# 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 | | | | |

# 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

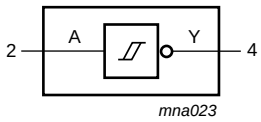



**Fig 1. Logic symbol**

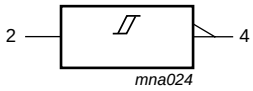



**Fig 2. IEC logic symbol**

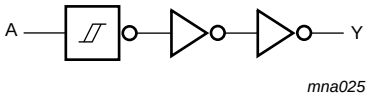



**Fig 3. Logic diagram**

# 7. Pinning information

## 7.1 Pinning

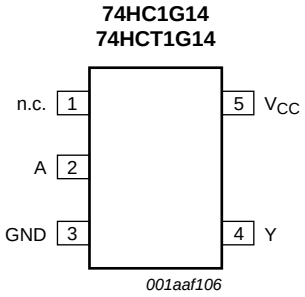



**Fig 4. Pin configuration**

## 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 |
| $\Delta I_{CC}$ | 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**

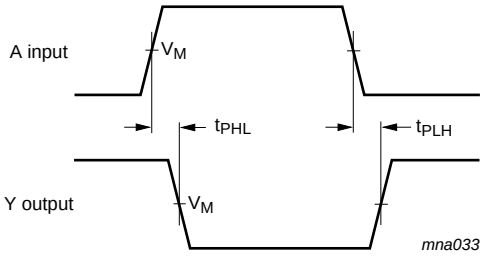
*GND = 0 V; $t_r = t_f \leq 6.0$ ns; All typical values are measured at $T_{amb}$ = 25 °C. For test circuit see Figure 6*

| 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

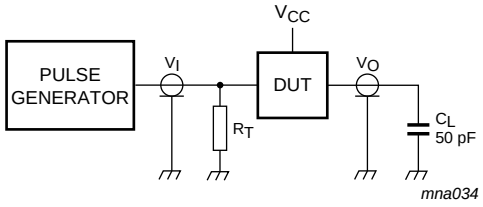



Measurement points are given in Table 9.

**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

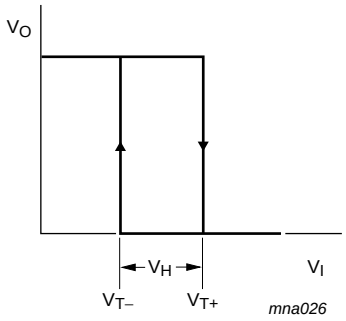



Fig 7. Transfer characteristic

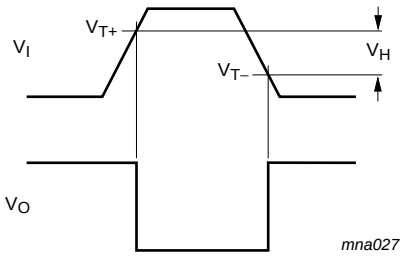



Fig 8. The definitions of $V_{T+}$, $V_{T-}$ and $V_H$; where $V_{T+}$ and $V_{T-}$ are between limits of 20 % and 70 %

