# 74LVC1G125-Q100

# Bus buffer/line driver; 3-state Rev. 1 — 9 July 2012

**Product data sheet** 

#### **General description** 1.

The 74LVC1G125-Q100 provides one non-inverting buffer/line driver with 3-state output. The 3-state output is controlled by the output enable input (OE). A HIGH-level at pin OE causes the output to assume a high-impedance OFF-state.

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<sub>OFF</sub>. The I<sub>OFF</sub> 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 °C to +85 °C and from -40 °C to +125 °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)
  - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- $\pm$  24 mA output drive (V<sub>CC</sub> = 3.0 V)
- ESD protection:
  - MIL-STD-883, method 3015 exceeds 2000 V
  - HBM JESD22-A114F exceeds 2000 V
  - ♦ MM JESD22-A115-A exceeds 200 V (C = 200 pf, R = 0 Ω)
- CMOS low power consumption
- Inputs accept voltages up to 5 V
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels



### 3. Ordering information

#### Table 1. Ordering information

Type number	Package						
	Temperature range	Name	Description	Version			
74LVC1G125GW-Q100	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1			
74LVC1G125GV-Q100	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753			

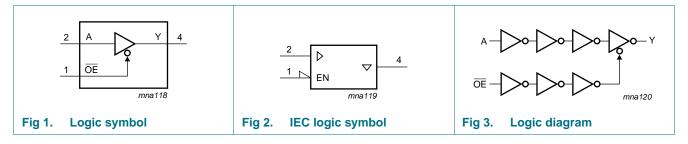
### 4. Marking

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC1G125GW-Q100	VM
74LVC1G125GV-Q100	V25

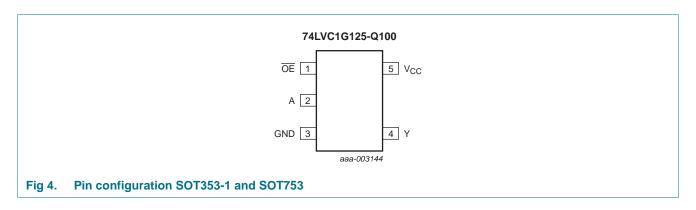
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

### 5. Functional diagram



### 6. Pinning information

#### 6.1 Pinning



#### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
OE	1	output enable input
A	2	data input
GND	3	ground (0 V)
Υ	4	data output
$V_{CC}$	5	supply voltage

### 7. Functional description

Table 4. Function table[1]

Input OE	Output	
OE	A	Υ
L	L	L
L	Н	Н
Н	X	Z

<sup>[1]</sup> H = HIGH 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 <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
VI	input voltage		<u>[1]</u> -0.5	+6.5	V
I <sub>OK</sub>	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 <sub>O</sub>	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[3] _	250	mW
$T_{stg}$	storage temperature		-65	+150	°C

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

L = LOW voltage level;

X = don't care;

Z = high-impedance OFF-state.

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

<sup>[3]</sup> For TSSOP5 and SC-74A packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K.

### 9. Recommended operating conditions

Table 6. Recommended operating conditions

Parameter	Conditions	Min	Тур	Max	Unit
supply voltage		1.65	-	5.5	V
input voltage		0	-	5.5	V
output voltage	Active mode	0	-	$V_{CC}$	V
	V <sub>CC</sub> = 0 V; Power-down mode	0	-	5.5	V
ambient temperature		-40	-	+125	°C
input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	-	-	20	ns/V
	V <sub>CC</sub> = 2.7 V to 5.5 V	-	-	10	ns/V
	supply voltage input voltage output voltage ambient temperature	supply voltage input voltage output voltage Active mode $V_{CC} = 0 \text{ V; Power-down mode}$ ambient temperature input transition rise and fall rate $V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

