

# 74LVC1G97-Q100

Low-power configurable multiple function gate

Rev. 1 — 22 March 2019

Product data sheet

## 1. General description

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The 74LVC1G97-Q100 is a configurable multiple function gate with Schmitt-trigger inputs. The device can be configured as any of the following logic functions MUX, AND, OR, NAND, NOR, inverter and buffer; using the 3-bit input. All inputs can be connected to  $V_{CC}$  or GND.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

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

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- 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 1.65 V to 5.5 V
- 5 V tolerant input/output for interfacing with 5 V logic
- 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).
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM ANSI/ESDA/Jedec JS-001 exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V ( $C = 200$  pf,  $R = 0$   $\Omega$ )
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V

3. Ordering information

Table 1. Ordering information

| Type number      | Package           |       |                                          |         |
|------------------|-------------------|-------|------------------------------------------|---------|
|                  | Temperature range | Name  | Description                              | Version |
| 74LVC1G97GW-Q100 | -40 °C to +125 °C | SC-88 | plastic surface-mounted package; 6 leads | SOT363  |

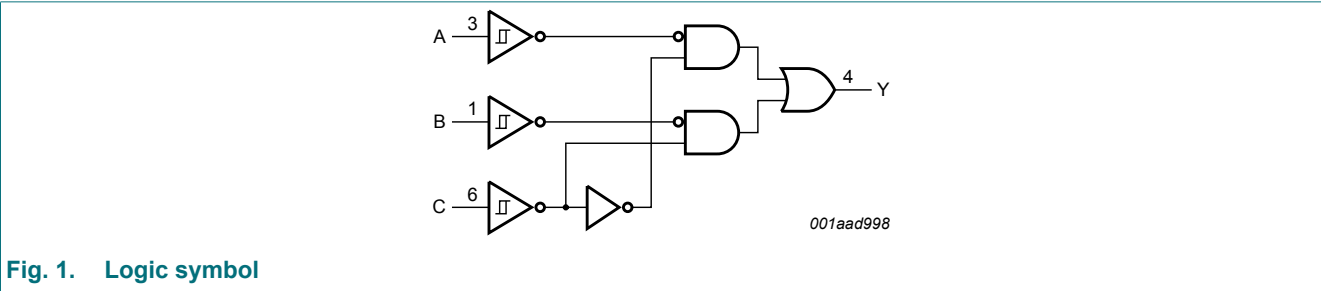
4. Marking

Table 2. Marking

| Type number      | Marking code [1] |
|------------------|------------------|
| 74LVC1G97GW-Q100 | YV               |

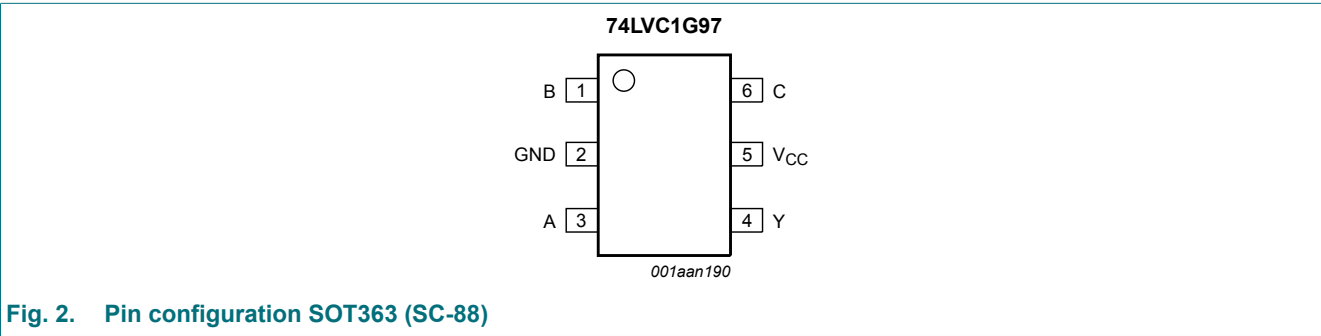
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1. Pinning



