**Product data sheet** 

### 1 General description

The 74LVC2G00 provides a 2-input NAND gate function.

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

### 2 Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- · 5 V tolerant outputs for interfacing with 5 V logic
- · High noise immunity
- ±24 mA output drive (V<sub>CC</sub> = 3.0 V)
- CMOS low power consumption
- · 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)
- Latch-up performance exceeds 250 mA
- · Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- ESD protection:
  - HBM JESD22-A114F exceeds 2 000 V
  - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

## 3 Ordering information

Table 1. Ordering information

Table 1. Ordering	momation						
Type number	Package Package						
	Temperature range	Name	Description	Version			
74LVC2G00DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2			
74LVC2G00DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1			



Type number	Package						
	Temperature range	Name	Description	Version			
74LVC2G00GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm	SOT833-1			
74LVC2G00GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1 x 0.5 mm	SOT1089			
74LVC2G00GM	-40 °C to +125 °C	XQFN8	plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 x 1.6 x 0.5 mm	SOT902-2			
74LVC2G00GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 x 1.0 x 0.35 mm	SOT1116			
74LVC2G00GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 x 1.0 x 0.35 mm	SOT1203			
74LVC2G00GX	-40 °C to +125 °C	X2SON8	plastic thermal enhanced extremely thin small outline package; no leads; 8 terminals; body 1.35 x 0.8 x 0.35 mm	SOT1233			

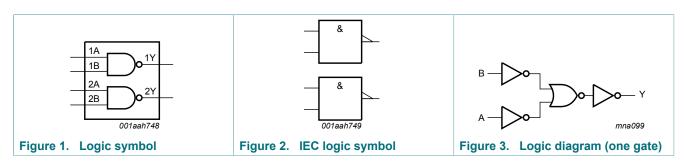
## 4 Marking

Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
74LVC2G00DP	V2G00
74LVC2G00DC	V00
74LVC2G00GT	V00
74LVC2G00GF	VA
74LVC2G00GM	V00
74LVC2G00GN	VA
74LVC2G00GS	VA
74LVC2G00GX	VA

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

## 5 Functional diagram

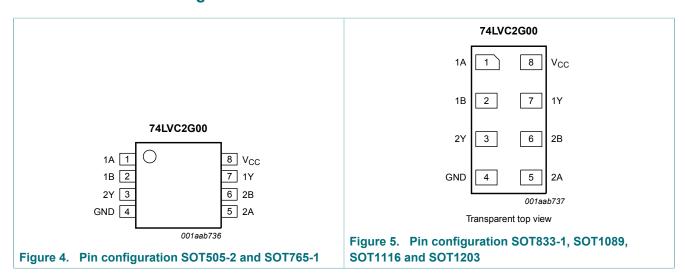


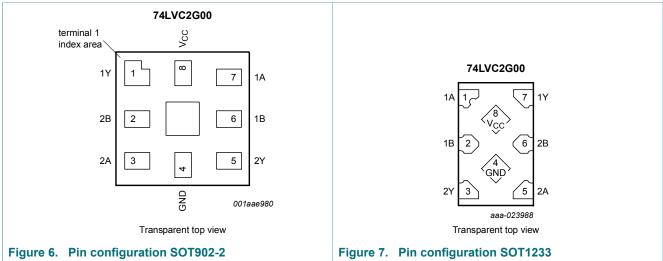
74LVC2G00

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## 6 Pinning information

## 6.1 Pinning





## 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description		
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT1116, SOT1203 and SOT1233	SOT902-2		
1A, 2A	1, 5	7, 3	data input	
1B, 2B	2, 6	6, 2	data input	
GND	4	4	ground (0 V)	
1Y, 2Y	7, 3	1, 5	data output	
V <sub>CC</sub>	8	8	supply voltage	

