

# 74LVC1G17-Q100

Single Schmitt trigger buffer

Rev. 1 — 9 July 2012

Product data sheet

## 1. General description

The 74LVC1G17-Q100 provides a buffer function with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined outputs.

The input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

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  $-40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  and from  $-40\text{ }^{\circ}\text{C}$  to  $+125\text{ }^{\circ}\text{C}$
- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- Complies with JEDEC standard
  - ◆ JESD8-7 (1.65 V to 1.95 V)
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ MIL-STD-883, method 3015 exceeds 2000 V
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V ( $C = 200\text{ pf}$ ,  $R = 0\text{ }\Omega$ )
- $\pm 24\text{ mA}$  output drive ( $V_{CC} = 3.0\text{ V}$ )
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Unlimited rise and fall times
- Inputs accept voltages up to 5 V
- Multiple package options



## 3. Ordering information

Table 1. Ordering information

| Type number      | Package           |        |  |          |
|------------------|-------------------|--------|--|----------|
|                  | Temperature range | Name   | Description  | Version  |
| 74LVC1G17GW-Q100 | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G17GV-Q100 | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads                               | SOT753   |

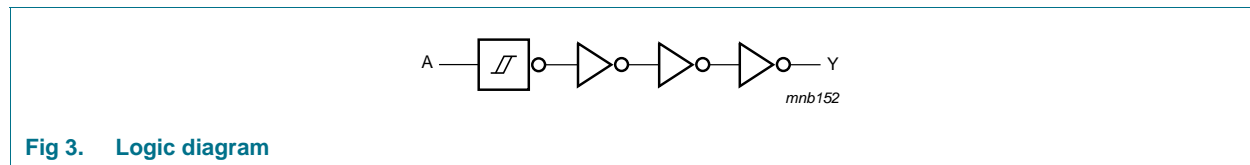
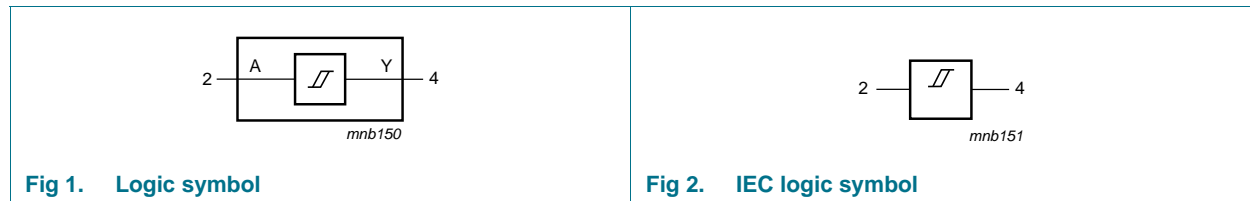
## 4. Marking

Table 2. Marking codes

| Type number      | Marking <sup>[1]</sup> |
|------------------|------------------------|
| 74LVC1G17GW-Q100 | VJ                     |
| 74LVC1G17GV-Q100 | V17                    |

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

## 5. Functional diagram



## 6. Pinning information

### 6.1 Pinning

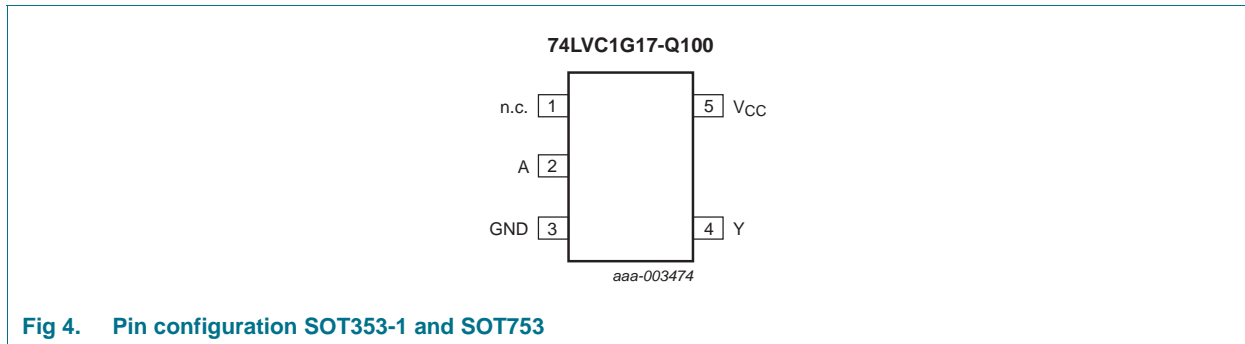


Fig 4. Pin configuration SOT353-1 and SOT753

### 6.2 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 |

## 7. Functional description

Table 4. Function table<sup>[1]</sup>

| Input | Output |
|-------|--------|
| A     | Y      |
| L     | L      |
| H     | H      |