## 6.2. Pin description

**Table 3. Pin description**

| Symbol          | Pin | Description    |
|-----------------|-----|----------------|
| B               | 1   | data input     |
| GND             | 2   | ground (0 V)   |
| A               | 3   | data input     |
| Y               | 4   | data output    |
| V <sub>CC</sub> | 5   | supply voltage |
| C               | 6   | data input     |

## 7. Functional description

**Table 4. Function table**

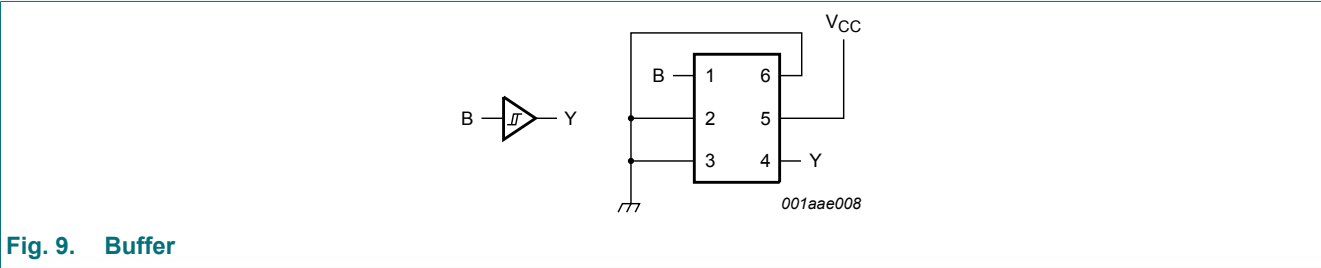
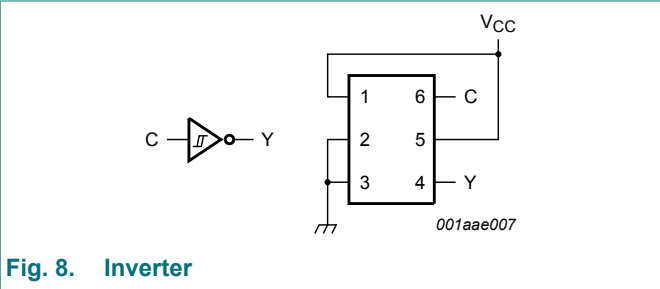
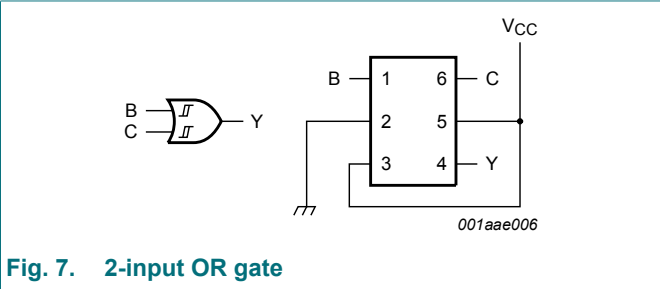
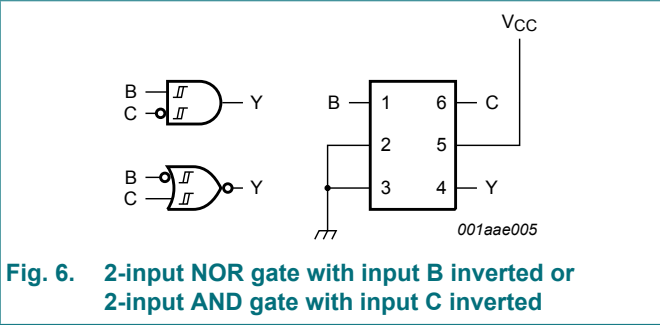
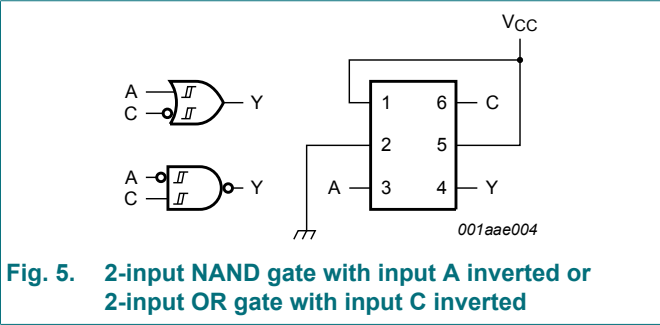
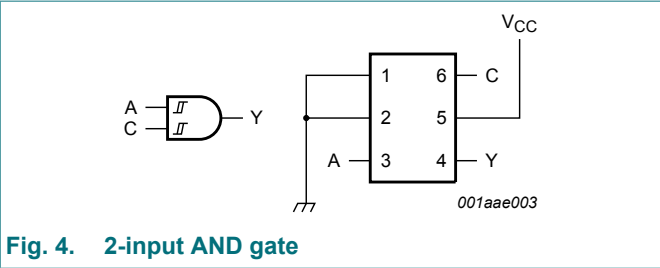
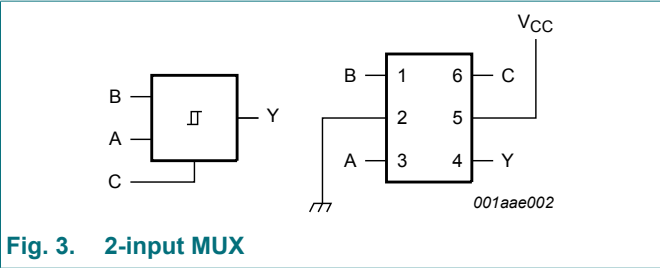
*H = HIGH voltage level; L = LOW voltage level.*