# 7 Functional description

#### Table 4. Function table

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level.$ 

Input	Output	
nA	nB	nY
L	L	Н
L	н	н
Н	L	Н
Н	Н	L

## **Limiting values**

### Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Parameter	Conditions		Min	Max	Unit
supply voltage			-0.5	+6.5	V
input voltage		[1]	-0.5	+6.5	V
output voltage	Active mode	[1]	-0.5	V <sub>CC</sub> + 0.5	V
	Power-down mode	[1] [2]	-0.5	+6.5	V
input clamping current	V <sub>I</sub> < 0 V		-50	-	mA
output clamping current	$V_O < 0 V \text{ or } V_O > V_{CC}$		-	±50	mA
output current	$V_O = 0 V \text{ to } V_{CC}$		-	±50	mA
supply current			-	100	mA
ground current			-100	-	mA
storage temperature			-65	+150	°C
total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C	[3]	-	300	mW
	supply voltage input voltage output voltage input clamping current output clamping current output current supply current ground current storage temperature	$\begin{array}{c} \text{supply voltage} \\ \text{input voltage} \\ \text{output voltage} \\ \text{output voltage} \\ \text{Active mode} \\ \text{Power-down mode} \\ \text{input clamping current} \\ \text{output clamping current} \\ \text{V}_{\text{I}} < 0 \text{ V} \\ \text{output clamping current} \\ \text{V}_{\text{O}} < 0 \text{ V or V}_{\text{O}} > \text{V}_{\text{CC}} \\ \text{output current} \\ \text{supply current} \\ \text{ground current} \\ \text{storage temperature} \end{array}$	$\begin{array}{c} \text{supply voltage} \\ \text{input voltage} \\ \text{output voltage} \\ \text{Output voltage} \\ \text{Power-down mode} \\ \text{I1} \\ \text{Power-down mode} \\ \text{I2} \\ \text{input clamping current} \\ \text{V}_{\text{I}} < 0 \text{ V} \\ \text{output clamping current} \\ \text{V}_{\text{O}} < 0 \text{ V or V}_{\text{O}} > \text{V}_{\text{CC}} \\ \text{output current} \\ \text{Supply current} \\ \text{ground current} \\ \text{storage temperature} \\ \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$

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

### **Recommended operating conditions**

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	5.5	V
VI	input voltage		0	5.5	V
Vo	output voltage	Active mode	0	V <sub>CC</sub>	V
		Power-down mode	0	5.5	V
T <sub>amb</sub>	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	-	20	ns/V
		$V_{CC}$ = 2.7 V to 5.5 V	-	10	ns/V

When  $V_{\rm CC}$  = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation. For TSSOP8 package: above 55 °C the value of  $P_{\rm tot}$  derates linearly with 2.5 mW/K. For VSSOP8 package: above 110  $^{\circ}\text{C}$  the value of Ptot derates linearly with 8 mW/K. For XSON8 and XQFN8 packages: above 118  $^{\circ}$ C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K. For X2SON8 package: above 118 °C the value of Ptot derates linearly with 7.7 mW/K.

## 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
T <sub>amb</sub> = -4	0 °C to +85 °C			<u> </u>		,
$V_{IH}$	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 x V <sub>CC</sub>	-	-	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 x V <sub>CC</sub>	-	-	V
$V_{IL}$	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 x V <sub>CC</sub>	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 x V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		$I_{O}$ = -100 $\mu$ A; $V_{CC}$ = 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	1.2	1.53	-	V
		$I_{O}$ = -8 mA; $V_{CC}$ = 2.3 V	1.9	2.13	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	2.50	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	2.60	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	4.10	-	V
$V_{OL}$	LOW-level output voltage	$V_I = V_{IH}$ or $V_{IL}$				
		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	-	0.08	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	0.14	0.3	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	0.19	0.4	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	0.37	0.55	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	0.43	0.55	V
l <sub>l</sub>	input leakage current	$V_I$ = 5.5 V or GND; $V_{CC}$ = 0 V to 5.5 V	-	±0.1	±1	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O}$ = 5.5 V; $V_{CC}$ = 0 V	-	±0.1	±2	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	-	0.1	4	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; V <sub>CC</sub> = 2.3 V to 5.5 V; I <sub>O</sub> = 0 A	-	5	500	μΑ
Cı	input capacitance		-	2.5	-	pF

