

# 74HC1G14; 74HCT1G14

## Inverting Schmitt trigger

Rev. 04 — 17 July 2007

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 those of the 74HC14 and 74HCT14.

## 2. Features

- 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

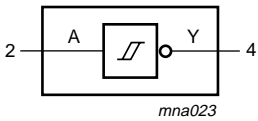
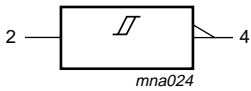
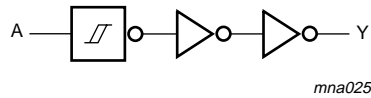
| Type number               | Package   |        |   |          |
|---------------------------|---|--------|---|----------|
|                           | Temperature range   | Name   | Description   | Version  |
| 74HC1G14GW<br>74HCT1G14GW | $-40\text{ }^{\circ}\text{C}$ to $+125\text{ }^{\circ}\text{C}$ | TSSOP5 | plastic thin shrink small outline package;<br>5 leads; body width 1.25 mm | SOT353-1 |
| 74HC1G14GV<br>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 |
|-------------|---------|
| 74HC1G14GW  | HF      |
| 74HCT1G14GW | TF      |
| 74HC1G14GV  | H14     |
| 74HCT1G14GV | T14     |

## 6. Functional diagram

|  |  |   |
|--|--|---|
|  <p>Fig 1. Logic symbol</p> |  <p>Fig 2. IEC logic symbol</p> |  <p>Fig 3. Logic diagram</p> |
|--|--|---|

## 7. Pinning information

### 7.1 Pinning

74HC1G14  
74HCT1G14

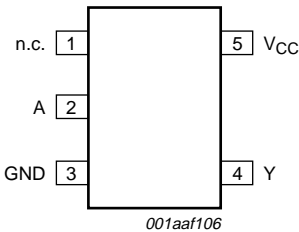


Fig 4. Pin configuration

### 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               | 5   | 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>IH</sub> or V <sub>IL</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>IH</sub> or V <sub>IL</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="#">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="#">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="#">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>IH</sub> or V <sub>IL</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>IH</sub> or V <sub>IL</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; $I_O = 0\text{ A}$ ;<br>$V_{CC} = 5.5\text{ V}$                                       | -                | -    | 10  | -                 | 20  | $\mu\text{A}$ |
| $\Delta I_{CC}$ | additional supply current        | per input; $V_{CC} = 4.5\text{ V}$ to $5.5\text{ V}$ ;<br>$V_I = V_{CC} - 2.1\text{ V}$ ; $I_O = 0\text{ A}$ | -                | -    | 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="#">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="#">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="#">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 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>           |                  |     |     |                   |     |      |
|                           |                               | $V_{CC} = 2.0\text{ V}$ ; $C_L = 50\text{ pF}$ | -                | 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 | $V_I = \text{GND to } V_{CC}$                  | -                | 20  | -   | -                 | -   | pF   |
| <b>For type 74HCT1G14</b> |                               |  |                  |     |     |                   |     |      |
| $t_{pd}$                  | propagation delay             | A to Y; see <a href="#">Figure 5</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 | $V_I = \text{GND to } V_{CC} - 1.5\text{ V}$   | -                | 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  $P_D$  ( $\mu\text{W}$ ).

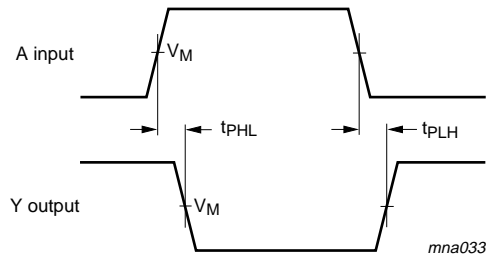
$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o) \text{ where:}$$

$f_i$  = 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

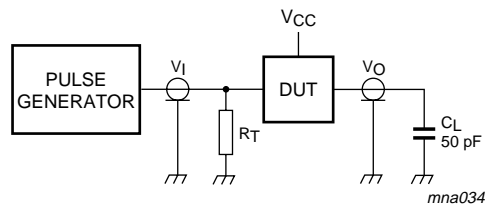


Measurement points are given in [Table 9](#).