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

### 7.1. Logic configurations

**Table 5. Function selection table**

| Logic function                       | Figure                     |
|--------------------------------------|----------------------------|
| 2-input MUX                          | see <a href="#">Fig. 3</a> |
| 2-input AND                          | see <a href="#">Fig. 4</a> |
| 2-input OR with one input inverted   | see <a href="#">Fig. 5</a> |
| 2-input NAND with one input inverted | see <a href="#">Fig. 5</a> |
| 2-input AND with one input inverted  | see <a href="#">Fig. 6</a> |
| 2-input NOR with one input inverted  | see <a href="#">Fig. 6</a> |
| 2-input OR                           | see <a href="#">Fig. 7</a> |
| Inverter                             | see <a href="#">Fig. 8</a> |
| Buffer                               | see <a href="#">Fig. 9</a> |



## 8. Limiting values

**Table 6. 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           |                                 | -0.5 | +6.5     | V    |
| $I_{OK}$  | output clamping current | $V_O > V_{CC}$ or $V_O < 0$ V   | -    | $\pm 50$ | mA   |
| $V_O$     | output voltage          | Active mode                     | -0.5 | +6.5     | V    |
|           |                         | $V_{CC} = 0$ V; Power-down mode | -0.5 | +6.5     | V    |
| $I_O$     | output current          | $V_O = 0$ V to $V_{CC}$         | -    | $\pm 50$ | mA   |
| $I_{CC}$  | supply current          |                                 | -    | +100     | mA   |
| $I_{GND}$ | ground current          |                                 | -100 | -        | mA   |
| $T_{stg}$ | storage temperature     |                                 | -65  | +150     | °C   |
| $P_{tot}$ | total power dissipation | $T_{amb} = -40$ °C to +125 °C   | -    | 250      | mW   |

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

[2] For SC-88 packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.