[1] H = HIGH voltage level; L = LOW voltage level

## 8. 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        | +6.5           | V    |
| $I_{IK}$  | input clamping current  | $V_I < 0$ V                     | -50         | -              | mA   |
| $V_I$     | input voltage           |                                 | [1] -0.5    | +6.5           | V    |
| $I_{OK}$  | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V   | -           | ±50            | mA   |
| $V_O$     | output voltage          | Active mode                     | [1][2] -0.5 | $V_{CC} + 0.5$ | V    |
|           |                         | Power-down mode                 | [1][2] -0.5 | +6.5           | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$         | -           | ±50            | mA   |
| $I_{CC}$  | supply current          |                                 | -           | 100            | mA   |
| $I_{GND}$ | ground current          |                                 | -100        | -              | mA   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to $+125$ °C | [3] -       | 250            | mW   |
| $T_{stg}$ | storage temperature     |                                 | -65         | +150           | °C   |

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

[2] When  $V_{CC} = 0$  V (Power-down mode), the output voltage can be 5.5 V in normal operation.

[3] For TSSOP5 and SC-74A packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.

## 9. Recommended operating conditions

**Table 6. Recommended operating conditions**

| Symbol    | Parameter           | Conditions                      | Min  | Typ | Max      | Unit |
|-----------|---------------------|---------------------------------|------|-----|----------|------|
| $V_{CC}$  | supply voltage      |                                 | 1.65 | -   | 5.5      | V    |
| $V_I$     | input voltage       |                                 | 0    | -   | 5.5      | V    |
| $V_O$     | output voltage      | Active mode                     | 0    | -   | $V_{CC}$ | V    |
|           |                     | $V_{CC} = 0$ V; Power-down mode | 0    | -   | 5.5      | V    |
| $T_{amb}$ | ambient temperature |                                 | -40  | -   | +125     | °C   |

## 10. Static characteristics

**Table 7. Static characteristics**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol  | Parameter                 | Conditions                                  | Min            | Typ <sup>[1]</sup> | Max | Unit |
|---|---------------------------|---|----------------|--------------------|-----|------|
| <b><math>T_{amb} = -40</math> °C to <math>+85</math> °C</b> |                           |   |                |                    |     |      |
| $V_{OH}$  | HIGH-level output voltage | $V_I = V_{T+}$ or $V_{T-}$                  |                |                    |     |      |
|   |                           | $I_O = -100$ μA; $V_{CC} = 1.65$ V to 5.5 V | $V_{CC} - 0.1$ | -                  | -   | V    |
|   |                           | $I_O = -4$ mA; $V_{CC} = 1.65$ V            | 1.2            | -                  | -   | V    |
|   |                           | $I_O = -8$ mA; $V_{CC} = 2.3$ V             | 1.9            | -                  | -   | V    |
|   |                           | $I_O = -12$ mA; $V_{CC} = 2.7$ V            | 2.2            | -                  | -   | V    |
|   |                           | $I_O = -24$ mA; $V_{CC} = 3.0$ V            | 2.3            | -                  | -   | V    |
|   |                           | $I_O = -32$ mA; $V_{CC} = 4.5$ V            | 3.8            | -                  | -   | V    |

