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 °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				

nexperia

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

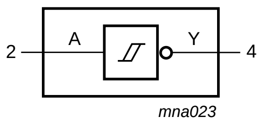


Fig 1. Logic symbol

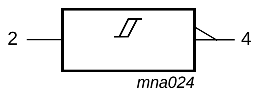


Fig 2. IEC logic symbol

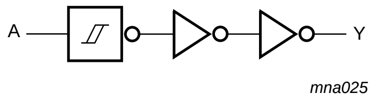


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

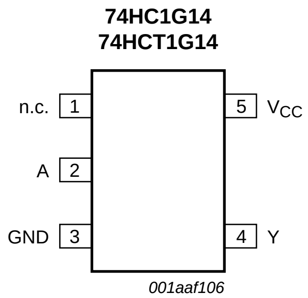


Fig 4. Pin configuration

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). Voltages are referenced to GND (ground = 0 V). [1]

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			–0.5	+7.0	V
I_{IK}	input clamping current	V_I < –0.5 V or V_I > V_{CC} + 0.5 V		-	±20	mA
I_{OK}	output clamping current	V_O < –0.5 V or V_O > V_{CC} + 0.5 V		-	±20	mA
I_O	output current	–0.5 V < V_O < V_{CC} + 0.5 V		-	±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 °C to +125 °C	[2]	-	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_{tot} 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_{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 °C.

Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ	Max	Min	Max	
For type 74HC1G14								
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}						
		I_O = −20 µA; V_{CC} = 2.0 V	1.9	2.0	-	1.9	-	V
		I_O = −20 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	V
		I_O = −20 µA; V_{CC} = 6.0 V	5.9	6.0	-	5.9	-	V
		I_O = −2.0 mA; V_{CC} = 4.5 V	4.13	4.32	-	3.7	-	V
		I_O = −2.6 mA; V_{CC} = 6.0 V	5.63	5.81	-	5.2	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}						
		I_O = 20 µA; V_{CC} = 2.0 V	-	0	0.1	-	0.1	V
		I_O = 20 µA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	V
		I_O = 20 µA; V_{CC} = 6.0 V	-	0	0.1	-	0.1	V
		I_O = 2.0 mA; V_{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
		I_O = 2.6 mA; V_{CC} = 6.0 V	-	0.16	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 6.0 V	-	-	1.0	-	1.0	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 6.0 V	-	-	10	-	20	µA
C_I	input capacitance		-	1.5	-	-	-	pF
V_{T+}	positive-going threshold voltage	see Figure 7 and Figure 8						
		V_{CC} = 2.0 V	0.7	1.09	1.5	0.7	1.5	V
		V_{CC} = 4.5 V	1.7	2.36	3.15	1.7	3.15	V
		V_{CC} = 6.0 V	2.1	3.12	4.2	2.1	4.2	V
V_{T-}	negative-going threshold voltage	see Figure 7 and Figure 8						
		V_{CC} = 2.0 V	0.3	0.60	0.9	0.3	0.9	V
		V_{CC} = 4.5 V	0.9	1.53	2.0	0.9	2.0	V
		V_{CC} = 6.0 V	1.2	2.08	2.6	1.2	2.6	V
V_H	hysteresis voltage	see Figure 7 and Figure 8						
		V_{CC} = 2.0 V	0.2	0.48	1.0	0.2	1.0	V
		V_{CC} = 4.5 V	0.4	0.83	1.4	0.4	1.4	V
		V_{CC} = 6.0 V	0.6	1.04	1.6	0.6	1.6	V
For type 74HCT1G14								
V_{OH}	HIGH-level output voltage	$V_I = V_{T+}$ or V_{T-}						
		I_O = −20 µA; V_{CC} = 4.5 V	4.4	4.5	-	4.4	-	V
		I_O = −2.0 mA; V_{CC} = 4.5 V	4.13	4.32	-	3.7	-	V
V_{OL}	LOW-level output voltage	$V_I = V_{T+}$ or V_{T-}						
		I_O = 20 µA; V_{CC} = 4.5 V	-	0	0.1	-	0.1	V
		I_O = 2.0 mA; V_{CC} = 4.5 V	-	0.15	0.33	-	0.4	V
I_I	input leakage current	$V_I = V_{CC}$ or GND; V_{CC} = 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 °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 A; V_{CC} = 5.5 V	-	-	10	-	20	μA
ΔI_{CC}	additional supply current	per input; V_{CC} = 4.5 V to 5.5 V; $V_I = V_{CC}$ − 2.1 V; I_O = 0 A	-	-	500	-	850	μA
C_I	input capacitance		-	1.5	-	-	-	pF
V_{T+}	positive-going threshold voltage	see Figure 7 and Figure 8						
		V_{CC} = 4.5 V	1.2	1.55	1.9	1.2	1.9	V
		V_{CC} = 5.5 V	1.4	1.80	2.1	1.4	2.1	V
V_{T-}	negative-going threshold voltage	see Figure 7 and Figure 8						
		V_{CC} = 4.5 V	0.5	0.76	1.2	0.5	1.2	V
		V_{CC} = 5.5 V	0.6	0.90	1.4	0.6	1.4	V
V_H	hysteresis voltage	see Figure 7 and Figure 8						
		V_{CC} = 4.5 V	0.4	0.80	-	0.4	-	V
		V_{CC} = 5.5 V	0.4	0.90	-	0.4	-	V

