

# 74AHC1G17-Q100; 74AHCT1G17-Q100

Single Schmitt trigger buffer

Rev. 1 — 8 March 2016

Product data sheet

## 1. General description

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The 74AHC1G17-Q100 and 74AHCT1G17-Q100 are single buffers with Schmitt-trigger inputs. Inputs are overvoltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

The AHC device has CMOS input switching levels and supply voltage range 2 V to 5.5 V.

The AHCT device has TTL input switching levels and supply voltage range 4.5 V to 5.5 V.

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

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- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
  - ◆ Specified from  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Symmetrical output impedance
- High noise immunity
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pF}$ ,  $R = 0\text{ }\Omega$ )
- Low power dissipation
- Balanced propagation delays

## 3. Applications

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- Wave and pulse shapers
- Astable multivibrators
- Monostable multivibrators

## 4. Ordering information

Table 1. Ordering information

| Type number       | Package           |        |   | Version  |
|-------------------|-------------------|--------|---|----------|
|                   | Temperature range | Name   | Description   |          |
| 74AHC1G17GW-Q100  | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package;<br>5 leads; body width 1.25 mm | SOT353-1 |
| 74AHCT1G17GW-Q100 |                   |        |   |          |

## 5. Marking

Table 2. Marking codes

| Type number       | Marking code <sup>[1]</sup> |
|-------------------|-----------------------------|
| 74AHC1G17GW-Q100  | AJ                          |
| 74AHCT1G17GW-Q100 | CJ                          |

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

## 6. Functional diagram

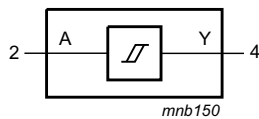


Fig 1. Logic symbol

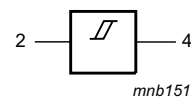


Fig 2. IEC logic symbol

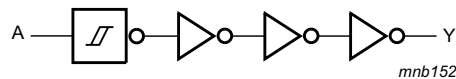


Fig 3. Logic diagram

## 7. Pinning information

### 7.1 Pinning

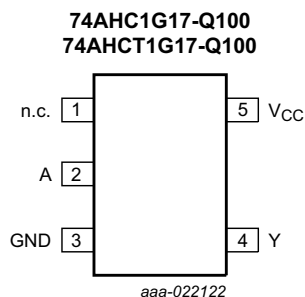


Fig 4. Pin configuration SOT353-1

### 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     | L      |
| H     | H      |

## 9. Limiting values

**Table 5. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol    | Parameter               | Conditions   | Min  | Max      | Unit |
|-----------|-------------------------|--|------|----------|------|
| $V_{CC}$  | supply voltage          |  | -0.5 | +7.0     | V    |
| $V_I$     | input voltage           |  | -0.5 | +7.0     | V    |
| $I_{IK}$  | input clamping current  | $V_I < -0.5$ V   | -20  | -        | mA   |
| $I_{OK}$  | output clamping current | $V_O < -0.5$ V or $V_O > V_{CC} + 0.5$ V <a href="#">[1]</a> | -    | $\pm 20$ | mA   |
| $I_O$     | output current          | $-0.5$ V $< V_O < V_{CC} + 0.5$ V                            | -    | $\pm 25$ | mA   |
| $I_{CC}$  | supply current          |  | -    | 75       | mA   |
| $I_{GND}$ | ground current          |  | -75  | -        | mA   |
| $T_{stg}$ | storage temperature     |  | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C <a href="#">[2]</a>            | -    | 250      | mW   |

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For TSSOP5 package: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

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

| Symbol    | Parameter           | Conditions | 74AHC1G17-Q100 |     |          | 74AHCT1G17-Q100 |     |          | Unit |
|-----------|---------------------|------------|----------------|-----|----------|-----------------|-----|----------|------|
|           |                     |            | Min            | Typ | Max      | Min             | Typ | Max      |      |
| $V_{CC}$  | supply voltage      |            | 2.0            | 5.0 | 5.5      | 4.5             | 5.0 | 5.5      | V    |
| $V_I$     | input voltage       |            | 0              | -   | 5.5      | 0               | -   | 5.5      | 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).