**Table 7. Static characteristics ...continued**

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol                                     | Parameter                 | Conditions   | Min                   | Typ <sup>[1]</sup> | Max  | Unit |
|--|---------------------------|--|-----------------------|--------------------|------|------|
| 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> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V   | -                     | -                  | 0.1  | V    |
|  |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V  | -                     | -                  | 0.45 | V    |
|  |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V   | -                     | -                  | 0.3  | V    |
|  |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V  | -                     | -                  | 0.4  | V    |
|  |                           | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V  | -                     | -                  | 0.55 | V    |
|  |                           | I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V  | -                     | -                  | 0.55 | V    |
| I <sub>I</sub>                             | input leakage current     | V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V  | -                     | ±0.1               | ±5   | μA   |
| I <sub>OFF</sub>                           | power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V  | -                     | ±0.1               | ±10  | μA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A                    | -                     | 0.1                | 10   | μA   |
| ΔI <sub>CC</sub>                           | additional supply current | V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 2.3 V to 5.5 V; per pin | -                     | 5                  | 500  | μA   |
| C <sub>I</sub>                             | input capacitance         |  | -                     | 5                  | -    | pF   |
| <b>T<sub>amb</sub> = -40 °C to +125 °C</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> = -100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V  | V <sub>CC</sub> - 0.1 | -                  | -    | V    |
|  |                           | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V   | 0.95                  | -                  | -    | V    |
|  |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V  | 1.7                   | -                  | -    | V    |
|  |                           | I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V   | 1.9                   | -                  | -    | V    |
|  |                           | I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V   | 2.0                   | -                  | -    | V    |
|  |                           | I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V   | 3.4                   | -                  | -    | 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> = 100 μA; V <sub>CC</sub> = 1.65 V to 5.5 V   | -                     | -                  | 0.1  | V    |
|  |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V  | -                     | -                  | 0.7  | V    |
|  |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V   | -                     | -                  | 0.45 | V    |
|  |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V  | -                     | -                  | 0.6  | V    |
|  |                           | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V  | -                     | -                  | 0.80 | V    |
|  |                           | I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V  | -                     | -                  | 0.80 | V    |
| I <sub>I</sub>                             | input leakage current     | V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V  | -                     | -                  | ±100 | μA   |
| I <sub>OFF</sub>                           | power-off leakage current | V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V  | -                     | -                  | ±200 | μA   |
| I <sub>CC</sub>                            | supply current            | V <sub>I</sub> = 5.5 V or GND;<br>V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A                    | -                     | -                  | 200  | μA   |
| ΔI <sub>CC</sub>                           | additional supply current | per pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A;<br>V <sub>CC</sub> = 2.3 V to 5.5 V | -                     | -                  | 5000 | μA   |

[1] All typical values are measured at maximum V<sub>CC</sub> and T<sub>amb</sub> = 25 °C.