12. Dynamic characteristics

Table 8. Dynamic characteristics

GND = 0 V; $t_r = t_f \leq 6.0$ ns; All typical values are measured at T_{amb} = 25 °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	
For type 74HC1G14									
t_{pd}	propagation delay	A to Y; see Figure 5	[1]						
		V_{CC} = 2.0 V; C_L = 50 pF		-	25	155	-	190	ns
		V_{CC} = 4.5 V; C_L = 50 pF		-	12	31	-	38	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	10	-	-	-	ns
		V_{CC} = 6.0 V; C_L = 50 pF		-	11	26	-	32	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC}	[2]	-	20	-	-	-	pF
For type 74HCT1G14									
t_{pd}	propagation delay	A to Y; see Figure 5	[1]						
		V_{CC} = 4.5 V; C_L = 50 pF		-	17	43	-	51	ns
		V_{CC} = 5.0 V; C_L = 15 pF		-	15	-	-	-	ns
C_{PD}	power dissipation capacitance	V_I = GND to V_{CC} − 1.5 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 (μW).

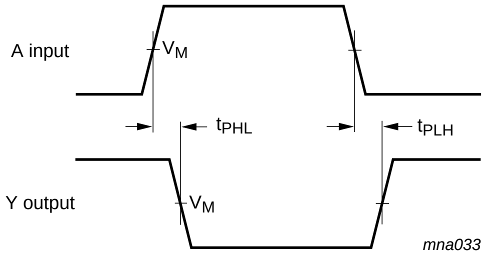
$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

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

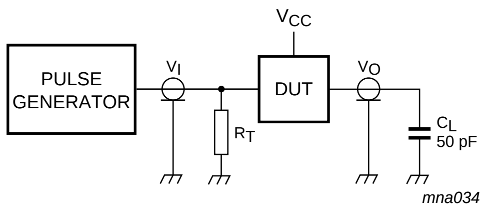


Measurement points are given in Table 9.

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

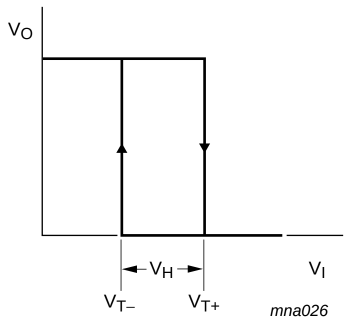


Fig 7. Transfer characteristic

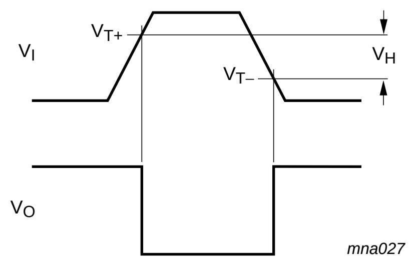


Fig 8. The definitions of V_{T+}, V_{T-} and V_H; where V_{T+} and V_{T-} are between limits of 20 % and 70 %