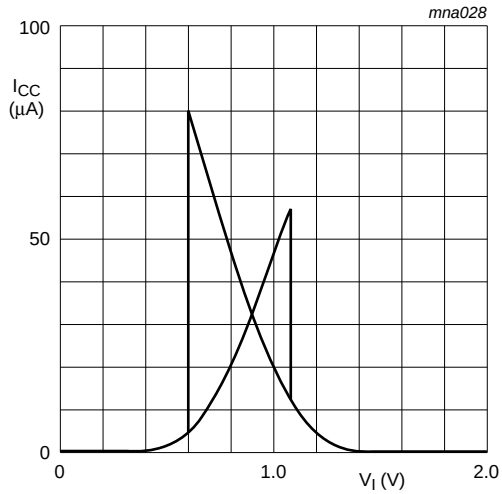



Fig 9. Typical 74HC1G14 transfer characteristics; $V_{CC}$ = 2.0 V

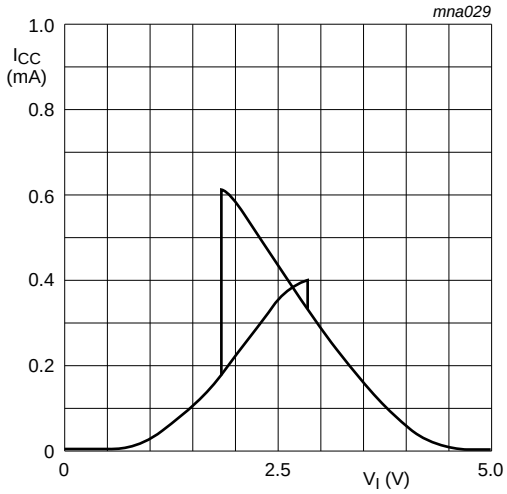



Fig 10. Typical 74HC1G14 transfer characteristics; $V_{CC}$ = 4.5 V

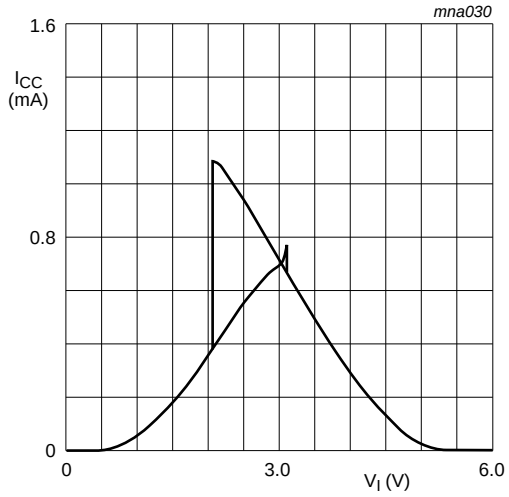



**Fig 11. Typical 74HC1G14 transfer characteristics; $V_{CC}$ = 6.0 V**

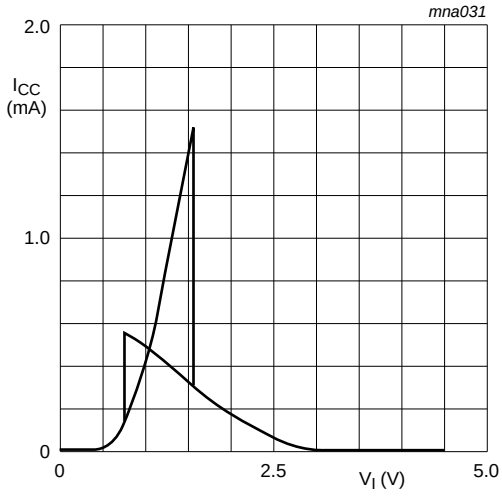