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

Table 9. Measurement points

| Type number | Input                  |                       | Output                |
|-------------|------------------------|-----------------------|-----------------------|
|             | V <sub>I</sub>         | V <sub>M</sub>        | V <sub>M</sub>        |
| 74HC1G14    | GND to V <sub>CC</sub> | 0.5 × V <sub>CC</sub> | 0.5 × V <sub>CC</sub> |
| 74HCT1G14   | GND to 3.0 V           | 1.5 V                 | 0.5 × V <sub>CC</sub> |



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

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.

Fig 6. Load circuitry for switching times

## 14. Transfer characteristics waveforms

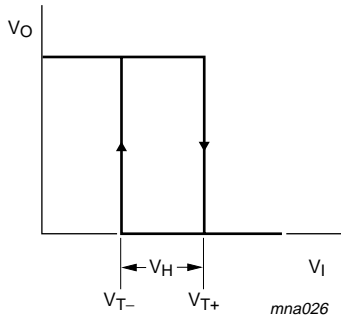


Fig 7. Transfer characteristic

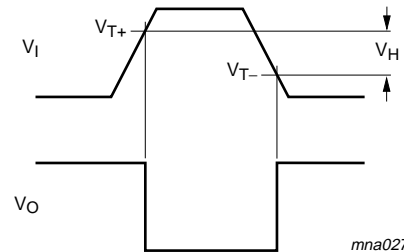


Fig 8. The definitions of  $V_{T+}$ ,  $V_{T-}$  and  $V_H$ ; where  $V_{T+}$  and  $V_{T-}$  are between limits of 20 % and 70 %

