# 74HC1G14-Q100; 74HCT1G14-Q100

## Inverting Schmitt trigger

Rev. 3 — 17 January 2022 Product data sheet

## 1. General description

The 74HC1G14-Q100; 74HCT1G14-Q100 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.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

## 2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - Specified from -40 °C to +85 °C and from -40 °C to +125 °C
- Wide supply voltage range from 2.0 V to 6.0 V
- Symmetrical output impedance
- High noise immunity
- CMOS low power dissipation
- Unimited 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-Q100: CMOS level
  - For 74HCT1G14-Q100: TTL level
- Complies with JEDEC standards:
  - JESD8C (2.7 V to 3.6 V)
  - JESD7A (2.0 V to 6.0 V)
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V (C = 200 pF, R = 0 Ω)

## 3. Applications

- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

nexperia

# 4. Ordering information

**Table 1. Ordering information**

| Type number | Package | | | |
|---|---|---|---|---|
| | Temperature range | Name | Description | Version |
| 74HC1G14GW-Q100 | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74HCT1G14GW-Q100 | | | | |
| 74HC1G14GV-Q100 | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74HCT1G14GV-Q100 | | | | |

# 5. Marking

**Table 2. Marking codes**

| Type number | Marking code [1] |
|---|---|
| 74HC1G14GW-Q100 | HF |
| 74HCT1G14GW-Q100 | TF |
| 74HC1G14GV-Q100 | H14 |
| 74HCT1G14GV-Q100 | T14 |

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

# 6. Functional diagram

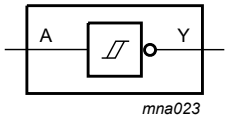



Fig. 1. Logic symbol


Fig. 2. IEC logic symbol

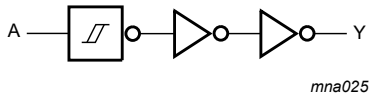



Fig. 3. Logic diagram

# 7. Pinning information

## 7.1. Pinning

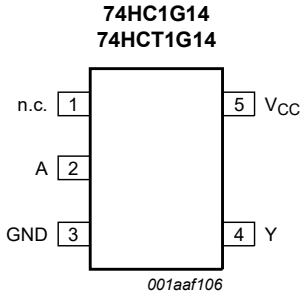



Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

### 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 |
| $V_{CC}$ | 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).*

| 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 [1] | - | ±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] | - | 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-Q100 | | | 74HCT1G14-Q100 | | | 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 | |
| **74HC1G14-Q100** | | | | | | | | |
| $V_{OH}$ | 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 Fig. 7 and Fig. 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 Fig. 7 and Fig. 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 Fig. 7 and Fig. 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 |

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| **74HCT1G14-Q100** | | | | | | | | |
| $V_{OH}$ | 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 |
| $I_{CC}$ | 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 Fig. 7 and Fig. 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 Fig. 7 and Fig. 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 Fig. 7 and Fig. 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 Fig. 6.*

| Symbol | Parameter | Conditions | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | Min | Max | |
| **74HC1G14-Q100** | | | | | | | | |
| $t_{pd}$ | propagation delay | A to Y; see Fig. 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 |
| **74HCT1G14-Q100** | | | | | | | | |
| $t_{pd}$ | propagation delay | A to Y; see Fig. 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).

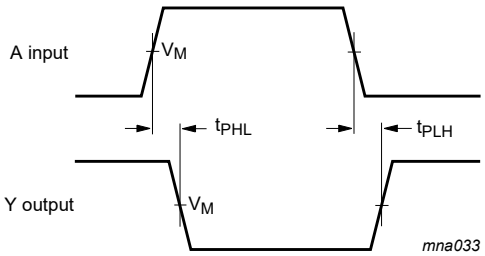
$P_D = C_{PD} \times V_{CC}{}^2 \times f_i + å (C_L \times V_{CC}{}^2 \times f_o)$ where:

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

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

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

## 12.1. Waveforms and test circuit

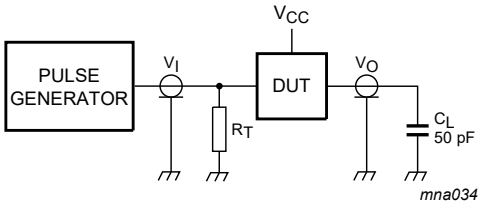



Measurement points are given in Table 9.