**Fig 12. Typical 74HCT1G14 transfer characteristics; $V_{CC}$ = 4.5 V**

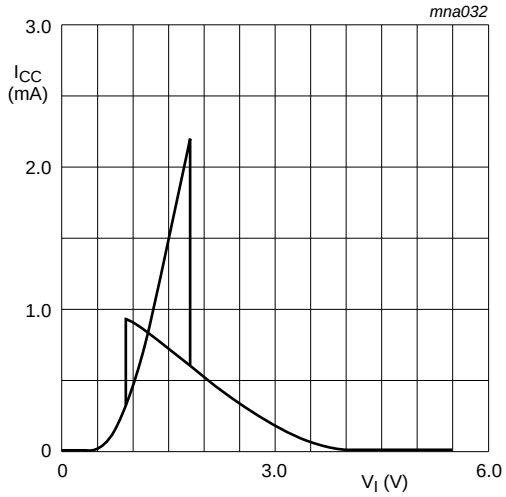



**Fig 13. Typical 74HCT1G14 transfer characteristics; $V_{CC}$ = 5.5 V**

## 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.

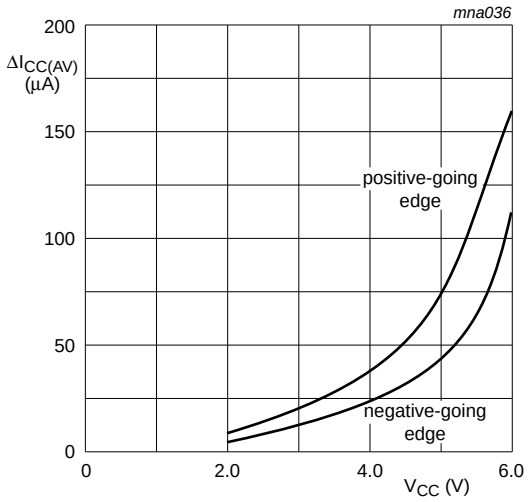



**Fig 14. $\Delta I_{CC(AV)}$ for 74HC1G14 devices; linear change of $V_I$ between 0.1 × $V_{CC}$ to 0.9 × $V_{CC}$**

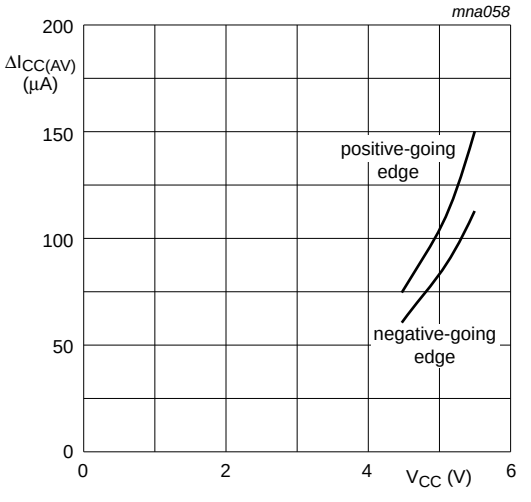
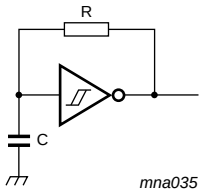