| Symbol                 | Parameter                 | Conditions   | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------------|---------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
|                        |                           |  | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC1G17-Q100</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> = -50 μA; V <sub>CC</sub> = 2.0 V   | 1.9   | 2.0 | -    | 1.9              | -    | 1.9               | -    | V    |
|                        |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 3.0 V   | 2.9   | 3.0 | -    | 2.9              | -    | 2.9               | -    | V    |
|                        |                           | I <sub>O</sub> = -50 μA; V <sub>CC</sub> = 4.5 V   | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                        |                           | I <sub>O</sub> = -4.0 mA; V <sub>CC</sub> = 3.0 V  | 2.58  | -   | -    | 2.48             | -    | 2.40              | -    | V    |
|                        |                           | I <sub>O</sub> = -8.0 mA; V <sub>CC</sub> = 4.5 V  | 3.94  | -   | -    | 3.8              | -    | 3.70              | -    | 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> = 50 μA; V <sub>CC</sub> = 2.0 V  | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                        |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 3.0 V  | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                        |                           | I <sub>O</sub> = 50 μA; V <sub>CC</sub> = 4.5 V  | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                        |                           | I <sub>O</sub> = 4.0 mA; V <sub>CC</sub> = 3.0 V   | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
|                        |                           | I <sub>O</sub> = 8.0 mA; V <sub>CC</sub> = 4.5 V   | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>         | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V   | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>        | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V  | -     | -   | 1.0  | -                | 10   | -                 | 40   | μA   |
| C <sub>I</sub>         | input capacitance         |  | -     | 1.5 | 10   | -                | 10   | -                 | 10   | pF   |
| <b>74AHCT1G17-Q100</b> |                           |  |       |     |      |                  |      |                   |      |      |
| V <sub>OH</sub>        | HIGH-level output voltage | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V  |       |     |      |                  |      |                   |      |      |
|                        |                           | I <sub>O</sub> = -50 μA  | 4.4   | 4.5 | -    | 4.4              | -    | 4.4               | -    | V    |
|                        |                           | I <sub>O</sub> = -8.0 mA   | 3.94  | -   | -    | 3.8              | -    | 3.70              | -    | V    |
| V <sub>OL</sub>        | LOW-level output voltage  | V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub> ; V <sub>CC</sub> = 4.5 V  |       |     |      |                  |      |                   |      |      |
|                        |                           | I <sub>O</sub> = 50 μA   | -     | 0   | 0.1  | -                | 0.1  | -                 | 0.1  | V    |
|                        |                           | I <sub>O</sub> = 8.0 mA  | -     | -   | 0.36 | -                | 0.44 | -                 | 0.55 | V    |
| I <sub>I</sub>         | input leakage current     | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 0 V to 5.5 V   | -     | -   | 0.1  | -                | 1.0  | -                 | 2.0  | μA   |
| I <sub>CC</sub>        | supply current            | V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 5.5 V  | -     | -   | 1.0  | -                | 10   | -                 | 40   | μA   |
| ΔI <sub>CC</sub>       | additional supply current | per input pin; V <sub>I</sub> = 3.4 V;<br>other inputs at V <sub>CC</sub> or GND;<br>I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V | -     | -   | 1.35 | -                | 1.5  | -                 | 1.5  | mA   |
| C <sub>I</sub>         | input capacitance         |  | -     | 1.5 | 10   | -                | 10   | -                 | 10   | pF   |

## 11.1 Transfer characteristics

**Table 8. Transfer characteristics**

At recommended operating conditions; voltages are referenced to GND (ground = 0 V). See [Figure 7](#) and [Figure 8](#).