**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-Q100 | GND to $V_{CC}$ | 0.5 × $V_{CC}$ | 0.5 × $V_{CC}$ |
| 74HCT1G14-Q100 | GND to 3.0 V | 1.5 V | 0.5 × $V_{CC}$ |




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

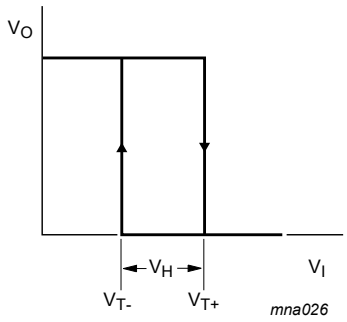



**Fig. 7. Transfer characteristic**

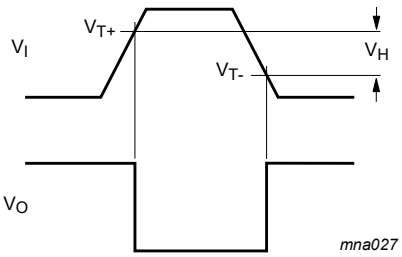



**Fig. 8. The definitions of $V_{T+}$, $V_{T-}$ and $V_H$; where $V_{T+}$ and $V_{T-}$ are between limits of 20 % and 70 %**

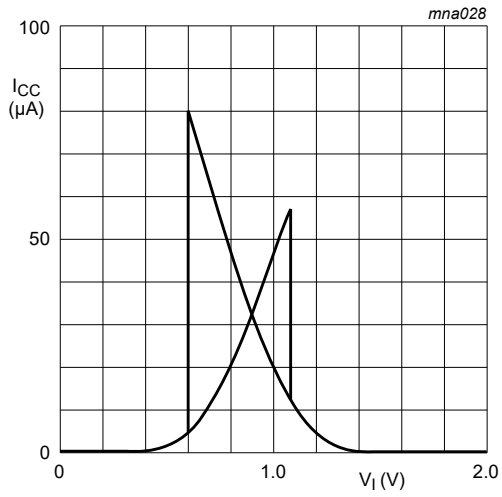



**Fig. 9. Typical 74HC1G14-Q100 transfer characteristics; $V_{CC}$ = 2.0 V**

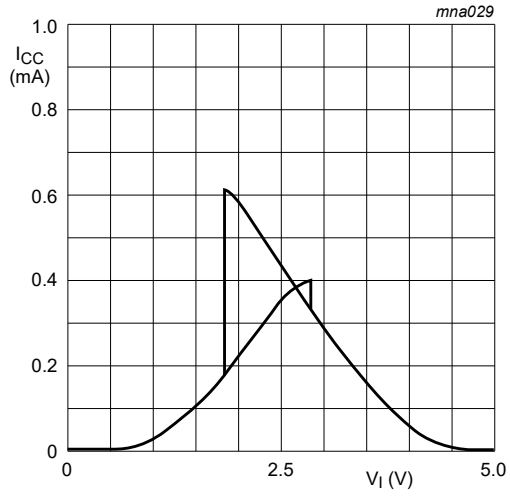



**Fig. 10. Typical 74HC1G14-Q100 transfer characteristics; $V_{CC}$ = 4.5 V**

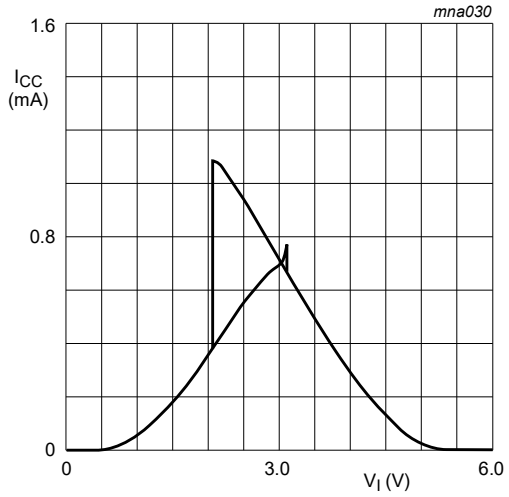