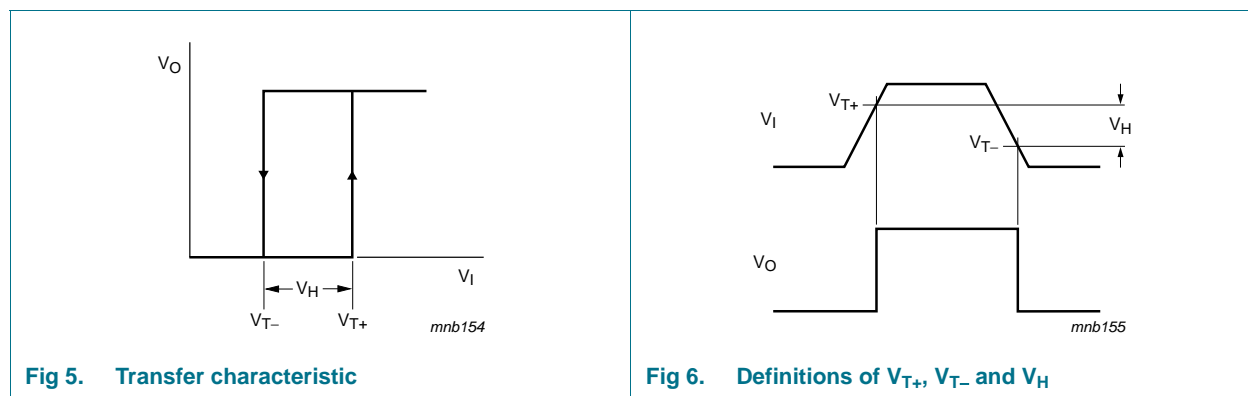
**Table 8. Transfer characteristics**

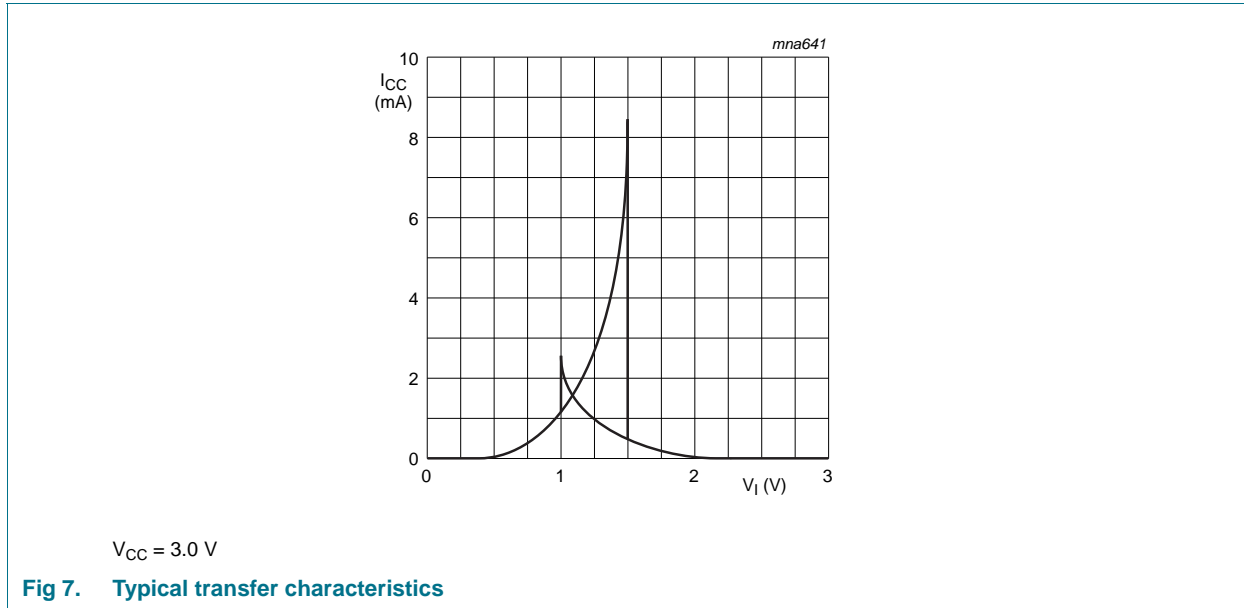
At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

| Symbol          | Parameter                        | Conditions   | -40 °C to +85 °C |                    |      | -40 °C to +125 °C |      | Unit |
|-----------------|----------------------------------|--|------------------|--------------------|------|-------------------|------|------|
|                 |                                  |  | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| V <sub>T+</sub> | positive-going threshold voltage | see <a href="#">Figure 5</a> and <a href="#">Figure 6</a>                            |                  |                    |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V  | 0.82             | 1.0                | 1.14 | 0.79              | 1.14 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V  | 1.03             | 1.2                | 1.40 | 1.00              | 1.40 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V  | 1.29             | 1.5                | 1.71 | 1.26              | 1.71 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V  | 1.84             | 2.1                | 2.36 | 1.81              | 2.36 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V  | 2.19             | 2.5                | 2.79 | 2.16              | 2.79 | V    |
| V <sub>T-</sub> | negative-going threshold voltage | see <a href="#">Figure 5</a> and <a href="#">Figure 6</a>                            |                  |                    |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V  | 0.46             | 0.6                | 0.75 | 0.46              | 0.78 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V  | 0.65             | 0.8                | 0.96 | 0.65              | 0.99 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V  | 0.88             | 1.0                | 1.24 | 0.88              | 1.27 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V  | 1.32             | 1.5                | 1.84 | 1.32              | 1.87 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V  | 1.58             | 1.8                | 2.24 | 1.58              | 2.27 | V    |
| V <sub>H</sub>  | hysteresis voltage               | see <a href="#">Figure 5</a> , <a href="#">Figure 6</a> and <a href="#">Figure 7</a> |                  |                    |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V  | 0.26             | 0.4                | 0.51 | 0.19              | 0.51 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V  | 0.28             | 0.4                | 0.57 | 0.22              | 0.57 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V  | 0.31             | 0.5                | 0.64 | 0.25              | 0.64 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V  | 0.40             | 0.6                | 0.77 | 0.34              | 0.77 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V  | 0.47             | 0.6                | 0.88 | 0.41              | 0.88 | V    |

[1] All typical values are measured at T<sub>amb</sub> = 25 °C.