## 9. Recommended operating conditions

**Table 7. 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 8. Static 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 [1] | Max  | Min                   | Max  |      |
| V <sub>OL</sub>  | LOW-level output voltage  | V <sub>I</sub> = V <sub>CC</sub> or GND                                                          |                       |         |      |                       |      |      |
|                  |                           | I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V                                       | -                     | -       | 0.1  | -                     | 0.1  | V    |
|                  |                           | I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V                                                  | -                     | -       | 0.45 | -                     | 0.7  | V    |
|                  |                           | I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V                                                   | -                     | -       | 0.3  | -                     | 0.45 | V    |
|                  |                           | I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V                                                  | -                     | -       | 0.4  | -                     | 0.6  | V    |
|                  |                           | I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V                                                  | -                     | -       | 0.55 | -                     | 0.8  | V    |
|                  |                           | I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V                                                  | -                     | -       | 0.55 | -                     | 0.8  | V    |
| V <sub>OH</sub>  | HIGH-level output voltage | V <sub>I</sub> = V <sub>CC</sub> or GND                                                          |                       |         |      |                       |      |      |
|                  |                           | I <sub>O</sub> = -100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V                                      | V <sub>CC</sub> - 0.1 | -       | -    | V <sub>CC</sub> - 0.1 | -    | V    |
|                  |                           | I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V                                                 | 1.2                   | -       | -    | 0.95                  | -    | V    |
|                  |                           | I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V                                                  | 1.9                   | -       | -    | 1.7                   | -    | V    |
|                  |                           | I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V                                                 | 2.2                   | -       | -    | 1.9                   | -    | V    |
|                  |                           | I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V                                                 | 2.3                   | -       | -    | 2.0                   | -    | V    |
|                  |                           | I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V                                                 | 3.8                   | -       | -    | 3.4                   | -    | 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    | ±1   | -                     | ±1   | 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    | ±2   | -                     | ±2   | µA   |
| I <sub>CC</sub>  | supply current            | V <sub>I</sub> = 5.5 V or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.65 V to 5.5 V           | -                     | 0.1     | 4    | -                     | 4    | 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; V <sub>CC</sub> = 2.3 V to 5.5 V | -                     | 5       | 500  | -                     | 500  | µA   |
| C <sub>I</sub>   | input capacitance         |                                                                                                  | -                     | 2.5     | -    | -                     | -    | pF   |

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

## 11. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 11.

| Symbol   | Parameter                     | Conditions                                                | -40 °C to +85 °C |         |      | -40 °C to +125 °C |      | Unit |
|----------|-------------------------------|-----------------------------------------------------------|------------------|---------|------|-------------------|------|------|
|          |                               |                                                           | Min              | Typ [1] | Max  | Min               | Max  |      |
| $t_{pd}$ | propagation delay             | A, B, C to Y; see Fig. 10 [2]                             |                  |         |      |                   |      |      |
|          |                               | $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$              | 1.0              | 6.0     | 14.4 | 1.0               | 18.0 | ns   |
|          |                               | $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$                | 0.5              | 3.5     | 8.3  | 0.5               | 10.4 | ns   |
|          |                               | $V_{CC} = 2.7 \text{ V}$                                  | 0.5              | 4.2     | 8.5  | 0.5               | 10.6 | ns   |
|          |                               | $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$                | 0.5              | 3.8     | 6.3  | 0.5               | 7.9  | ns   |
|          |                               | $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$                | 0.5              | 3.0     | 5.1  | 0.5               | 6.4  | ns   |
| $C_{PD}$ | power dissipation capacitance | $V_{CC} = 3.3 \text{ V}; V_I = \text{GND to } V_{CC}$ [3] | -                | 22      | -    | -                 | -    | pF   |

[1] Typical values are measured at nominal  $V_{CC}$  and at  $T_{amb} = 25 \text{ °C}$ .