#### 10. Static characteristics

 Table 7.
 Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T <sub>amb</sub> = -	40 °C to +85 °C					
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	$0.7 \times V_{CC}$	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	٧
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	$0.3 \times V_{CC}$	V
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC}$ = 1.65 V to 5.5 V; $I_{O}$ = 100 $\mu A$	-	-	0.1	٧
		$V_{CC} = 1.65 \text{ V}; I_{O} = 4 \text{ mA}$	-	-	0.45	٧
		$V_{CC} = 2.3 \text{ V}; I_O = 8 \text{ mA}$	-	-	0.3	٧
		$V_{CC} = 2.7 \text{ V}; I_O = 12 \text{ mA}$	-	-	0.4	٧
		$V_{CC} = 3.0 \text{ V}; I_{O} = 24 \text{ mA}$	-	-	0.55	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = 32 \text{ mA}$	-	-	0.55	V
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC}$ = 1.65 V to 5.5 V; $I_{O}$ = -100 $\mu A$	V <sub>CC</sub> - 0.1	-	-	V
		$V_{CC} = 1.65 \text{ V}; I_{O} = -4 \text{ mA}$	1.2	-	-	V
		$V_{CC} = 2.3 \text{ V; } I_{O} = -8 \text{ mA}$	1.9	-	-	V
		$V_{CC} = 2.7 \text{ V}; I_{O} = -12 \text{ mA}$	2.2	-	-	V
		$V_{CC} = 3.0 \text{ V; } I_{O} = -24 \text{ mA}$	2.3	-	-	V
		$V_{CC} = 4.5 \text{ V; } I_{O} = -32 \text{ mA}$	3.8	-	-	V
l <sub>l</sub>	input leakage current	$V_{CC} = 0 \text{ V to } 5.5 \text{ V}; V_I = 5.5 \text{ V or GND}$	-	±0.1	±5	μΑ
I <sub>OZ</sub>	OFF-state output current	$V_{CC} = 3.6 \text{ V}; V_I = V_{IH} \text{ or } V_{IL};$ $V_O = 5.5 \text{ V or GND}$	-	±0.1	±10	μΑ

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 Table 7.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
I <sub>OFF</sub>	power-off leakage current	$V_{CC} = 0 \text{ V}$ ; $V_I \text{ or } V_O = 5.5 \text{ V}$	-	±0.1	±10	μΑ
I <sub>CC</sub>	supply current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V; } I_O = 0 \text{ A}$	-	0.1	10	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V};$ $V_I = V_{CC} - 0.6 \text{ V};$ $I_O = 0 \text{ A}$	-	5	500	μΑ
Cı	input capacitance		-	5	-	pF
T <sub>amb</sub> = -	40 °C to +125 °C					
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	$0.7 \times V_{CC}$	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	$0.3 \times V_{CC}$	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC}$ = 1.65 V to 5.5 V; $I_{O}$ = 100 $\mu A$	-	-	0.1	V
		$V_{CC} = 1.65 \text{ V}; I_{O} = 4 \text{ mA}$	-	-	0.70	V
		$V_{CC} = 2.3 \text{ V; } I_{O} = 8 \text{ mA}$	-	-	0.45	V
		$V_{CC} = 2.7 \text{ V; } I_{O} = 12 \text{ mA}$	-	-	0.60	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = 24 \text{ mA}$	-	-	0.80	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = 32 \text{ mA}$	-	-	0.80	V
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$V_{CC}$ = 1.65 V to 5.5 V; $I_{O}$ = -100 $\mu A$	$V_{CC}-0.1$	-	-	V
		$V_{CC} = 1.65 \text{ V}; I_{O} = -4 \text{ mA}$	0.95	-	-	V
		$V_{CC} = 2.3 \text{ V; } I_{O} = -8 \text{ mA}$	1.7	-	-	V
		$V_{CC} = 2.7 \text{ V}; I_{O} = -12 \text{ mA}$	1.9	-	-	V
		$V_{CC} = 3.0 \text{ V}; I_{O} = -24 \text{ mA}$	2.0	-	-	V
		$V_{CC} = 4.5 \text{ V}; I_{O} = -32 \text{ mA}$	3.4	-	-	V
l <sub>l</sub>	input leakage current	$V_{CC} = 0 \text{ V to } 5.5 \text{ V; } V_{I} = 5.5 \text{ V or GND}$	-	-	±100	μΑ
I <sub>OZ</sub>	OFF-state output current	$V_{CC} = 3.6 \text{ V}; V_I = V_{IH} \text{ or } V_{IL};$ $V_O = 5.5 \text{ V or GND}$	-	-	±200	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_{CC} = 0 \text{ V}$ ; $V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	-	±200	μΑ
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 1.65 V to 5.5 V; I <sub>O</sub> = 0 A	-	-	200	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V};$ $V_1 = V_{CC} - 0.6 \text{ V};$ $I_0 = 0 \text{ A}$	-	-	5000	μΑ

<sup>[1]</sup> All typical values are measured at  $V_{CC}$  = 3.3 V and  $T_{amb}$  = 25 °C.