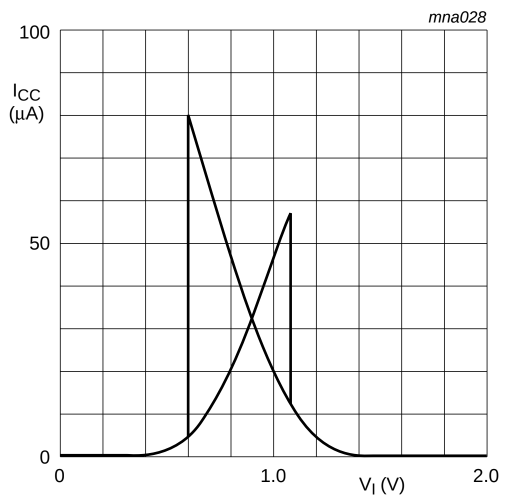


Fig 9. Typical 74HC1G14 transfer characteristics; V_{CC} = 2.0 V

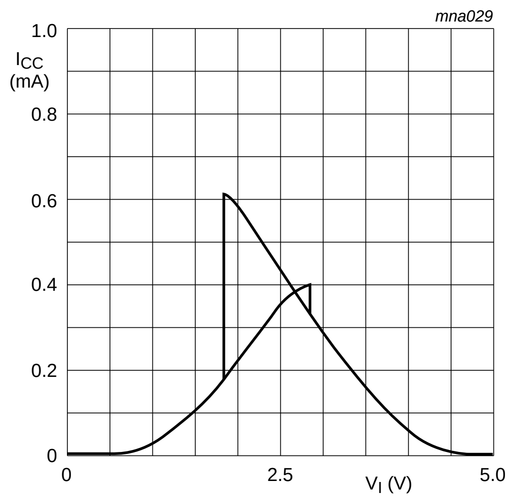


Fig 10. Typical 74HC1G14 transfer characteristics; V_{CC} = 4.5 V

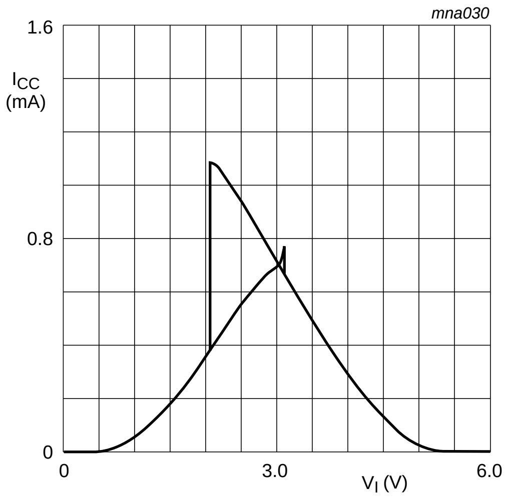


Fig 11. Typical 74HC1G14 transfer characteristics; V_{CC} = 6.0 V

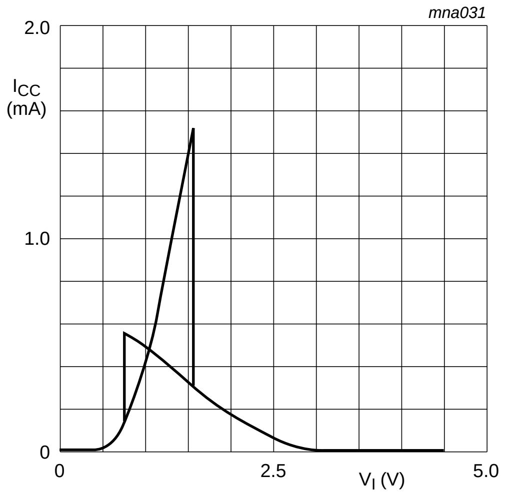


Fig 12. Typical 74HCT1G14 transfer characteristics; V_{CC} = 4.5 V

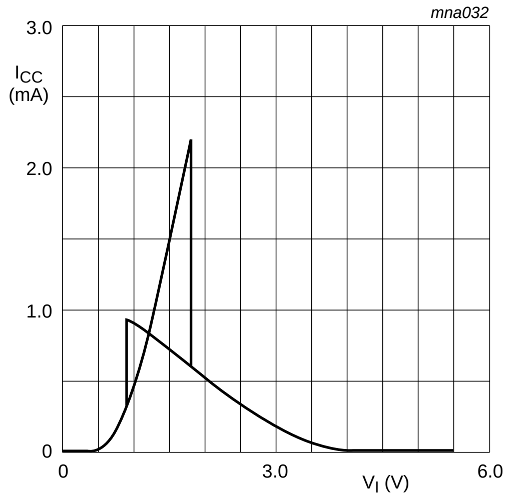


Fig 13. Typical 74HCT1G14 transfer characteristics; V_{CC} = 5.5 V