### 10.1 Transfer characteristic waveforms





## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 9](#).

| Symbol          | Parameter                     | Conditions  | -40 °C to +85 °C |                    |      | -40 °C to +125 °C |      | Unit |
|-----------------|-------------------------------|---|------------------|--------------------|------|-------------------|------|------|
|                 |                               |   | Min              | Typ <sup>[1]</sup> | Max  | Min               | Max  |      |
| t <sub>pd</sub> | propagation delay             | A to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>                                 |                  |                    |      |                   |      |      |
|                 |                               | V <sub>CC</sub> = 1.65 V to 1.95 V  | 1.0              | 4.1                | 11.0 | 1.0               | 14.0 | ns   |
|                 |                               | V <sub>CC</sub> = 2.3 V to 2.7 V  | 0.7              | 2.8                | 6.5  | 0.7               | 8.5  | ns   |
|                 |                               | V <sub>CC</sub> = 2.7 V   | 0.7              | 3.2                | 6.5  | 0.7               | 8.5  | ns   |
|                 |                               | V <sub>CC</sub> = 3.0 V to 3.6 V  | 0.7              | 3.0                | 5.5  | 0.7               | 7.0  | ns   |
|                 |                               | V <sub>CC</sub> = 4.5 V to 5.5 V  | 0.7              | 2.2                | 5.0  | 0.7               | 6.5  | ns   |
| C <sub>PD</sub> | power dissipation capacitance | V <sub>I</sub> = GND to V <sub>CC</sub> ;<br>V <sub>CC</sub> = 3.3 V <sup>[3]</sup> | -                | 16.6               | -    | -                 | -    | pF   |

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

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

12. Waveforms

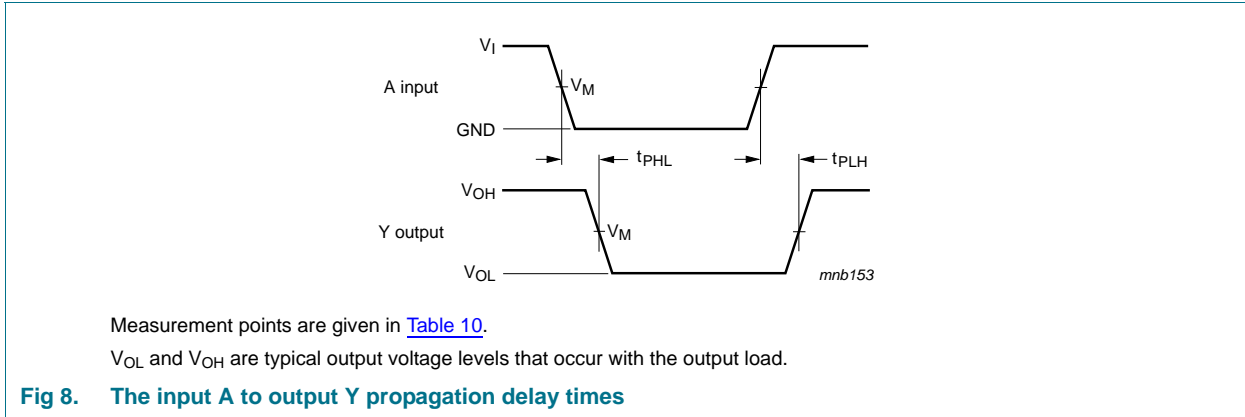


Table 10. Measurement points

| Supply voltage   | Input               | Output              |
|------------------|---------------------|---------------------|
| $V_{CC}$         | $V_M$               | $V_M$               |
| 1.65 V to 1.95 V | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.3 V to 2.7 V   | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |
| 2.7 V            | 1.5 V               | 1.5 V               |
| 3.0 V to 3.6 V   | 1.5 V               | 1.5 V               |
| 4.5 V to 5.5 V   | $0.5 \times V_{CC}$ | $0.5 \times V_{CC}$ |