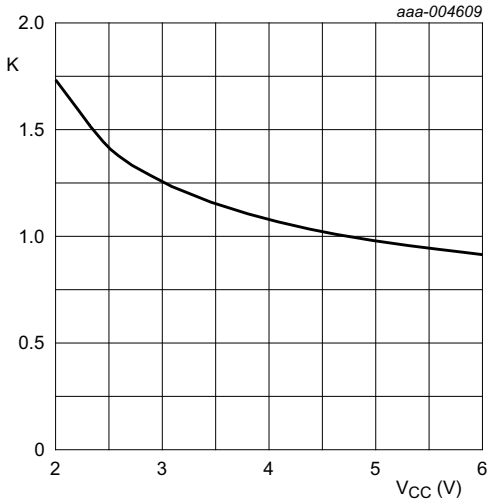

**Fig 15. $\Delta I_{CC(AV)}$ for 74HCT1G14 devices; linear change of $V_I$ between 0.1 × $V_{CC}$ to 0.9 × $V_{CC}$**



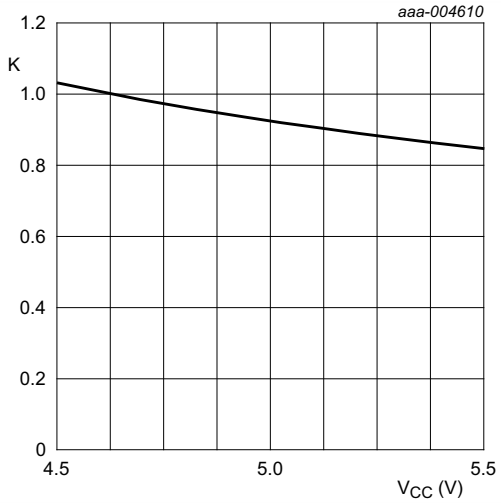

For 74HC1G14 and 74HCT1G14: $f = \frac{1}{T} \approx \frac{1}{K \times RC}$

For K-factor, see Figure 17

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




K-factor for 74HC1G14

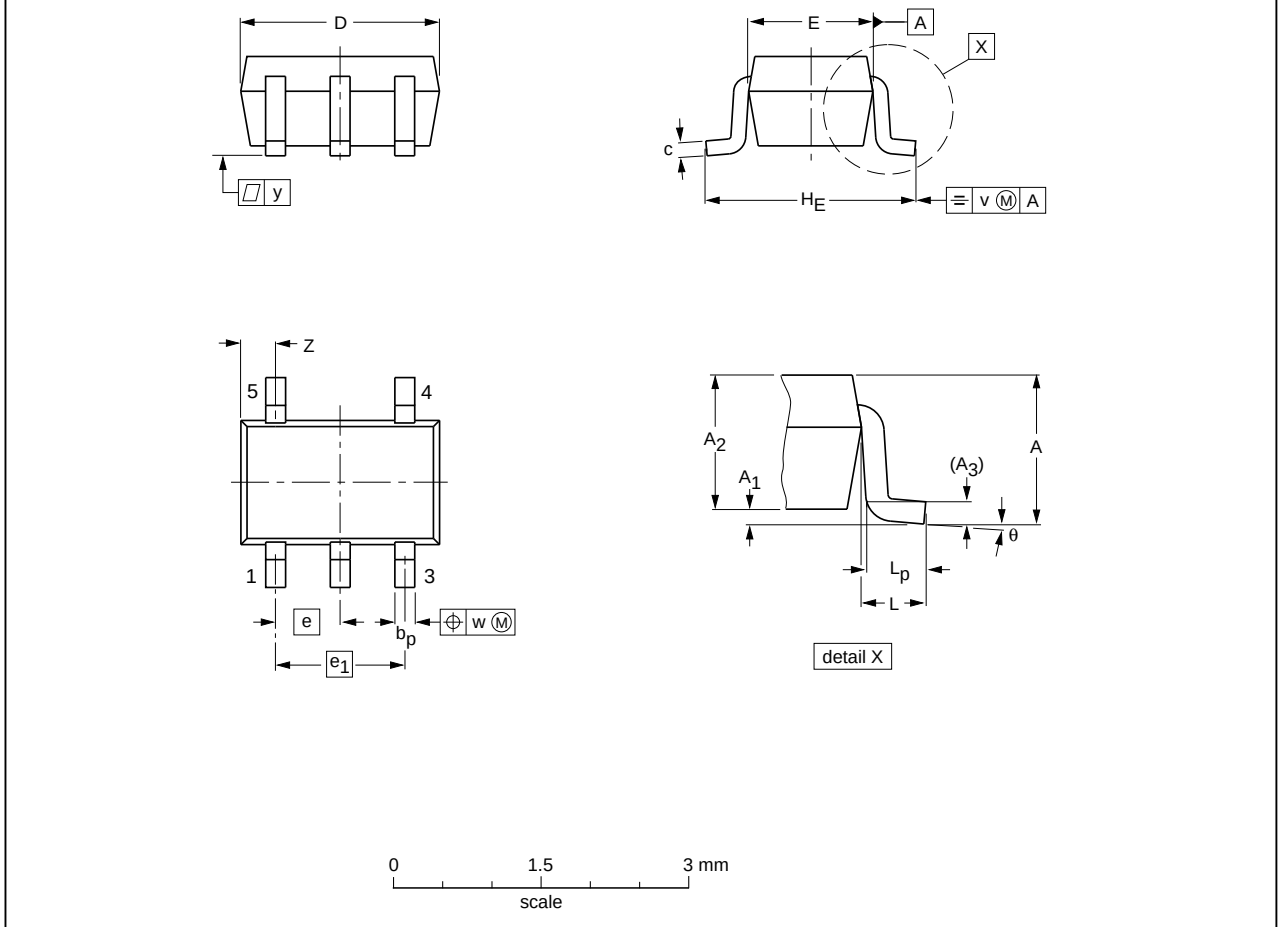



K-factor for 74HCT1G14

**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<br>0 | 1.0<br>0.8 | 0.15 | 0.30<br>0.15 | 0.25<br>0.08 | 2.25<br>1.85 | 1.35<br>1.15 | 0.65 | 1.3 | 2.25<br>2.0 | 0.425 | 0.46<br>0.21 | 0.3 | 0.1 | 0.1 | 0.60<br>0.15 | 7°<br>0° |