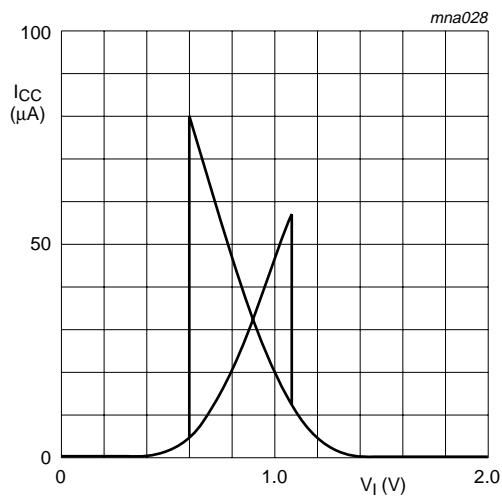


Fig 9. Typical 74HC1G14 transfer characteristics;  $V_{CC} = 2.0\text{ V}$

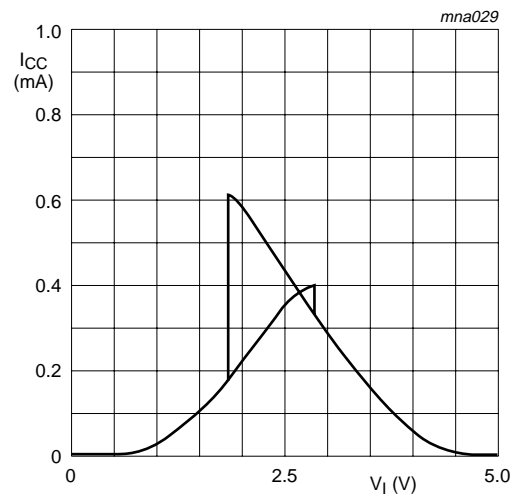


Fig 10. Typical 74HC1G14 transfer characteristics;  $V_{CC} = 4.5\text{ V}$

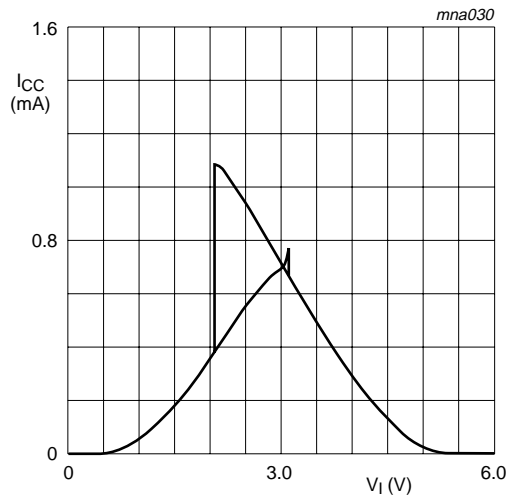


Fig 11. Typical 74HC1G14 transfer characteristics; V<sub>CC</sub> = 6.0 V

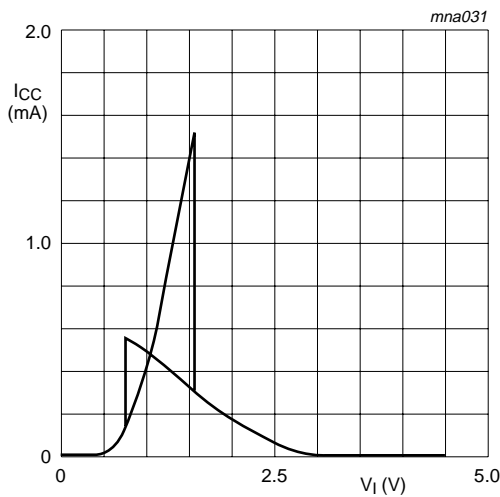


Fig 12. Typical 74HCT1G14 transfer characteristics; V<sub>CC</sub> = 4.5 V

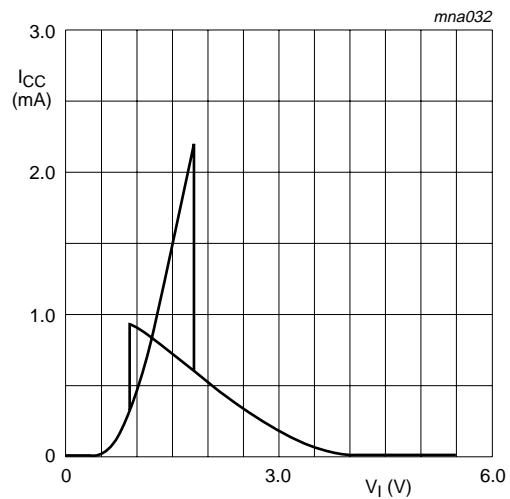


Fig 13. Typical 74HCT1G14 transfer characteristics; V<sub>CC</sub> = 5.5 V

## 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 [15](#).

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

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

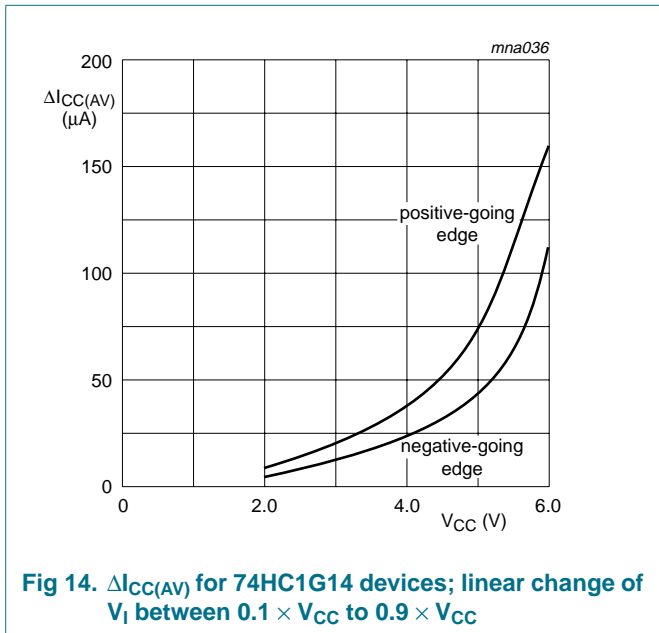


Fig 14.  $\Delta I_{CC(AV)}$  for 74HC1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$