| Symbol                 | Parameter                        | Conditions              | 25 °C |     |      | −40 °C to +85 °C |      | −40 °C to +125 °C |      | Unit |
|------------------------|----------------------------------|-------------------------|-------|-----|------|------------------|------|-------------------|------|------|
|                        |                                  |                         | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC1G17-Q100</b>  |                                  |                         |       |     |      |                  |      |                   |      |      |
| V <sub>T+</sub>        | positive-going threshold voltage | V <sub>CC</sub> = 3.0 V | -     | -   | 2.2  | -                | 2.2  | -                 | 2.2  | V    |
|                        |                                  | V <sub>CC</sub> = 4.5 V | -     | -   | 3.15 | -                | 3.15 | -                 | 3.15 | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | -     | -   | 3.85 | -                | 3.85 | -                 | 3.85 | V    |
| V <sub>T-</sub>        | negative-going threshold voltage | V <sub>CC</sub> = 3.0 V | 0.9   | -   | -    | 0.9              | -    | 0.9               | -    | V    |
|                        |                                  | V <sub>CC</sub> = 4.5 V | 1.35  | -   | -    | 1.35             | -    | 1.35              | -    | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | 1.65  | -   | -    | 1.65             | -    | 1.65              | -    | V    |
| V <sub>H</sub>         | hysteresis voltage               | V <sub>CC</sub> = 3.0 V | 0.3   | -   | 1.2  | 0.3              | 1.2  | 0.25              | 1.2  | V    |
|                        |                                  | V <sub>CC</sub> = 4.5 V | 0.4   | -   | 1.4  | 0.4              | 1.4  | 0.35              | 1.4  | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | 0.5   | -   | 1.6  | 0.5              | 1.6  | 0.45              | 1.6  | V    |
| <b>74AHCT1G17-Q100</b> |                                  |                         |       |     |      |                  |      |                   |      |      |
| V <sub>T+</sub>        | positive-going threshold voltage | V <sub>CC</sub> = 4.5 V | -     | -   | 2.0  | -                | 2.0  | -                 | 2.0  | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | -     | -   | 2.0  | -                | 2.0  | -                 | 2.0  | V    |
| V <sub>T-</sub>        | negative-going threshold voltage | V <sub>CC</sub> = 4.5 V | 0.5   | -   | -    | 0.5              | -    | 0.5               | -    | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | 0.6   | -   | -    | 0.6              | -    | 0.6               | -    | V    |
| V <sub>H</sub>         | hysteresis voltage               | V <sub>CC</sub> = 4.5 V | 0.4   | -   | 1.4  | 0.4              | 1.4  | 0.35              | 1.4  | V    |
|                        |                                  | V <sub>CC</sub> = 5.5 V | 0.4   | -   | 1.6  | 0.4              | 1.6  | 0.35              | 1.6  | V    |

## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

$GND = 0\text{ V}$ ;  $t_r = t_f \leq 3.0\text{ ns}$ . For waveform, see [Figure 5](#). For test circuit, see [Figure 6](#).