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

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

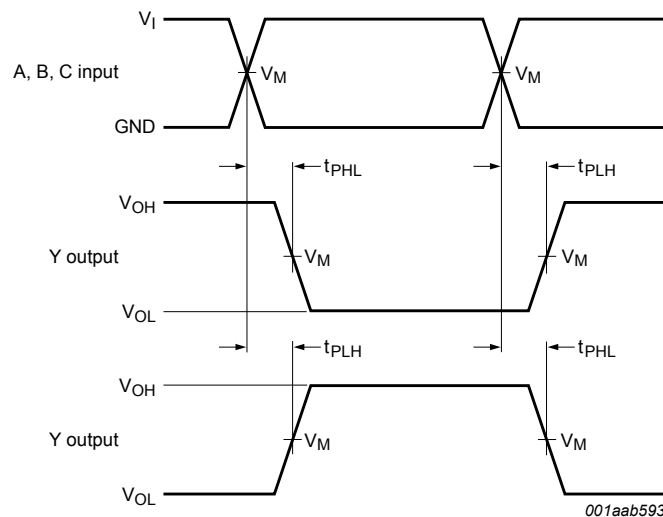
$C_L$  = output load capacitance in pF;

$V_{CC}$  = supply voltage in V;

$N$  = number of inputs switching;

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

### 11.1. Waveforms and test circuit



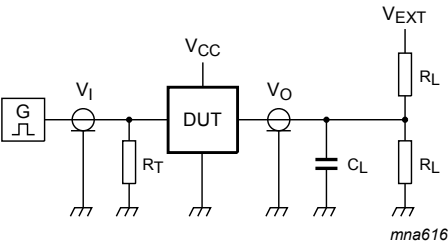
Measurement points are given in Table 10.

$V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig. 10. Input A, B and C to output Y propagation delay times**

Table 10. Measurement points

| Supply voltage   | Input              |                 | Output             |
|------------------|--------------------|-----------------|--------------------|
| V <sub>CC</sub>  | V <sub>M</sub>     | V <sub>I</sub>  | V <sub>M</sub>     |
| 1.65 V to 1.95 V | 0.5V <sub>CC</sub> | V <sub>CC</sub> | 0.5V <sub>CC</sub> |
| 2.3 V to 2.7 V   | 0.5V <sub>CC</sub> | V <sub>CC</sub> | 0.5V <sub>CC</sub> |
| 2.7 V            | 1.5 V              | 2.7 V           | 1.5 V              |
| 3.0 V to 3.6 V   | 1.5 V              | 2.7 V           | 1.5 V              |
| 4.5 V to 5.5 V   | 0.5V <sub>CC</sub> | V <sub>CC</sub> | 0.5V <sub>CC</sub> |



Measurement points are given in [Table 11](#).  
Definitions test circuit:  
RL = Load resistance.  
CL = Load capacitance including jig and probe capacitance.  
RT = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.  
V<sub>EXT</sub> = External voltage for measuring switching times.

Fig. 11. Test circuit for measuring switching times

Table 11. Measurement points

| 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 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                                |