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 (μW)

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 (μA)

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

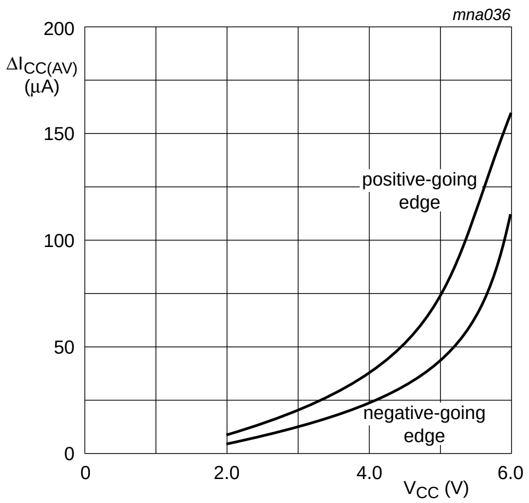


Fig 14. $\Delta I_{CC(AV)}$ **for 74HC1G14 devices; linear change of** V_I **between 0.1 ×** V_{CC} **to 0.9 ×** V_{CC}

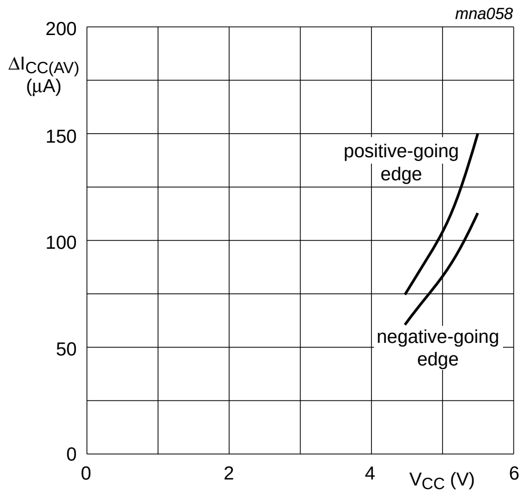
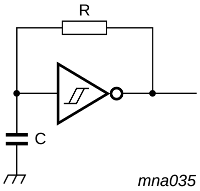


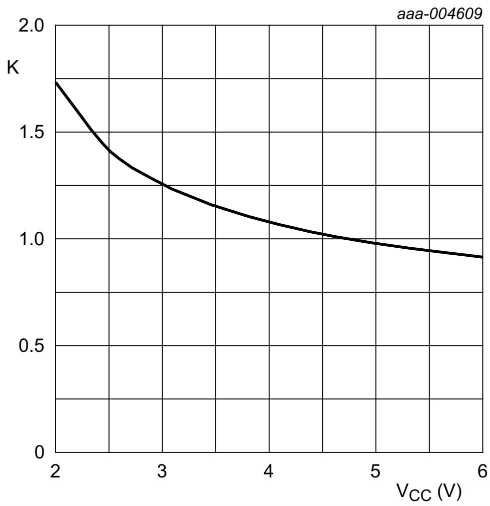
Fig 15. $\Delta I_{CC(AV)}$ **for 74HCT1G14 devices; linear change of** V_I **between 0.1 ×** V_{CC} **to 0.9 ×** V_{CC}