| Symbol                 | Parameter                     | Conditions   | 25 °C |     |      | -40 °C to +85 °C |      | -40 °C to +125 °C |      | Unit |
|------------------------|-------------------------------|--|-------|-----|------|------------------|------|-------------------|------|------|
|                        |                               |  | Min   | Typ | Max  | Min              | Max  | Min               | Max  |      |
| <b>74AHC1G17-Q100</b>  |                               |  |       |     |      |                  |      |                   |      |      |
| $t_{pd}$               | propagation delay             | A to Y; <a href="#">[1]</a>  |       |     |      |                  |      |                   |      |      |
|                        |                               | $V_{CC} = 3.0\text{ V to }3.6\text{ V}$ <a href="#">[2]</a>  |       |     |      |                  |      |                   |      |      |
|                        |                               | $C_L = 15\text{ pF}$   | -     | 4.2 | 12.8 | 1.0              | 15.0 | 1.0               | 16.5 | ns   |
|                        |                               | $C_L = 50\text{ pF}$   | -     | 6.0 | 16.3 | 1.0              | 18.5 | 1.0               | 20.5 | ns   |
|                        |                               | $V_{CC} = 4.5\text{ V to }5.5\text{ V}$ <a href="#">[3]</a>  |       |     |      |                  |      |                   |      |      |
|                        |                               | $C_L = 15\text{ pF}$   | -     | 3.2 | 8.6  | 1.0              | 10.0 | 1.0               | 11.0 | ns   |
|                        |                               | $C_L = 50\text{ pF}$   | -     | 4.6 | 10.6 | 1.0              | 12.0 | 1.0               | 13.5 | ns   |
| $C_{PD}$               | power dissipation capacitance | per buffer; <a href="#">[4]</a><br>$C_L = 50\text{ pF}$ ; $f = 1\text{ MHz}$ ;<br>$V_I = GND\text{ to }V_{CC}$ | -     | 12  | -    | -                | -    | -                 | -    | pF   |
| <b>74AHCT1G17-Q100</b> |                               |  |       |     |      |                  |      |                   |      |      |
| $t_{pd}$               | propagation delay             | A to Y; <a href="#">[1][3]</a><br>$V_{CC} = 4.5\text{ V to }5.5\text{ V}$                                      |       |     |      |                  |      |                   |      |      |
|                        |                               | $C_L = 15\text{ pF}$   | -     | 4.1 | 7.0  | 1.0              | 8.0  | 1.0               | 9.0  | ns   |
|                        |                               | $C_L = 50\text{ pF}$   | -     | 5.9 | 8.5  | 1.0              | 10.0 | 1.0               | 11.0 | ns   |
| $C_{PD}$               | power dissipation capacitance | per buffer; <a href="#">[4]</a><br>$V_I = GND\text{ to }V_{CC}$  | -     | 13  | -    | -                | -    | -                 | -    | pF   |

[1]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[2] Typical values are measured at  $V_{CC} = 3.3\text{ V}$ .

[3] Typical values are measured at  $V_{CC} = 5.0\text{ V}$ .

[4]  $C_{PD}$  is used to determine the dynamic power dissipation  $P_D$  ( $\mu\text{W}$ ).

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

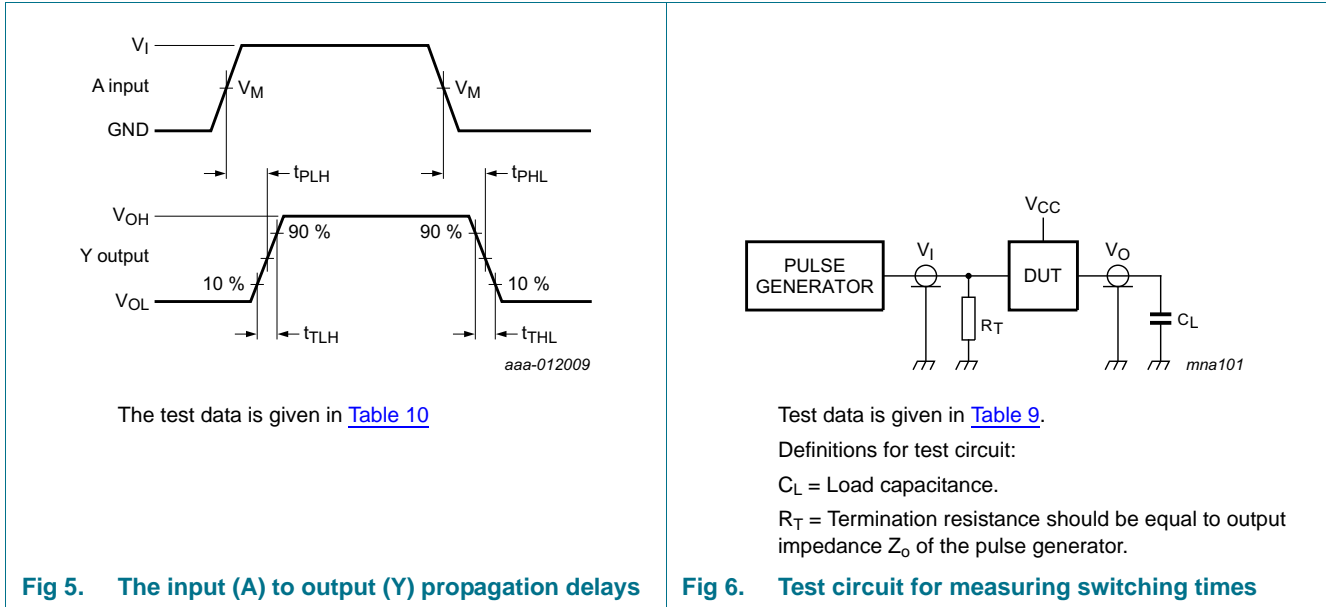
$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in Volts.