**Fig. 11. Typical 74HC1G14-Q100 transfer characteristics; $V_{CC}$ = 6.0 V**

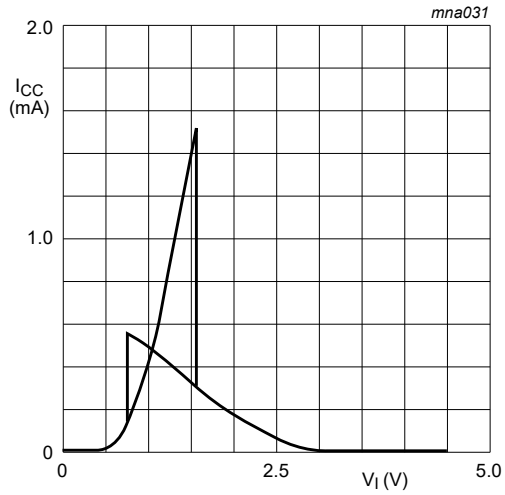



**Fig. 12. Typical 74HCT1G14-Q100 transfer characteristics; $V_{CC}$ = 4.5 V**

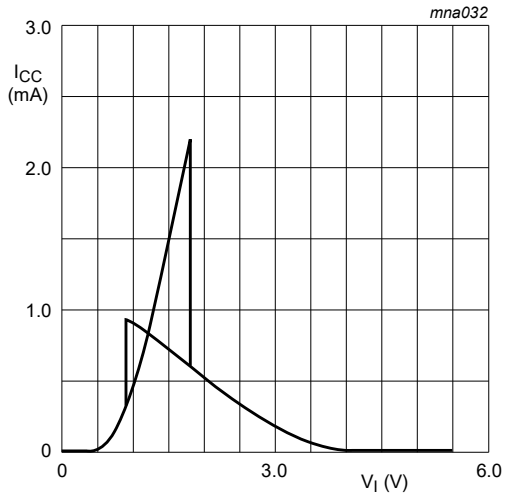



**Fig. 13. Typical 74HCT1G14-Q100 transfer characteristics; $V_{CC}$ = 5.5 V**

# 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 (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 Fig. 14 and Fig. 15.

74HC1G14-Q100 and 74HCT1G14-Q100 used in relaxation oscillator circuit, see Fig. 16.

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

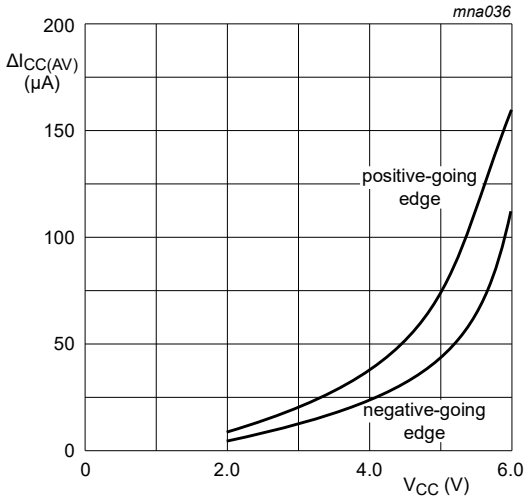



**Fig. 14. $\Delta I_{CC(AV)}$ for 74HC1G14-Q100 devices; linear change of $V_I$ between 0.1 × $V_{CC}$ to 0.9 × $V_{CC}$**