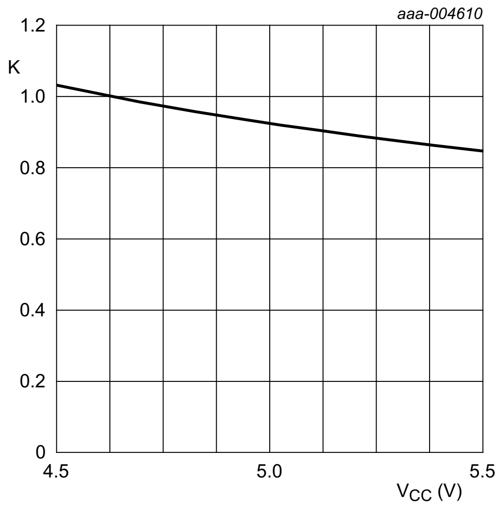
For 74HC1G14 and 74HCT1G14: $f = \frac{1}{T} \approx \frac{1}{K \times RC}$

For K-factor, see Figure 17

Fig 16. Relaxation oscillator using 74HC1G14 and 74HCT1G14



K-factor for 74HC1G14

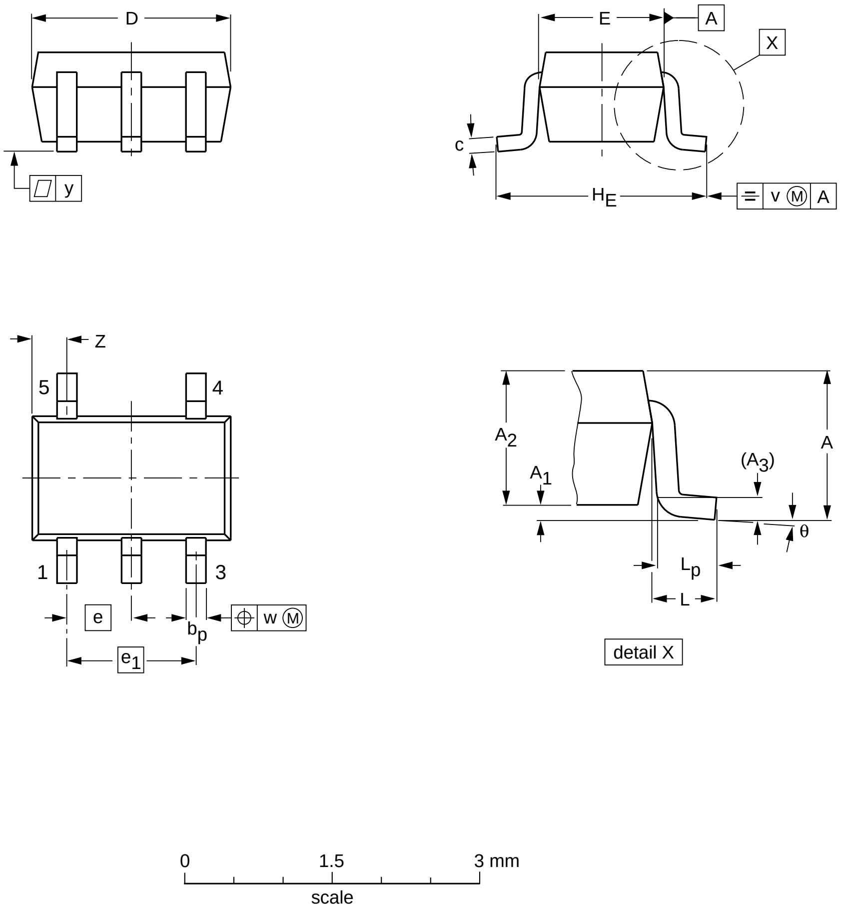


K-factor for 74HCT1G14

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**



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°

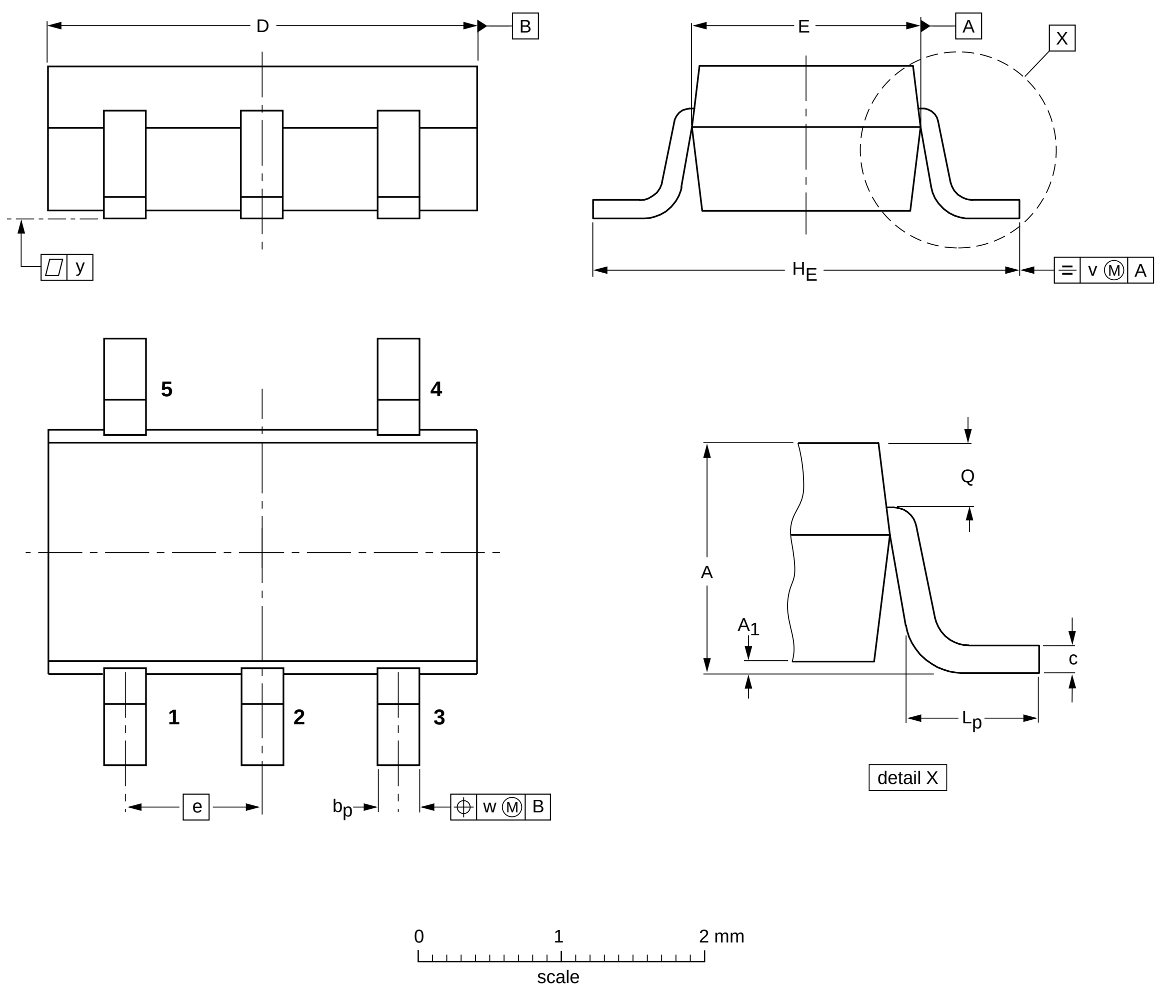
Note

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 18. 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 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:	• Table 3: Pin number Y output changed from 5 to 4 (errata).			
74HC_HCT1G14 v.5	20120924	Product data sheet	-	74HC_HCT1G14 v.4
Modifications:	• Figure 17 added (typical K-factor for relaxation oscillator). • Legal page updated.			
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[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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