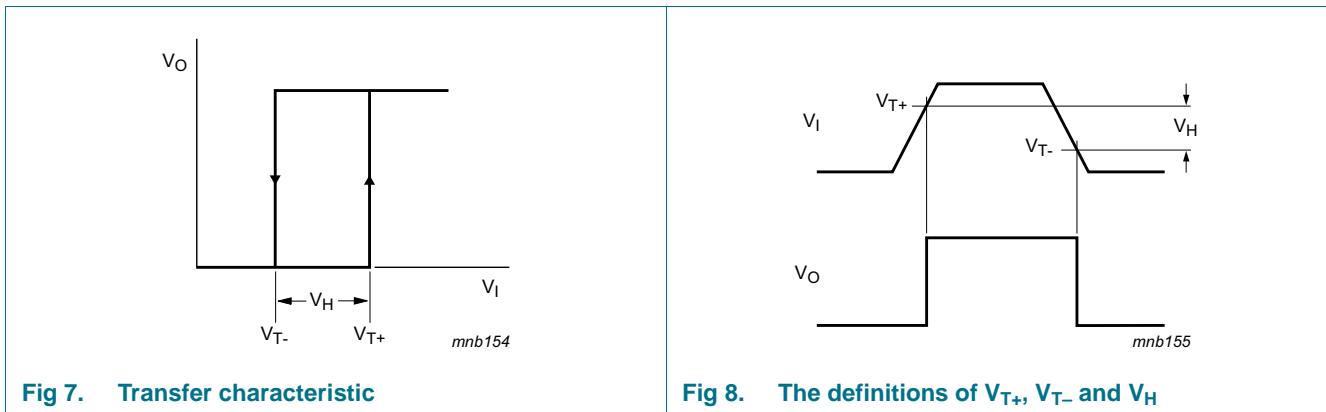
## 13. Waveforms



**Table 10. Test data**

| Type number     | Input           |                     | Output              |
|-----------------|-----------------|---------------------|---------------------|
|                 | $V_I$           | $V_M$               | $V_M$               |
| 74AHC1G17-Q100  | GND to $V_{CC}$ | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 74AHCT1G17-Q100 | GND to 3.0 V    | 1.5 V               | $0.5 \times V_{CC}$ |