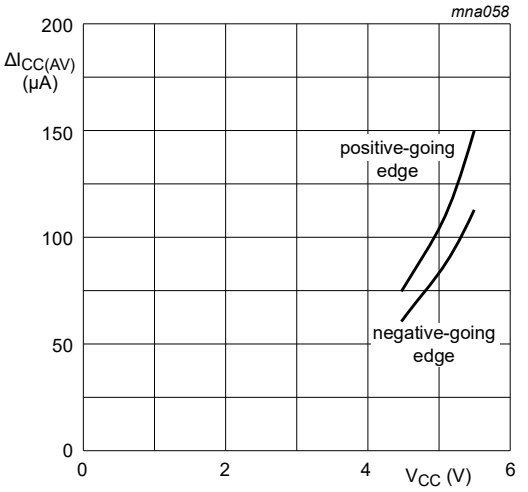
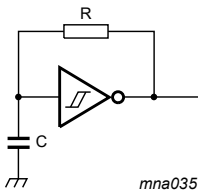


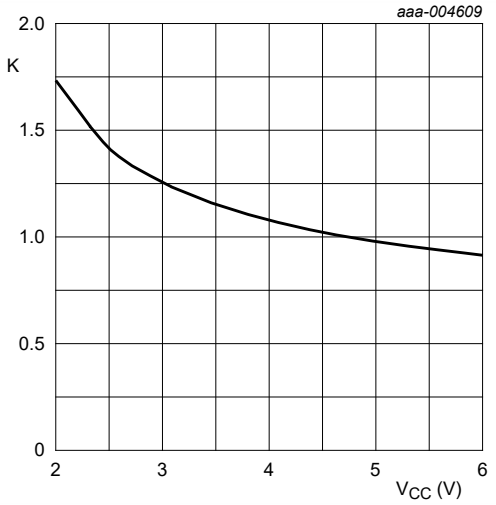

**Fig. 15. $\Delta I_{CC(AV)}$ for 74HCT1G14-Q100 devices; linear change of $V_I$ between 0.1 × $V_{CC}$ to 0.9 × $V_{CC}$**



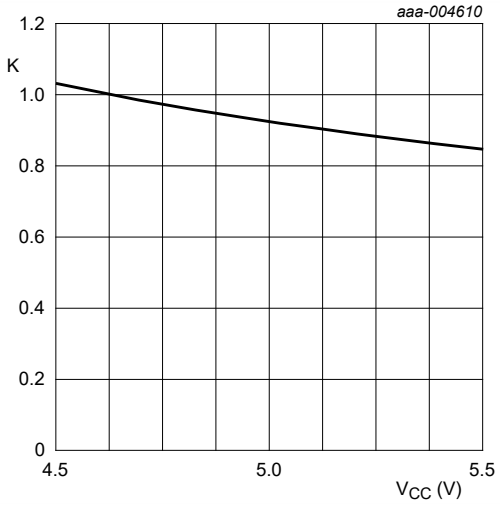

For 74HC1G14-Q100 and 74HCT1G14-Q100: $f = \frac{1}{T} \approx \frac{1}{K \times R C}$

For K-factor, see Fig. 17.