## 12. Transfer characteristics

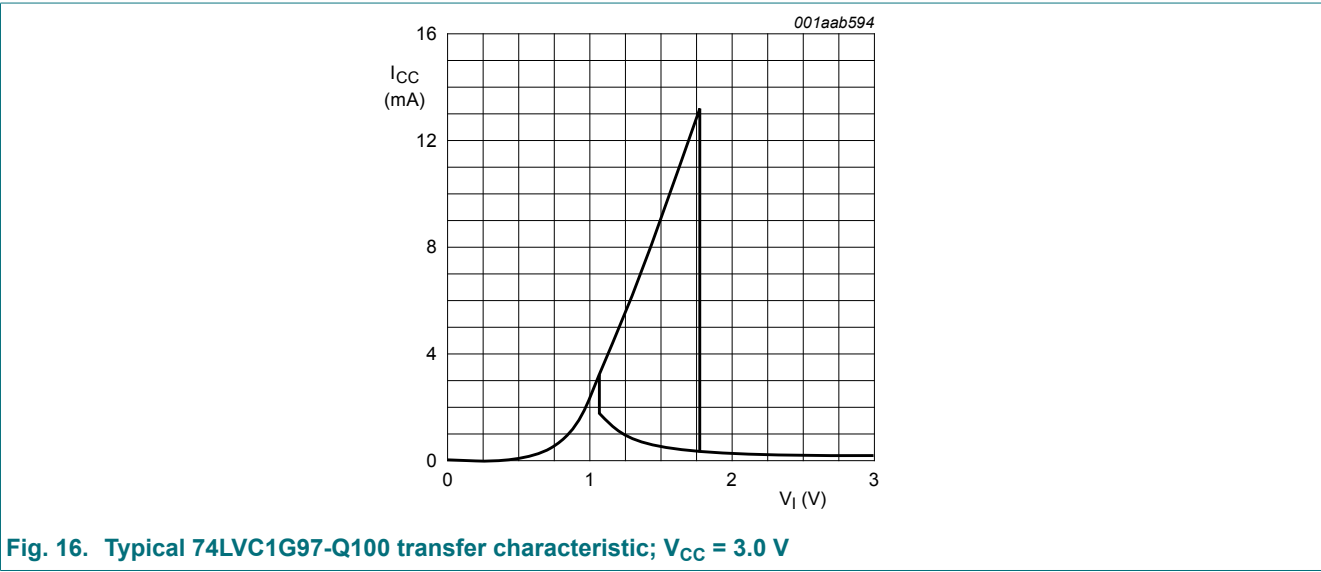
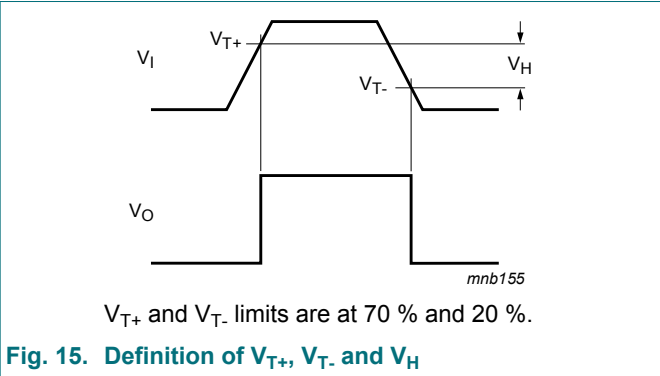
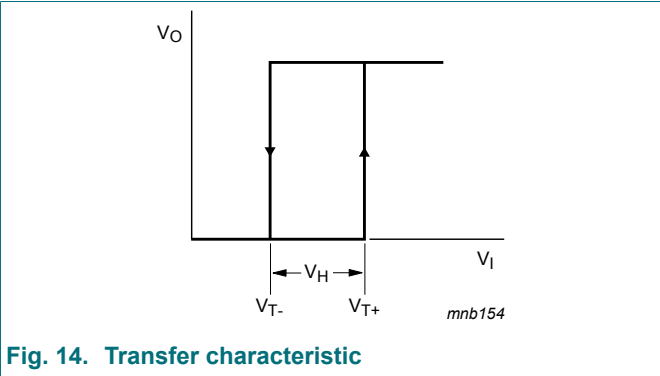
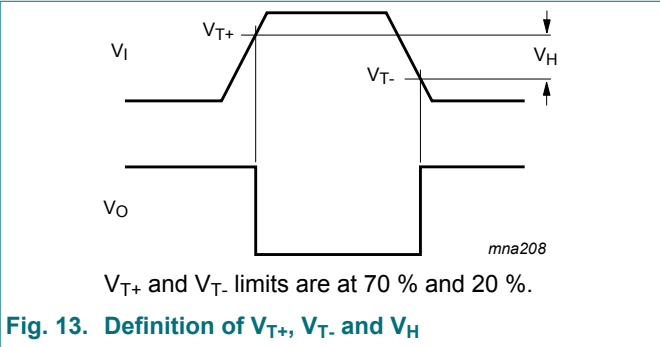
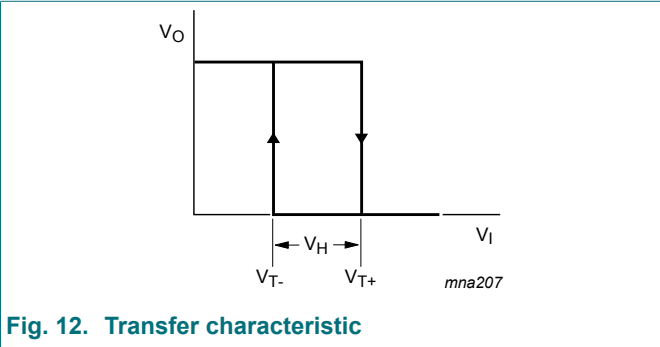
**Table 12. Transfer characteristics**