### 13.1 Transfer characteristic waveforms



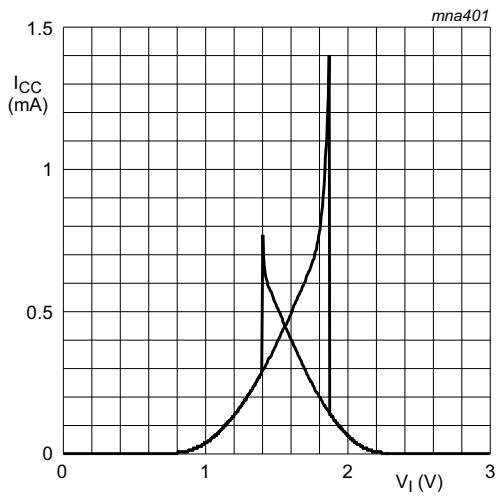


Fig 9. Typical 74AHC1G17-Q100 transfer characteristics;  $V_{CC} = 3.0\text{ V}$

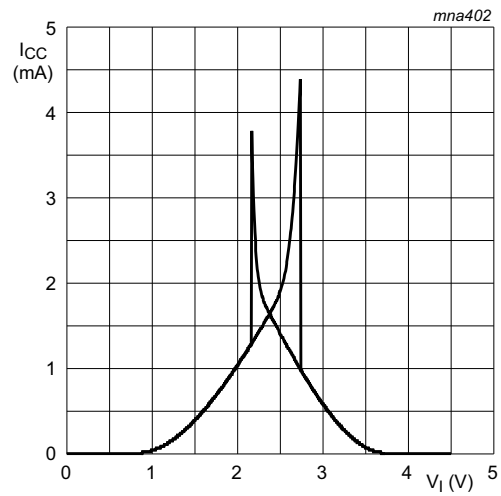


Fig 10. Typical 74AHC1G17-Q100 transfer characteristics;  $V_{CC} = 4.5\text{ V}$

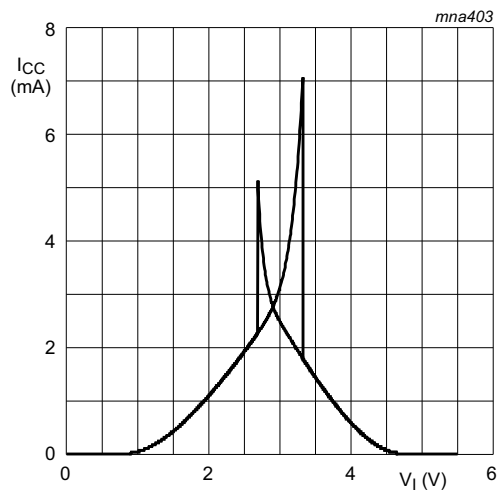


Fig 11. Typical 74AHC1G17-Q100 transfer characteristics;  $V_{CC} = 5.5\text{ V}$

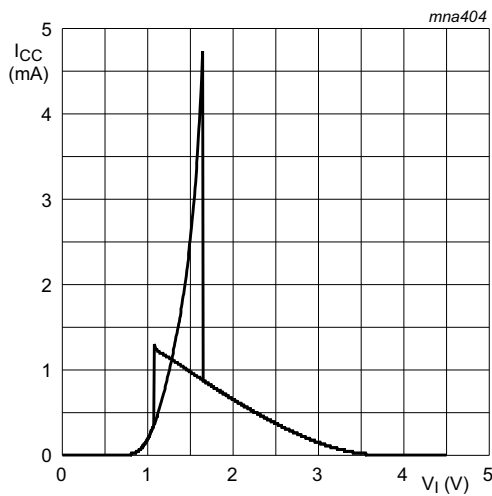


Fig 12. Typical 74AHCT1G17-Q100 transfer characteristics;  $V_{CC} = 4.5\text{ V}$

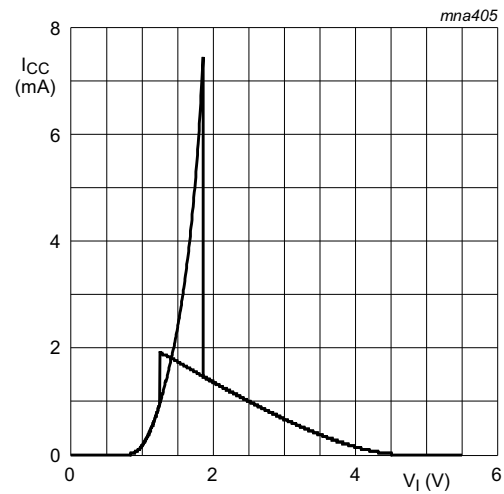


Fig 13. Typical 74AHCT1G17-Q100 transfer characteristics;  $V_{CC} = 5.5\text{ V}$