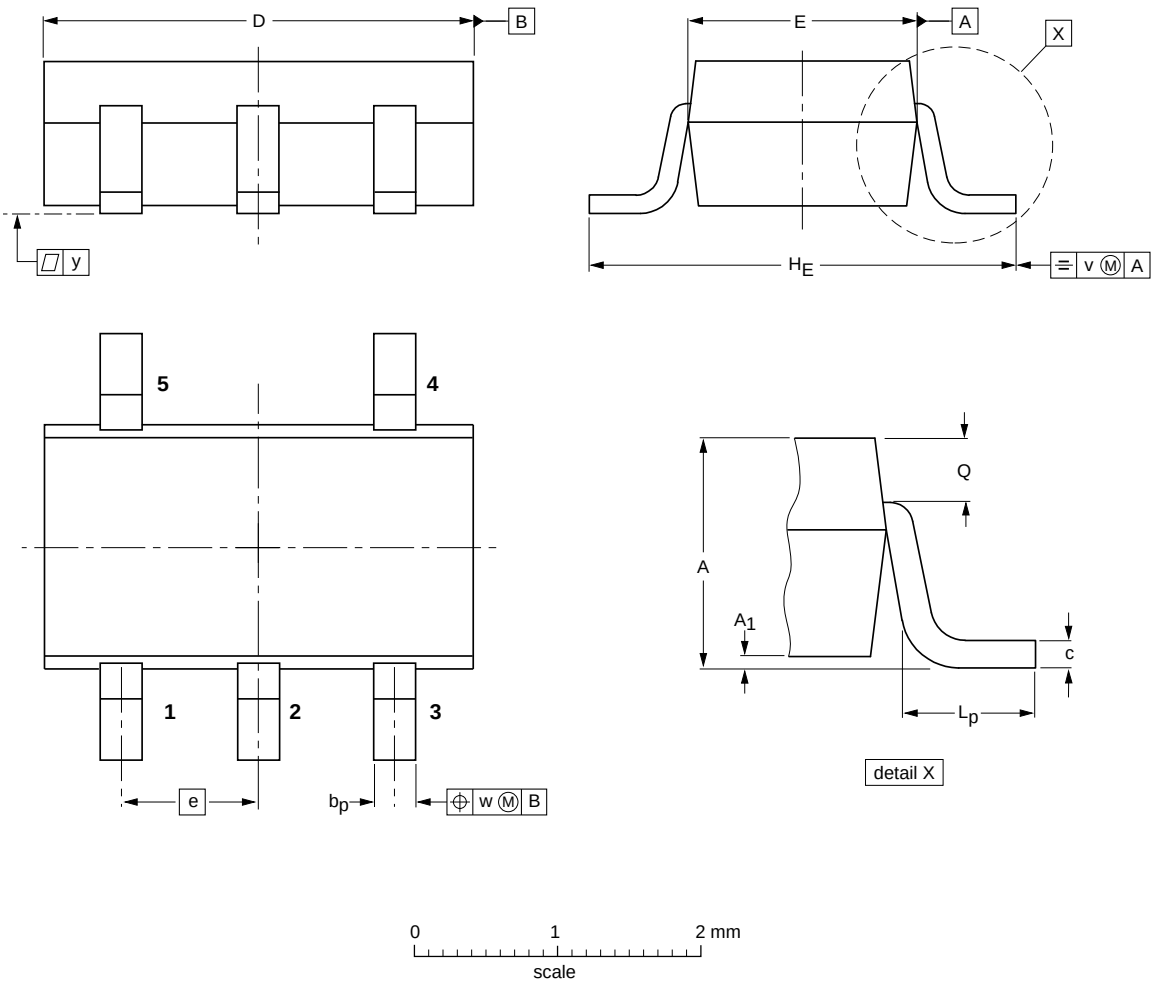
**Note**

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~~<br>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<br>0.9 | 0.100<br>0.013 | 0.40<br>0.25 | 0.26<br>0.10 | 3.1<br>2.7 | 1.7<br>1.3 | 0.95 | 3.0<br>2.5 | 0.6<br>0.2 | 0.33<br>0.23 | 0.2 | 0.2 | 0.1 |

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT753 | | | SC-74A | | | ~~02-04-16~~<br>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).<br>• 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.nxp.com.

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## 21. Contents





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