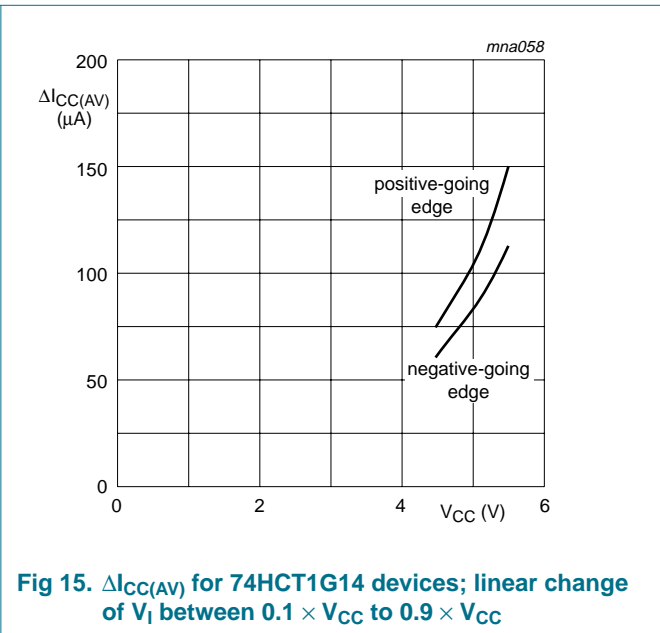


Fig 15.  $\Delta I_{CC(AV)}$  for 74HCT1G14 devices; linear change of  $V_I$  between  $0.1 \times V_{CC}$  to  $0.9 \times V_{CC}$