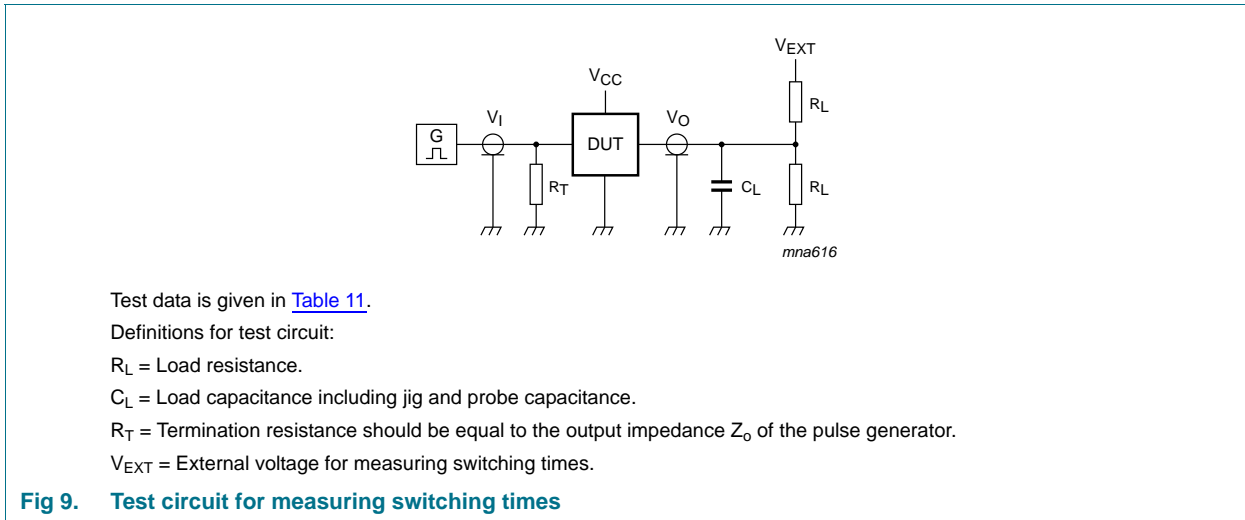
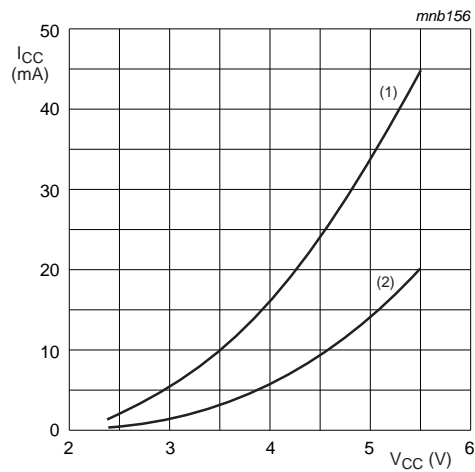




Table 11. Test data

| Supply voltage   | Input           |                                 | Load           |                | V <sub>EXT</sub>                    |
|------------------|-----------------|---------------------------------|----------------|----------------|-------------------------------------|
| V <sub>CC</sub>  | V <sub>I</sub>  | t <sub>r</sub> = t <sub>f</sub> | C <sub>L</sub> | R <sub>L</sub> | t <sub>PLH</sub> , t <sub>PHL</sub> |
| 1.65 V to 1.95 V | V <sub>CC</sub> | ≤ 2.0 ns                        | 30 pF          | 1 kΩ           | open                                |
| 2.3 V to 2.7 V   | V <sub>CC</sub> | ≤ 2.0 ns                        | 30 pF          | 500 Ω          | open                                |
| 2.7 V            | 2.7 V           | ≤ 2.5 ns                        | 50 pF          | 500 Ω          | open                                |
| 3.0 V to 3.6 V   | 2.7 V           | ≤ 2.5 ns                        | 50 pF          | 500 Ω          | open                                |
| 4.5 V to 5.5 V   | V <sub>CC</sub> | ≤ 2.5 ns                        | 50 pF          | 500 Ω          | open                                |

### 13. Application information



Linear change of V<sub>I</sub> between 0.8 V to 2.0 V.

- (1) Positive-going edge.
- (2) Negative-going edge.