**Fig. 16. Relaxation oscillator using 74HC1G14-Q100 and 74HCT1G14-Q100**




K-factor for 74HC1G14-Q100

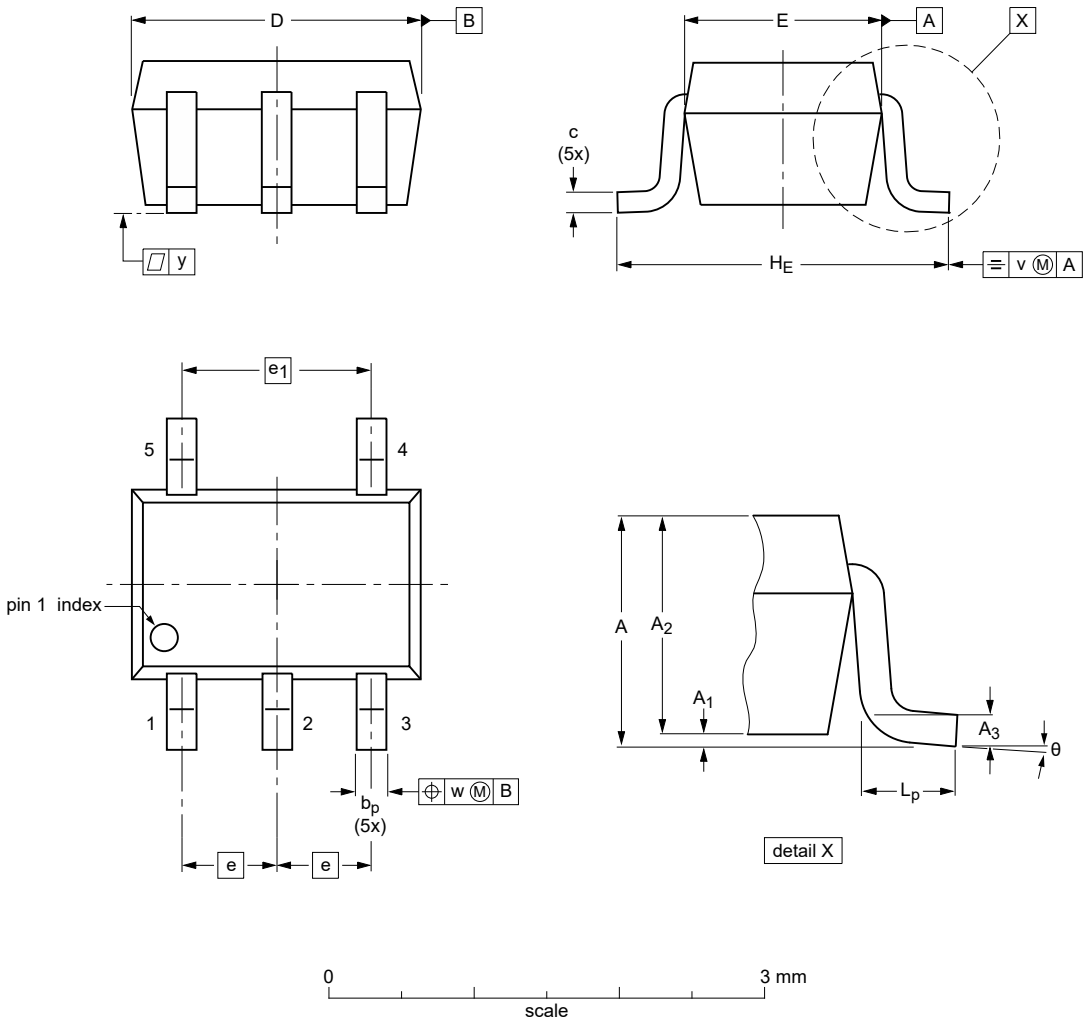



K-factor for 74HCT1G14-Q100

**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**




Dimensions (mm are the original dimensions)

| Unit | | A | $A_1$ | $A_2$ | $A_3$ | $b_p$ | c | $D^{(1)}$ | $E^{(1)}$ | e | $e_1$ | $H_E$ | $L_p$ | v | w | y | θ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 1.1 | 0.1 | 1.0 | 0.15 | 0.30 | 0.25 | 2.2 | 1.35 | 0.65 | 1.3 | 2.4 | 0.46 | 0.3 | 0.1 | 0.1 | 8° |
| | min | 0.8 | 0 | 0.8 | | 0.15 | 0.08 | 1.8 | 1.15 | | | 1.8 | 0.26 | | | | 0° |

