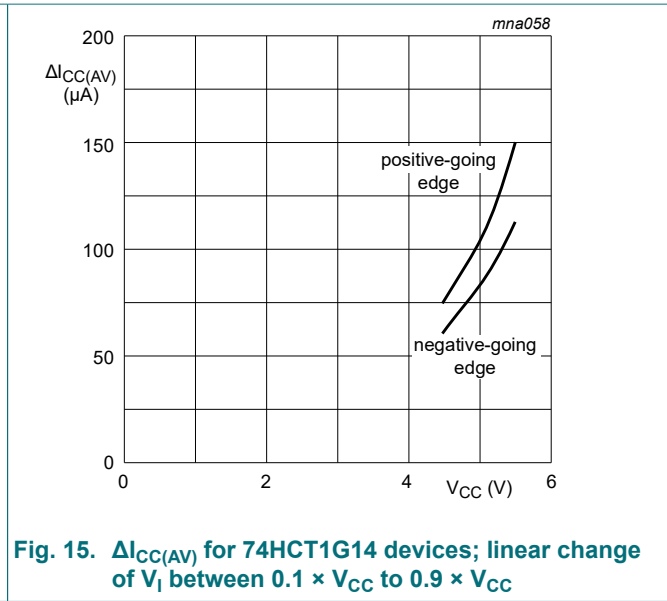


Fig. 15.  $\Delta I_{CC(AV)}$  for 74HCT1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$

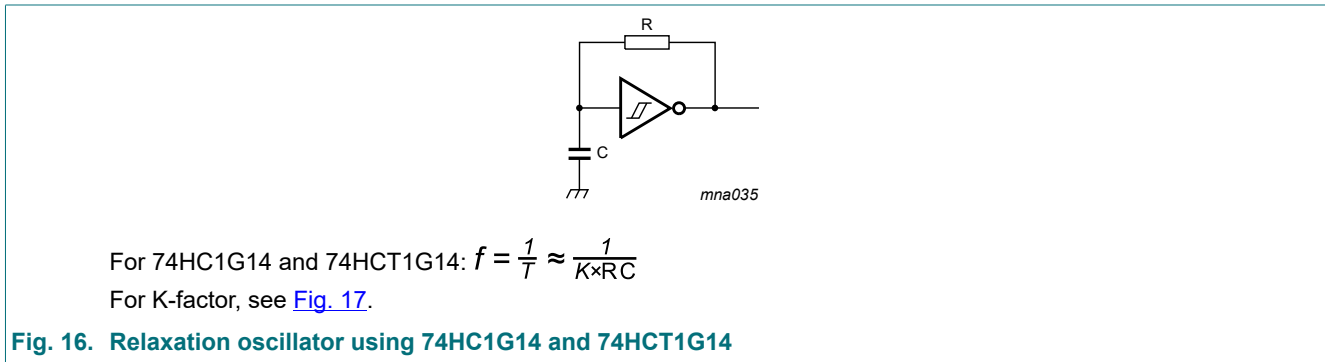


Fig. 16. Relaxation oscillator using 74HC1G14 and 74HCT1G14

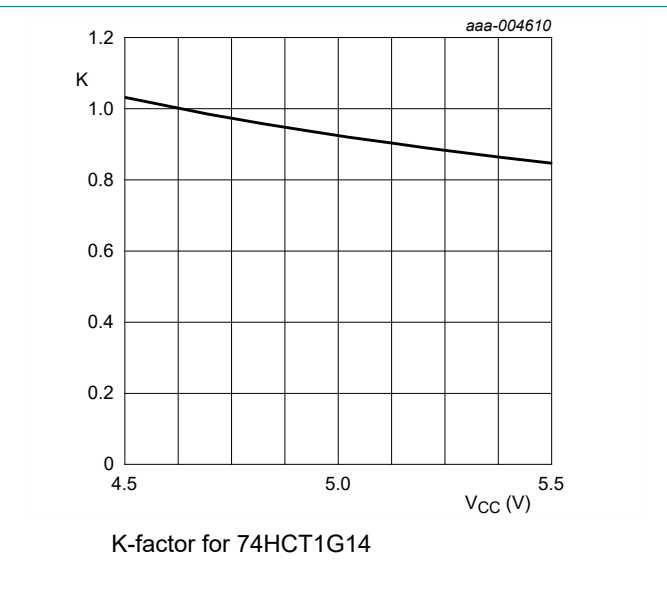
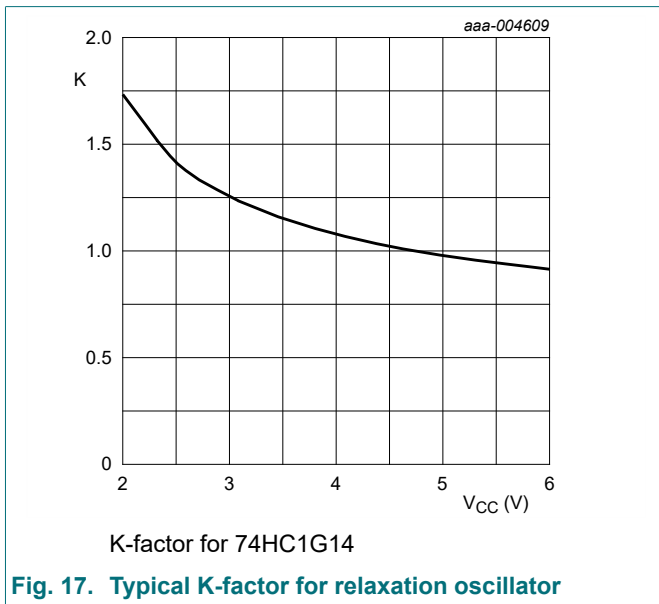