Fig 10. Average supply current as a function of supply voltage

## 14. Package outline

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

SOT353-1

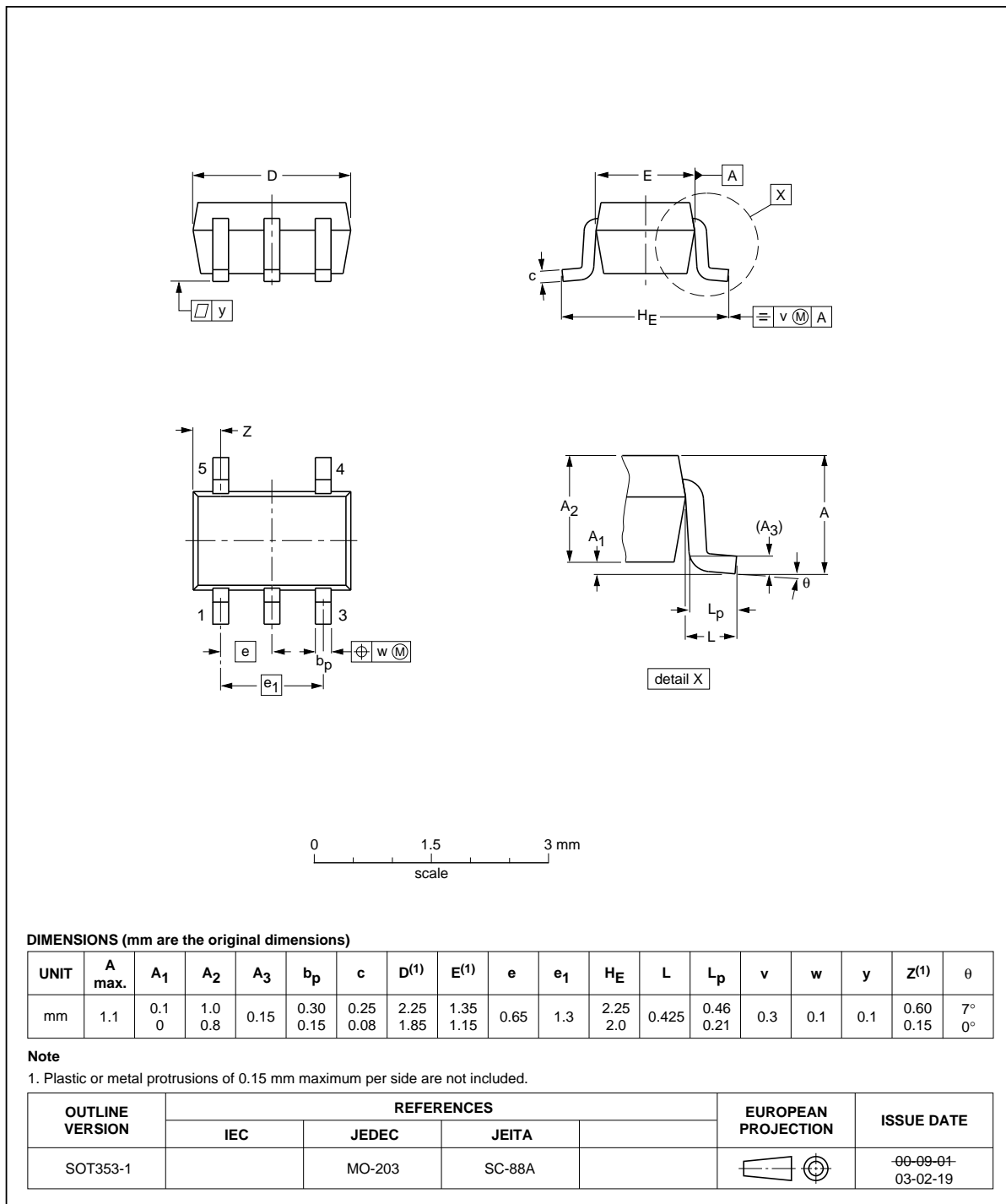


Fig 11. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

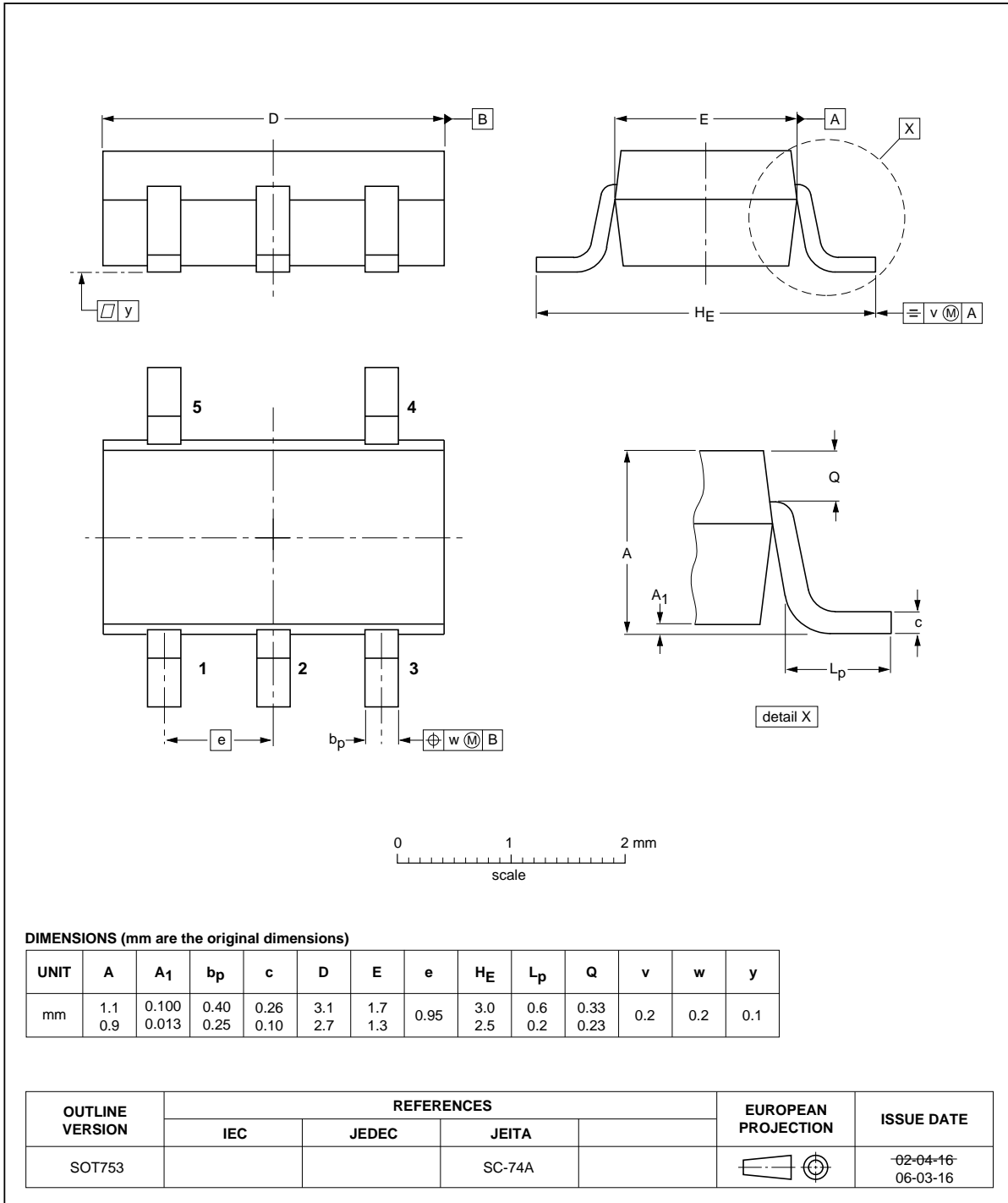


Fig 12. Package outline SOT753 (SC-74A)

## 15. Abbreviations

Table 12. Abbreviations

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

## 16. Revision history

Table 13. Revision history

| Document ID        | Release date | Data sheet status  | Change notice | Supersedes |
|--------------------|--------------|--------------------|---------------|------------|
| 74LVC1G17_Q100 v.1 | 20120709     | Product data sheet | -             | -          |

## 17. Legal information

### 17.1 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>.

### 17.2 Definitions

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Date of release: 9 July 2012

Document identifier: 74LVC1G17\_Q100