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
T <sub>amb</sub> = -4	0 °C to +125 °C				1	
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 x V <sub>CC</sub>	-	-	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 x V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 x V <sub>CC</sub>	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 x V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	$V_{I} = V_{IH}$ or $V_{IL}$				
		$I_{O}$ = -100 $\mu$ A; $V_{CC}$ = 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
		$I_{O}$ = -8 mA; $V_{CC}$ = 2.3 V	1.7	-	-	V
		$I_{O}$ = -12 mA; $V_{CC}$ = 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	$V_{I} = V_{IH}$ or $V_{IL}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.45	V
		$I_{O}$ = 12 mA; $V_{CC}$ = 2.7 V	-	-	0.60	V
		$I_{O}$ = 24 mA; $V_{CC}$ = 3.0 V	-	-	0.80	V
		$I_{O}$ = 32 mA; $V_{CC}$ = 4.5 V	-	-	0.80	V
I <sub>I</sub>	input leakage current	$V_I$ = 5.5 V or GND; $V_{CC}$ = 0 V to 5.5 V	-	-	±1	μA
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O}$ = 5.5 V; $V_{CC}$ = 0 V	-	-	±2	μA
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	-	-	4	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; $V_I = V_{CC} - 0.6 \text{ V}$ ; $V_{CC} = 2.3 \text{ V}$ to 5.5 V; $I_O = 0 \text{ A}$	-	-	500	μΑ

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

## **Dynamic characteristics**

**Table 8. 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	nA, nB to nY; see Figure 8	[2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V		1.2	3.5	8.6	1.2	10.8	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V		0.7	2.3	4.8	0.7	6.0	ns
		V <sub>CC</sub> = 2.7 V		0.7	3.0	5.6	0.7	7.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V		0.7	2.2	4.3	0.7	5.4	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V		0.5	1.8	3.3	0.5	4.2	ns
C <sub>PD</sub>	power dissipation capacitance	per gate; $V_I$ = GND to $V_{CC}$	[3]	-	14	-	-	-	pF

Typical values are measured at nominal  $V_{CC}$  and at  $T_{amb}$  = 25 °C.

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

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

 $f_o$  = output frequency in MHz;

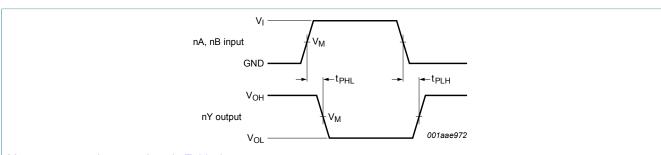
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

 $\sum (C_L \times V_{CC}^2 \times f_0) = \text{sum of outputs.}$ 

### 11.1 Waveforms and test circuit



Measurement points are given in Table 9.

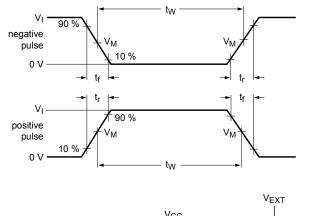
 $V_{\text{OL}}$  and  $V_{\text{OH}}$  are typical output voltage levels that occur with the output load.

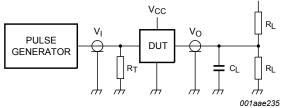
Figure 8. Input (nA, nB) to output (nY) propagation delays

 $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$   $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

**Table 9. Measurement points** 

Supply voltage	Input	Output				
V <sub>CC</sub>	V <sub>M</sub>	$V_{M}$				
1.65 V to 1.95 V	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				
2.3 V to 2.7 V	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				
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 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				





Test data is given in Table 10.

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

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

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

V<sub>EXT</sub> = Test voltage for switching times.

Figure 9. Test circuit for measuring switching times

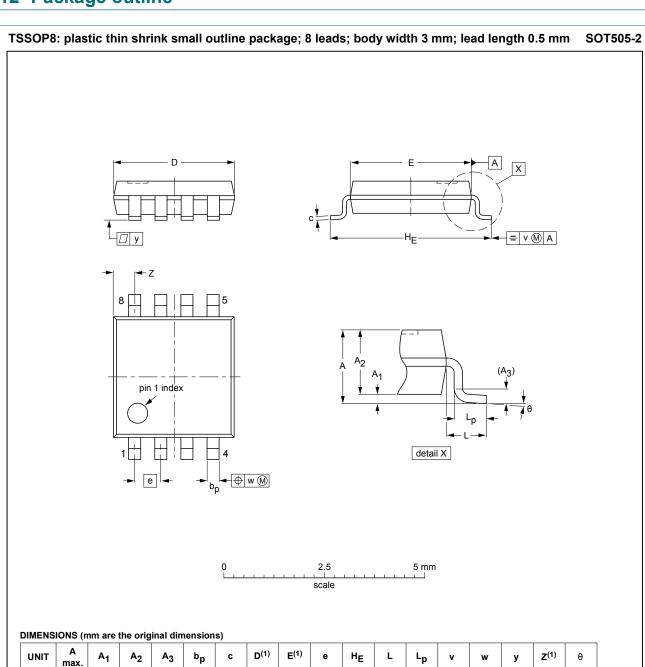
Table 10. Test data

Supply voltage	Input		Load		V <sub>EXT</sub>
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	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