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 [1] | Max  | Min               | Max  |      |
| V <sub>T+</sub> | positive-going threshold voltage | See Fig. 12, Fig. 13, Fig. 14 and Fig. 15                                          |                  |         |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V                                                            | 0.70             | 1.02    | 1.20 | 0.67              | 1.20 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V                                                            | 1.11             | 1.42    | 1.60 | 1.08              | 1.60 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V, see Fig. 16                                               | 1.50             | 1.79    | 2.00 | 1.47              | 2.00 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                            | 2.16             | 2.52    | 2.74 | 2.13              | 2.74 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V                                                            | 2.61             | 2.99    | 3.33 | 2.58              | 3.33 | V    |
| V <sub>T-</sub> | negative-going threshold voltage | See Fig. 12, Fig. 13, Fig. 14 and Fig. 15                                          |                  |         |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V                                                            | 0.30             | 0.53    | 0.72 | 0.30              | 0.75 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V                                                            | 0.58             | 0.77    | 1.00 | 0.58              | 1.03 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V, see Fig. 16                                               | 0.80             | 1.04    | 1.30 | 0.80              | 1.33 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                            | 1.21             | 1.55    | 1.90 | 1.21              | 1.93 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V                                                            | 1.45             | 1.86    | 2.29 | 1.45              | 2.32 | V    |
| V <sub>H</sub>  | hysteresis voltage               | (V <sub>T+</sub> - V <sub>T-</sub> ).<br>See Fig. 12, Fig. 13, Fig. 14 and Fig. 15 |                  |         |      |                   |      |      |
|                 |                                  | V <sub>CC</sub> = 1.8 V                                                            | 0.30             | 0.48    | 0.62 | 0.23              | 0.62 | V    |
|                 |                                  | V <sub>CC</sub> = 2.3 V                                                            | 0.40             | 0.64    | 0.80 | 0.34              | 0.80 | V    |
|                 |                                  | V <sub>CC</sub> = 3.0 V, see Fig. 16                                               | 0.50             | 0.75    | 1.00 | 0.44              | 1.00 | V    |
|                 |                                  | V <sub>CC</sub> = 4.5 V                                                            | 0.71             | 0.97    | 1.20 | 0.65              | 1.20 | V    |
|                 |                                  | V <sub>CC</sub> = 5.5 V                                                            | 0.71             | 1.13    | 1.40 | 0.65              | 1.40 | V    |