### 11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 7.

Symbol	Parameter			-40	°C to +85	5 °C	-40 °C to	Unit	
				Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Figure 5	[2]						
•		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	3.3	8.0	1.0	10.5	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.5	2.2	5.5	0.5	7	ns
		$V_{CC} = 2.7 \text{ V}$		0.5	2.5	5.5	0.5	7	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		0.5	2.1	4.5	0.5	6	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	1.7	4.0	0.5	5.5	ns
t <sub>en</sub>	enable time	OE to Y; see Figure 6	[3]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	4.1	9.4	1.0	12	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.5	2.8	6.6	0.5	8.5	ns
		$V_{CC} = 2.7 \text{ V}$		0.5	3.3	6.6	0.5	8.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		0.5	2.4	5.3	0.5	7	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	2.1	5.0	0.5	6.5	ns
t <sub>dis</sub>	disable time	OE to Y; see Figure 6	[4]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	4.3	9.2	1.0	12	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.5	2.7	5.0	0.5	6.5	ns
		$V_{CC} = 2.7 \text{ V}$		0.5	3.0	5.0	0.5	6.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		0.5	3.1	5.0	0.5	6.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	2.2	4.2	0.5	5.5	ns
$C_{PD}$	power dissipation	per buffer; $V_I = GND$ to $V_{CC}$	[5]						
	capacitance	output enabled		-	25	-	-	-	pF
		output disabled		-	6	-	-	-	pF

<sup>[1]</sup> Typical values are measured at  $T_{amb}$  = 25 °C and  $V_{CC}$  = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

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

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

 $f_i$  = input frequency in MHz;

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

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

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

N = number of inputs switching;

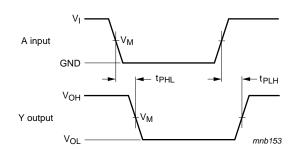
 $\sum (C_L \times V_{CC}^2 \times f_o) = \text{sum of outputs.}$ 

<sup>[2]</sup>  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ 

<sup>[3]</sup> t<sub>en</sub> is the same as t<sub>PZH</sub> and t<sub>PZL</sub>

<sup>[4]</sup>  $t_{dis}$  is the same as  $t_{PLZ}$  and  $t_{PHZ}$ 

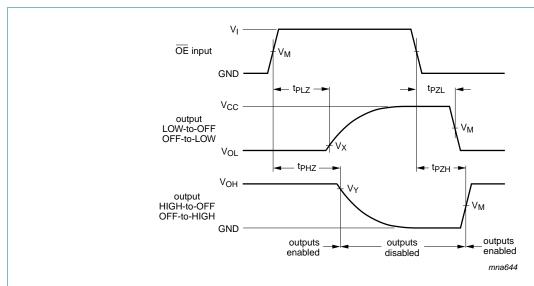
#### 12. Waveforms



Measurement points are given in Table 9.

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Fig 5. Input A to output Y propagation delay times



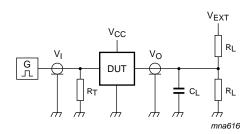
Measurement points are given in Table 9.

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

Fig 6. 3-state enable and disable times

Table 9. Measurement points

Supply voltage	Input	Output	Output				
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	V <sub>Y</sub>			
1.65 V to 1.95 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	$V_{OH} - 0.15 V$			
2.3 V to 2.7 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	V <sub>OL</sub> + 0.15 V	$V_{OH}-0.15~V$			
2.7 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH}-0.3\ V$			
3.0 V to 3.6 V	1.5 V	1.5 V	$V_{OL} + 0.3 V$	$V_{OH}-0.3\ V$			
4.5 V to 5.5 V	0.5V <sub>CC</sub>	0.5V <sub>CC</sub>	$V_{OL} + 0.3 V$	$V_{OH} - 0.3 V$			



Test data is given in Table 10.

Definitions for test circuit:

 $R_L$  = Load resistance.

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to the output impedance  $Z_0$  of the pulse generator.

 $V_{\text{EXT}}$  = External voltage for measuring switching times.