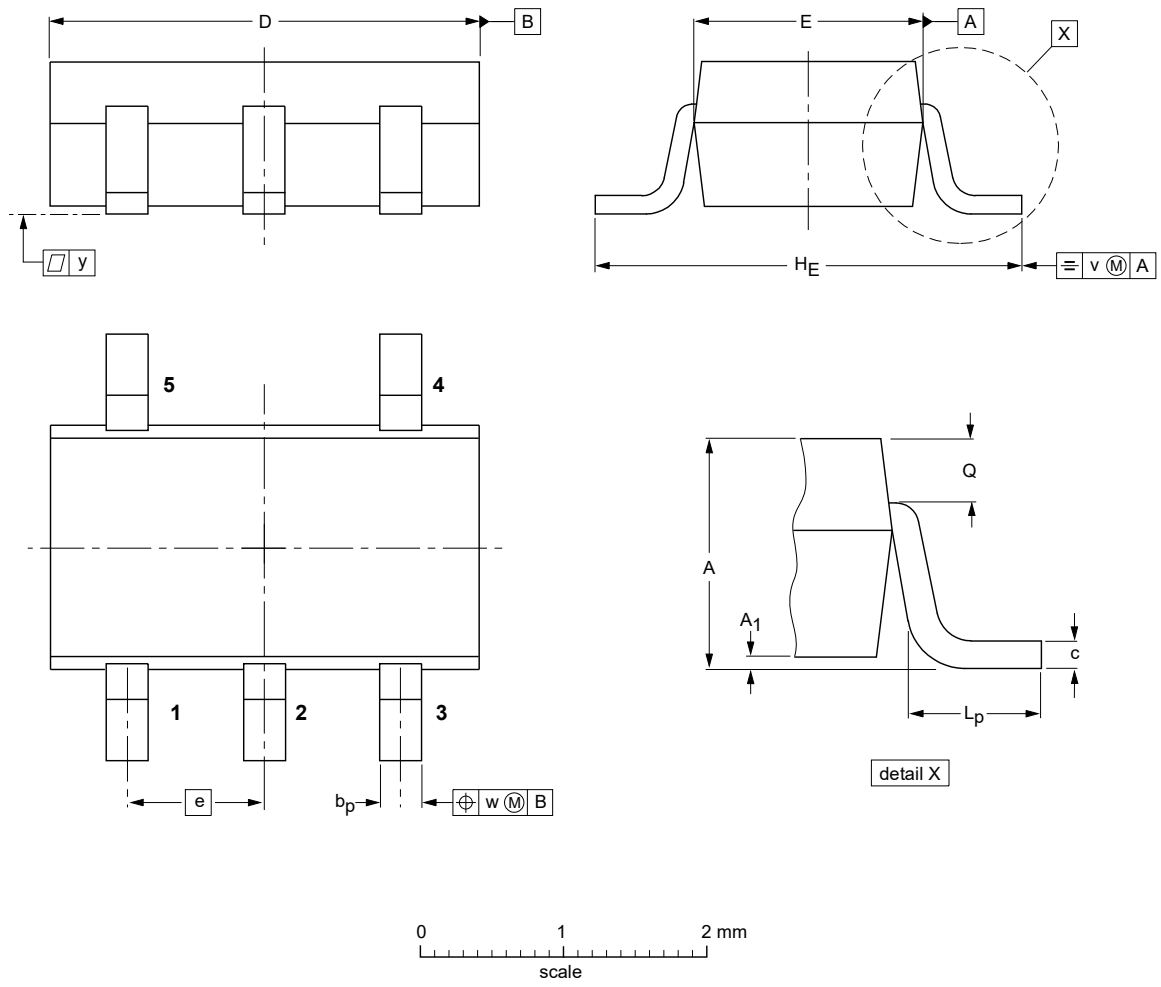
Note
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

*sot353-1_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT353-1 | | MO-203 | SC-88A | | | ~~21-12-15~~ 21-12-16 |

**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)**

# 15. Abbreviations

**Table 10. Abbreviations**

| Acronym | Description |
|---|---|
| CMOS | Complementary Metal-Oxide Semiconductor |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |
| MIL | Military |
| 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_Q100 v.3 | 20220117 | Product data sheet | - | 74HC_HCT1G14_Q100 v.2 |
| Modifications: | • The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.<br>• Legal texts have been adapted to the new company name where appropriate.<br>• Section 1 and Section 2 updated.<br>• Table 5: Derating values for $P_{tot}$ total power dissipation updated.<br>• Fig. 18: Package outline drawing for SOT353-1 (TSSOP5) has changed | | | |
| 74HC_HCT1G14_Q100 v.2 | 20121227 | Product data sheet | - | 74HC_HCT1G14_Q100 v.1 |
| Modifications: | • Table 3: Pin number Y output changed from 5 to 4 (errata). | | | |
| 74HC_HCT1G14_Q100 v.1 | 20120820 | Product data sheet | - | - |

# 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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