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

12.1. Waveforms transfer characteristics



13. Package outline

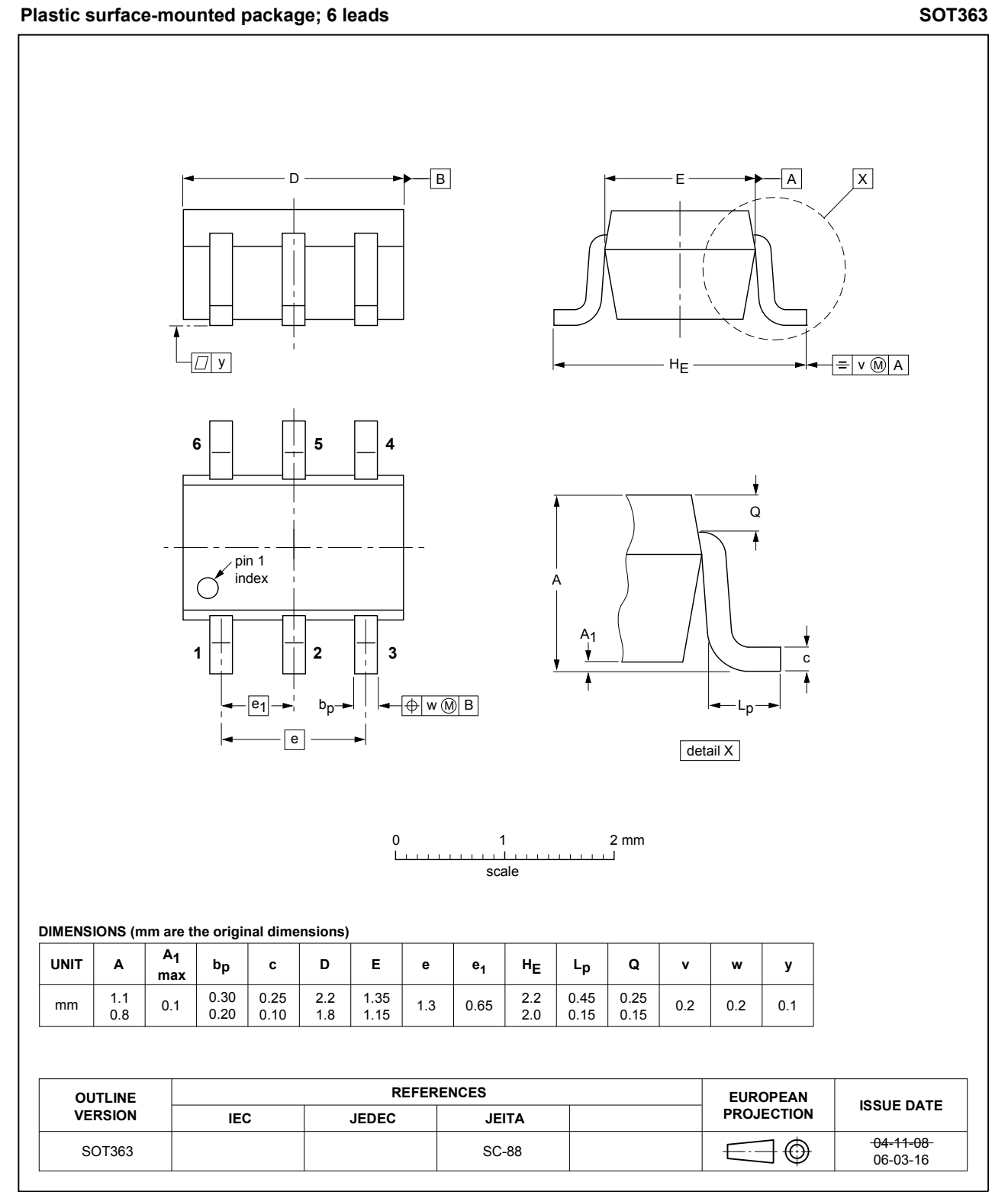


Fig. 17. Package outline SOT363 (SC-88)

## 14. Abbreviations

**Table 13. 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             |

## 15. Revision history

**Table 14. Revision history**

| Document ID        | Release date | Data sheet status  | Change notice | Supersedes |
|--------------------|--------------|--------------------|---------------|------------|
| 74LVC1G97_Q100 v.1 | 20190322     | Product data sheet | -             | -          |

## 16. Legal information

### Data sheet status

| Document status<br>[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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