Fig 7. Test circuit for measuring switching times

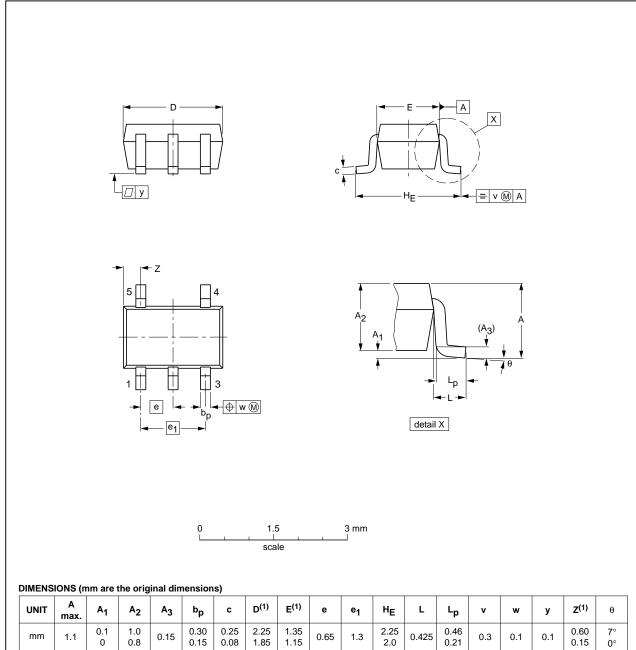
Table 10. Test data

Supply voltage	Input	Input		Load		V <sub>EXT</sub>		
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	$R_L$	t <sub>PLH</sub> , t <sub>PHL</sub>	t <sub>PZH</sub> , t <sub>PHZ</sub>	$t_{PZL}, t_{PLZ}$	
1.65 V to 1.95 V	$V_{CC}$	$\leq$ 2.0 ns	30 pF	1 k $\Omega$	open	GND	$2V_{CC}$	
2.3 V to 2.7 V	$V_{CC}$	$\leq$ 2.0 ns	30 pF	$500 \Omega$	open	GND	$2V_{CC}$	
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V	
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V	
4.5 V to 5.5 V	$V_{CC}$	≤ 2.5 ns	50 pF	$500 \Omega$	open	GND	2V <sub>CC</sub>	

### 13. Package outline

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

SOT353-1



1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE		REFERENCES			EUROPEAN	ISSUE DATE	
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT353-1		MO-203	SC-88A			<del>-00-09-01-</del> 03-02-19	

Fig 8. Package outline SOT353-1 (TSSOP5)

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#### Plastic surface-mounted package; 5 leads

**SOT753** 

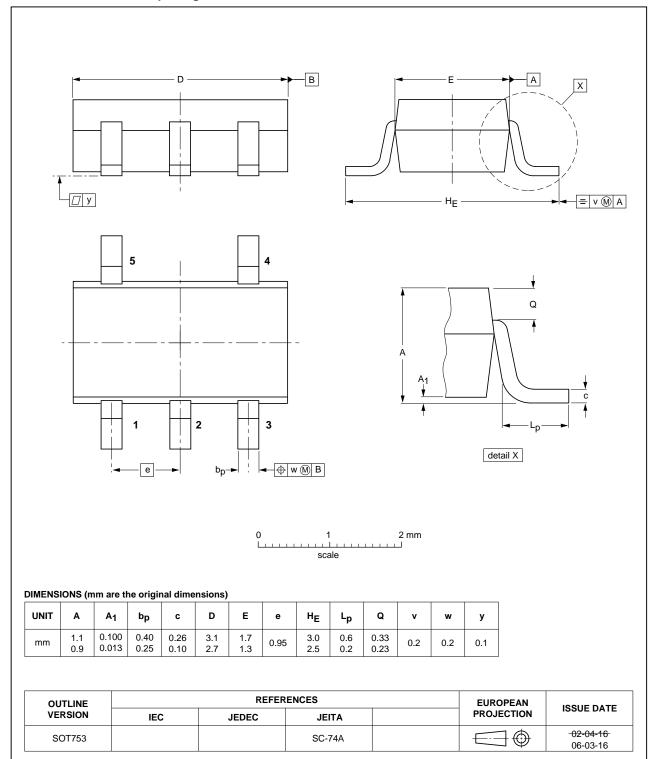


Fig 9. Package outline SOT753

### 14. Abbreviations

#### Table 11. Abbreviations

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

## 15. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G125_Q100 v.1	20120709	Product data sheet	-	-

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#### 16. Legal information

#### 16.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions"
- [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <a href="http://www.nxp.com">http://www.nxp.com</a>.

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74LVC1G125\_Q100

# 74LVC1G125-Q100

Bus buffer/line driver; 3-state

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