Fig. 17. Typical K-factor for relaxation oscillator

14. Package outline

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

SOT353-1

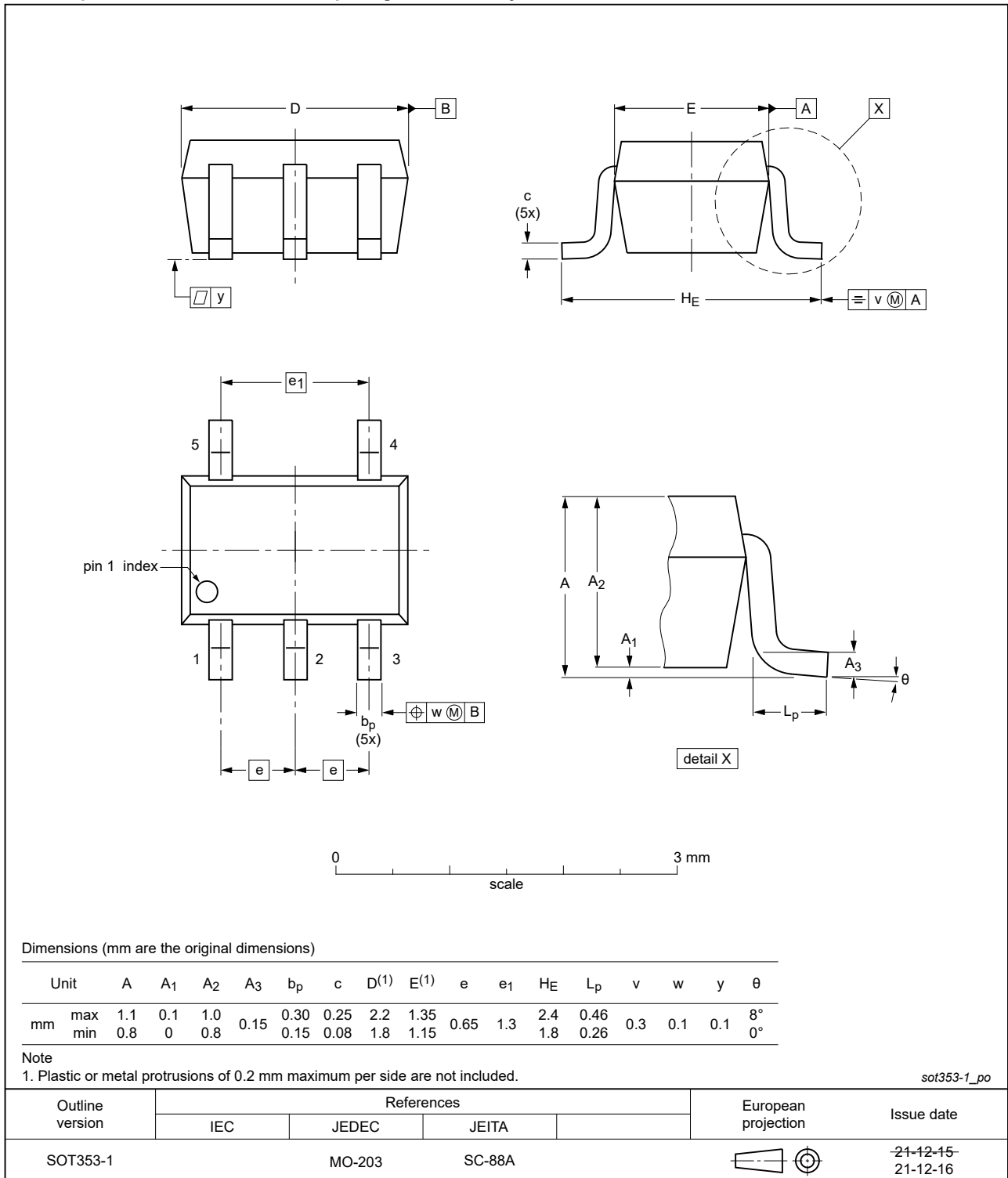


Fig. 18. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

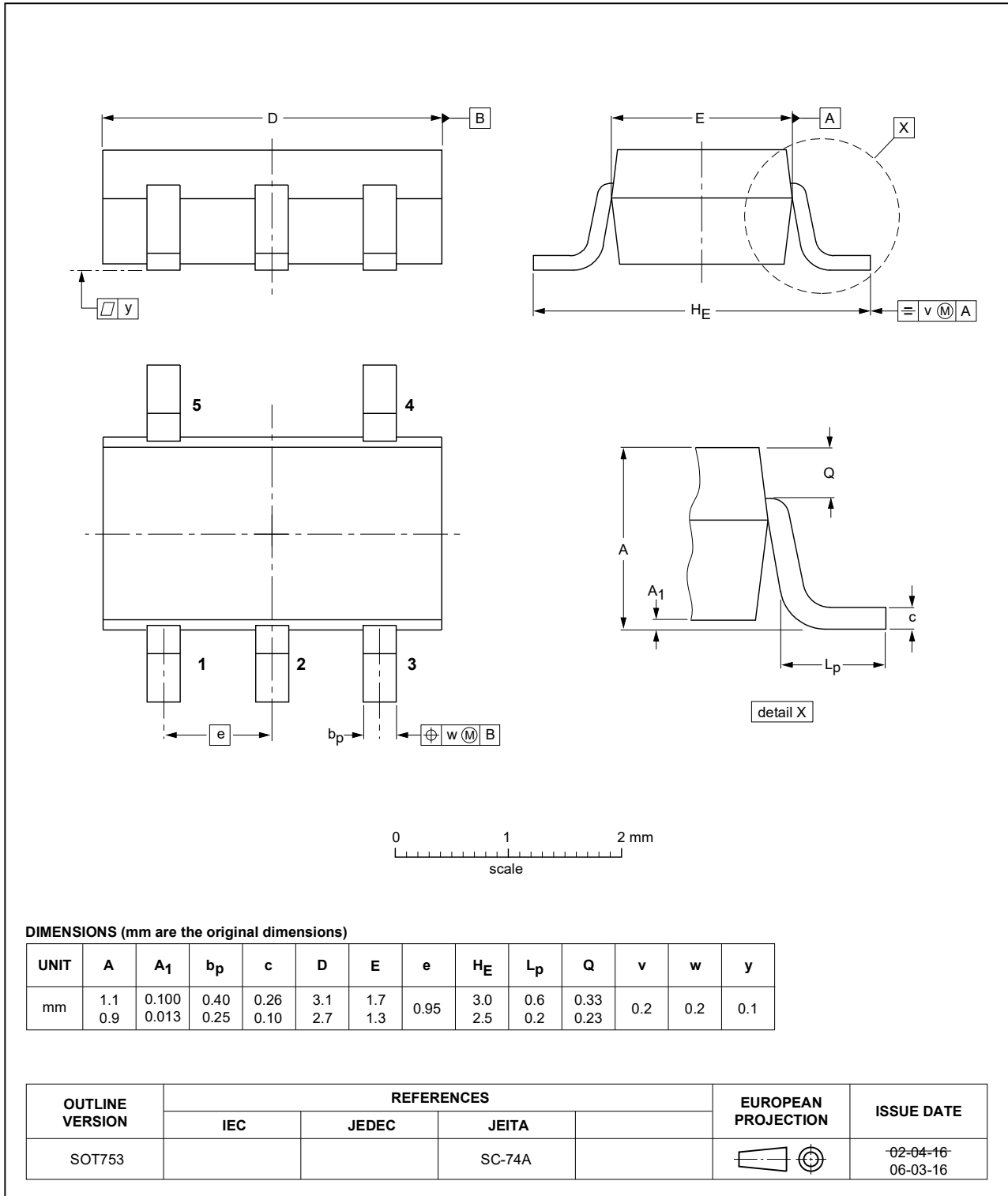


Fig. 19. Package outline SOT753 (SC-74A)

## 15. Abbreviations

Table 10. Abbreviations

Acronym	Description
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 11. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74HC_HCT1G14 v.7	20220117	Product data sheet	-	74HC_HCT1G14 v.6
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="#">Section 1</a> and <a href="#">Section 2</a> updated.</li> <li><a href="#">Table 5</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> <li><a href="#">Fig. 18</a>: Package outline drawing for SOT353-1 (TSSOP5) has changed</li> </ul>			
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="#">Fig. 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	-	-

## 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".
- [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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For more information, please visit: <http://www.nexperia.com>  
For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)  
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