## 14. Application information

The slow input rise and fall times cause additional power dissipation, which can be calculated using the following formula:

$$P_{\text{add}} = f_i \times (t_r \times \Delta I_{\text{CC(AV)}} + t_f \times \Delta I_{\text{CC(AV)}}) \times V_{\text{CC}} \text{ where:}$$

$P_{\text{add}}$  = additional power dissipation ( $\mu\text{W}$ );

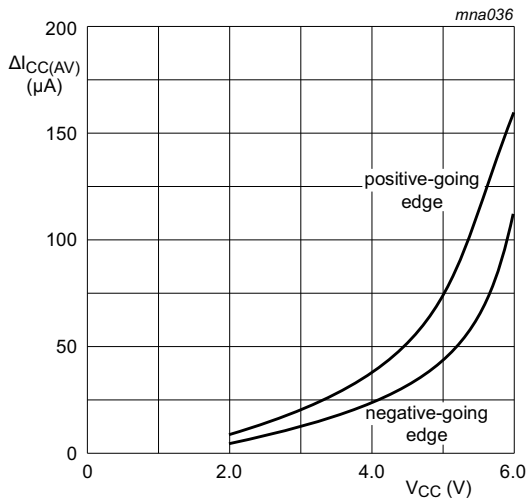
$f_i$  = input frequency (MHz);

$t_r$  = input rise time (ns); 10 % to 90 %;

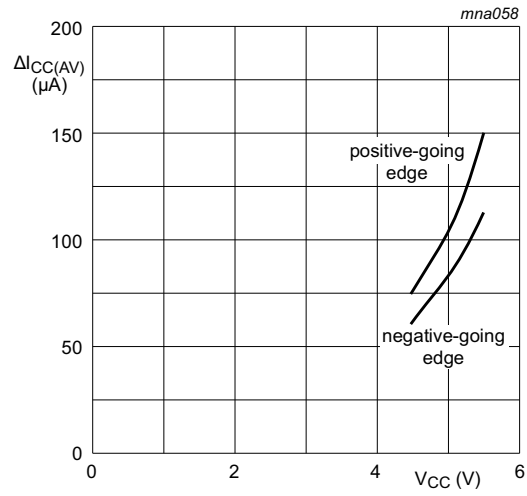
$t_f$  = input fall time (ns); 90 % to 10 %;

$\Delta I_{\text{CC(AV)}}$  = average additional supply current ( $\mu\text{A}$ ).

Average additional  $I_{\text{CC}}$  differs with positive or negative input transitions, as shown in [Figure 14](#) and [Figure 15](#).



**Fig 14. Average additional I<sub>CC</sub> for 74AHC1G17-Q100 Schmitt trigger devices; linear change of V<sub>I</sub> between 0.1V<sub>CC</sub> to 0.9V<sub>CC</sub>**



**Fig 15. Average additional I<sub>CC</sub> for 74AHCT1G17-Q100 Schmitt trigger devices; linear change of V<sub>I</sub> between 0.1V<sub>CC</sub> to 0.9V<sub>CC</sub>**