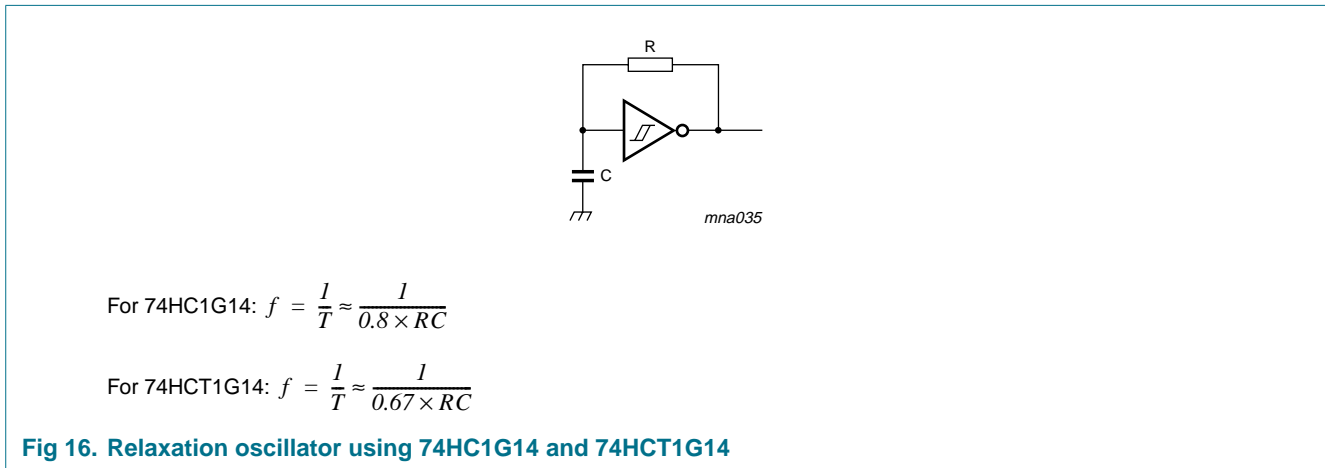


Fig 16. Relaxation oscillator using 74HC1G14 and 74HCT1G14

16. Package outline

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

SOT353-1

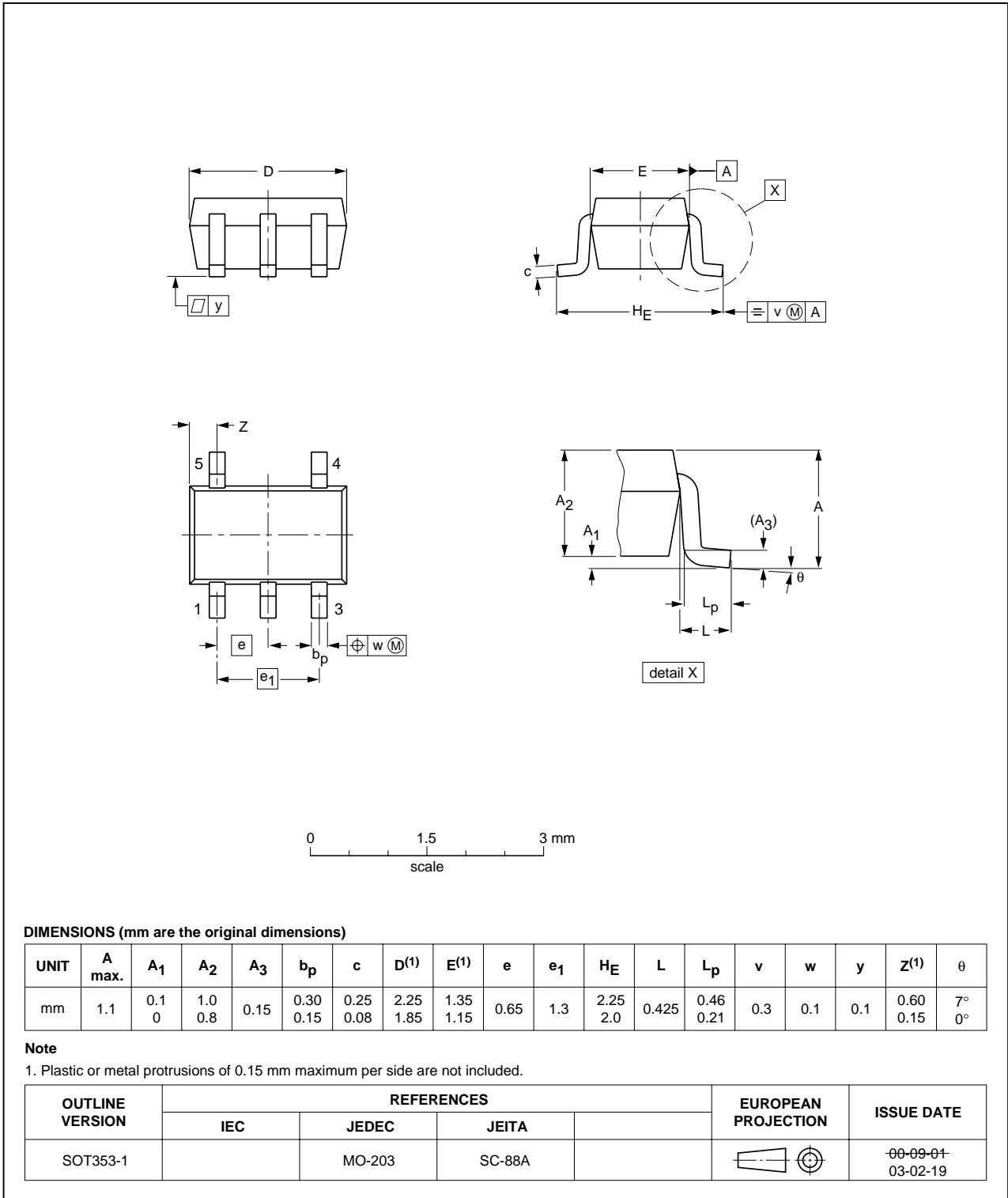


Fig 17. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

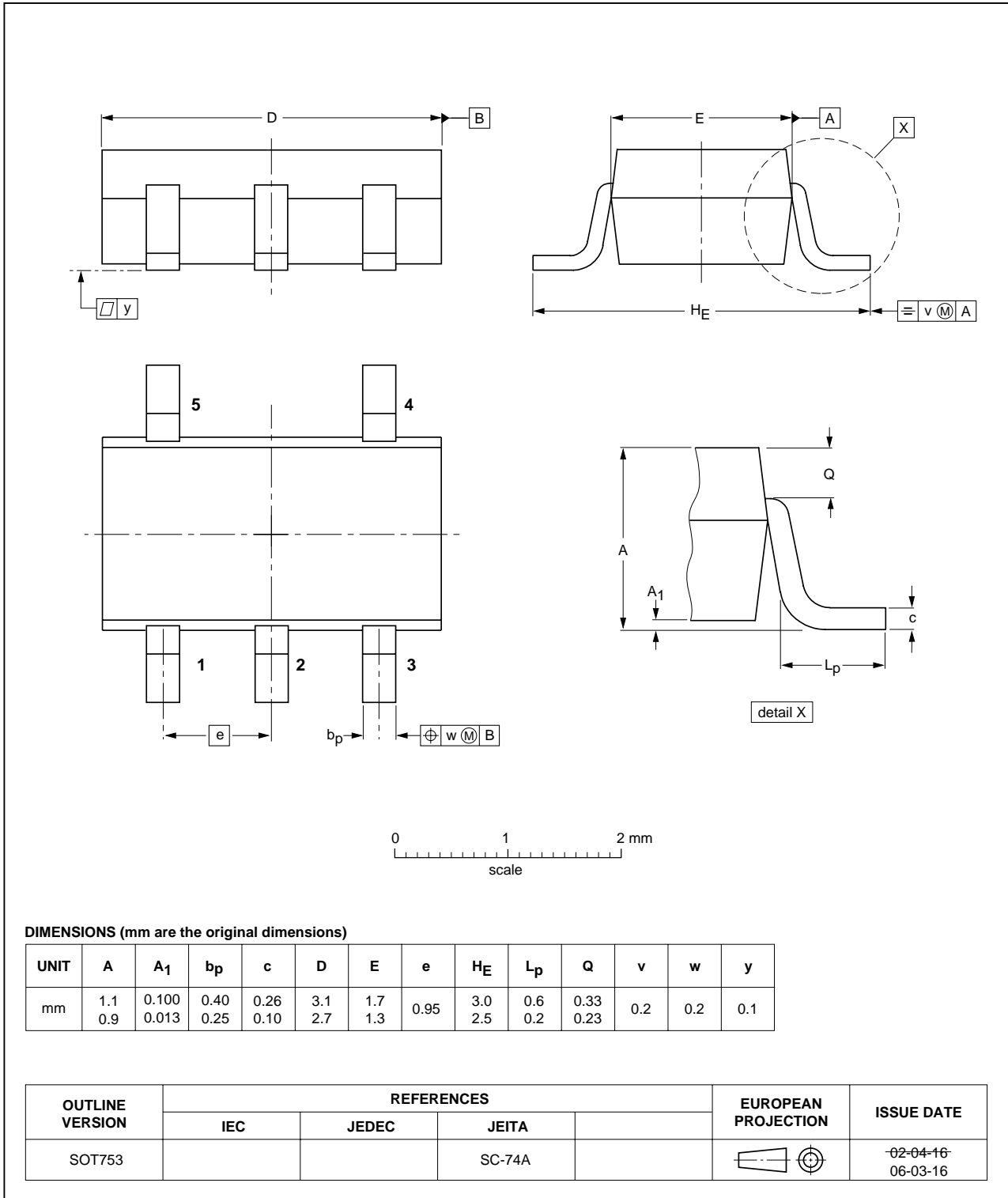


Fig 18. Package outline SOT753 (SC-74A)

## 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_4 | 20070717   | Product data sheet    | -             | 74HC_HCT1G14_3 |
| Modifications: | <ul style="list-style-type: none"> <li>• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors.</li> <li>• Legal texts have been adapted to the new company name where appropriate.</li> <li>• Package SOT353 changed to SOT353-1 in <a href="#">Table 1</a> and <a href="#">Figure 17</a>.</li> <li>• Quick Reference Data and Soldering sections removed.</li> <li>• <a href="#">Section 2 "Features"</a> updated.</li> </ul> |                       |               |                |
| 74HC_HCT1G14_3 | 20020515   | Product specification | -             | 74HC_HCT1G14_2 |
| 74HC_HCT1G14_2 | 20010302   | Product specification | -             | 74HC_HCT1G14_1 |
| 74HC_HCT1G14_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".

[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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