## 15. Package outline

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

SOT353-1

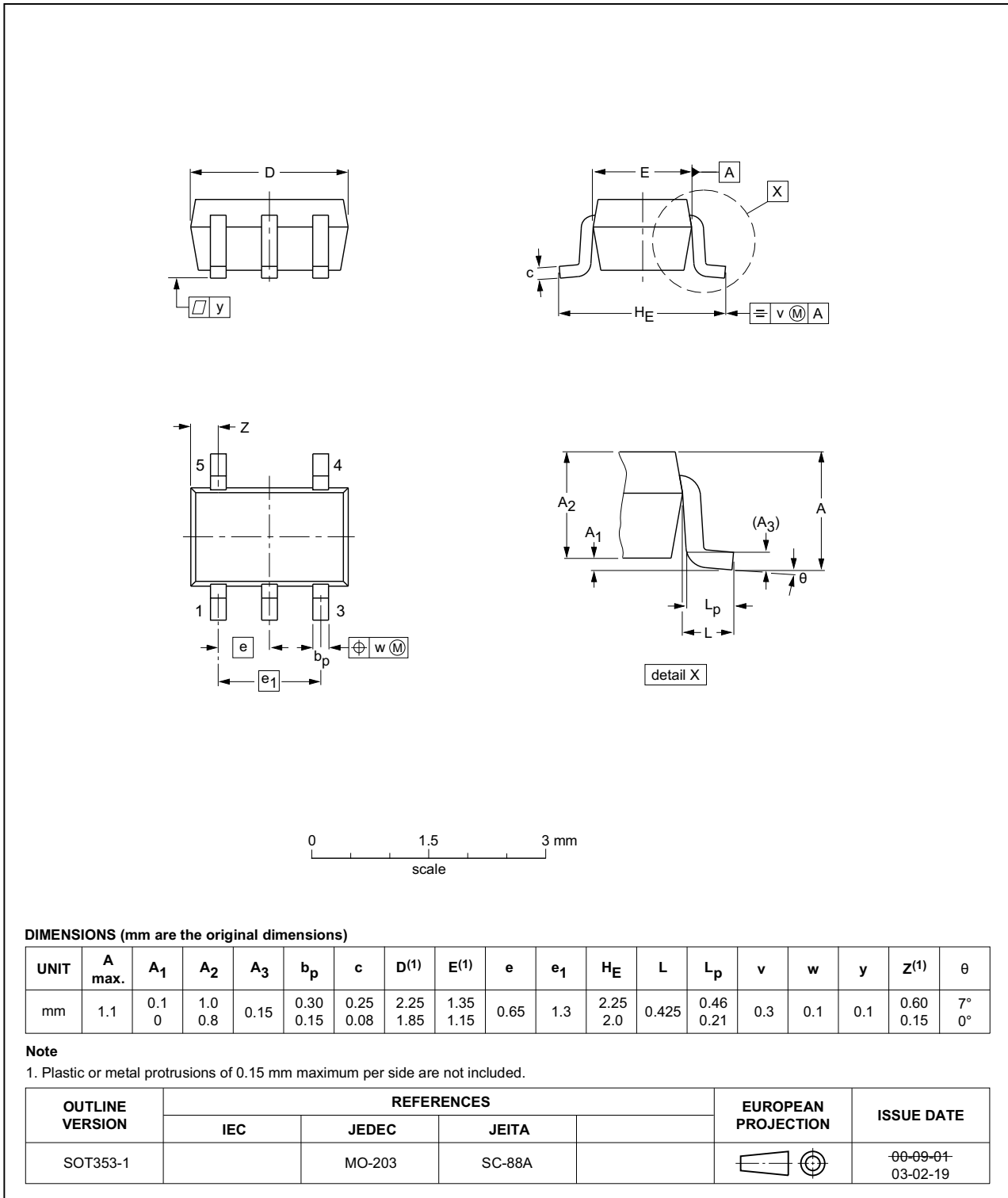


Fig 16. Package outline SOT353-1 (TSSOP5)

## 16. Abbreviations

Table 11. Abbreviations

| Acronym | Description                             |
|---------|---|
| CDM     | Charged Device Model                    |
| CMOS    | Complementary Metal-Oxide Semiconductor |
| DUT     | Device Under Test                       |
| ESD     | ElectroStatic Discharge                 |
| HBM     | Human Body Model                        |
| MM      | Machine Model                           |
| TTL     | Transistor-Transistor Logic             |
| MIL     | Military                                |

## 17. Revision history

Table 12. Revision history

| Document ID             | Release date | Data sheet status  | Change notice | Supersedes |
|-------------------------|--------------|--------------------|---------------|------------|
| 74AHC_AHCT1G17_Q100 v.1 | 20160308     | Product data sheet | -             | -          |

## 18. Legal information

### 18.1 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.nexperia.com>.

### 18.2 Definitions

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#### Suitability for use in automotive applications — This Nexperia

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## 19. Contact information

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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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