74LVC2G00

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## 12 Package outline



UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	bp	С	D <sup>(1)</sup>	E <sup>(1)</sup>	е	HE	L	Lp	v	w	у	Z <sup>(1)</sup>	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

#### Note

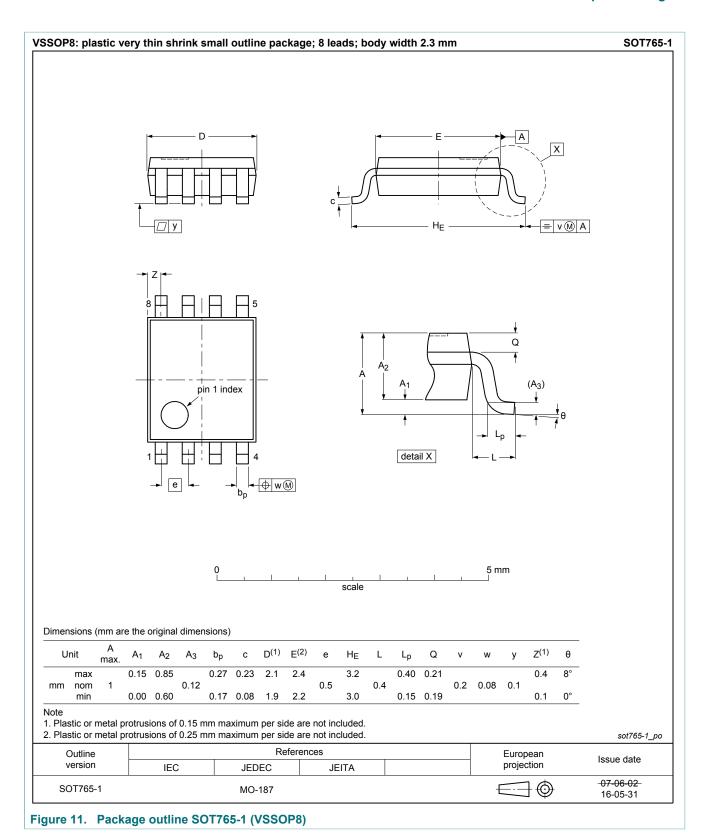
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE		REFER	EUROPEAN	ISSUE DATE			
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT505-2						02-01-16	

Figure 10. Package outline SOT505-2 (TSSOP8)

74LVC2G00

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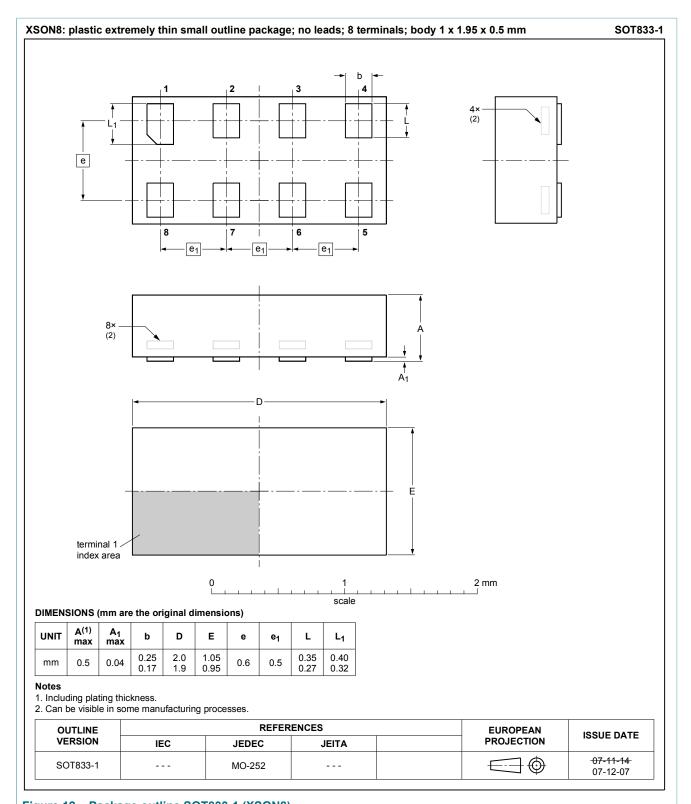
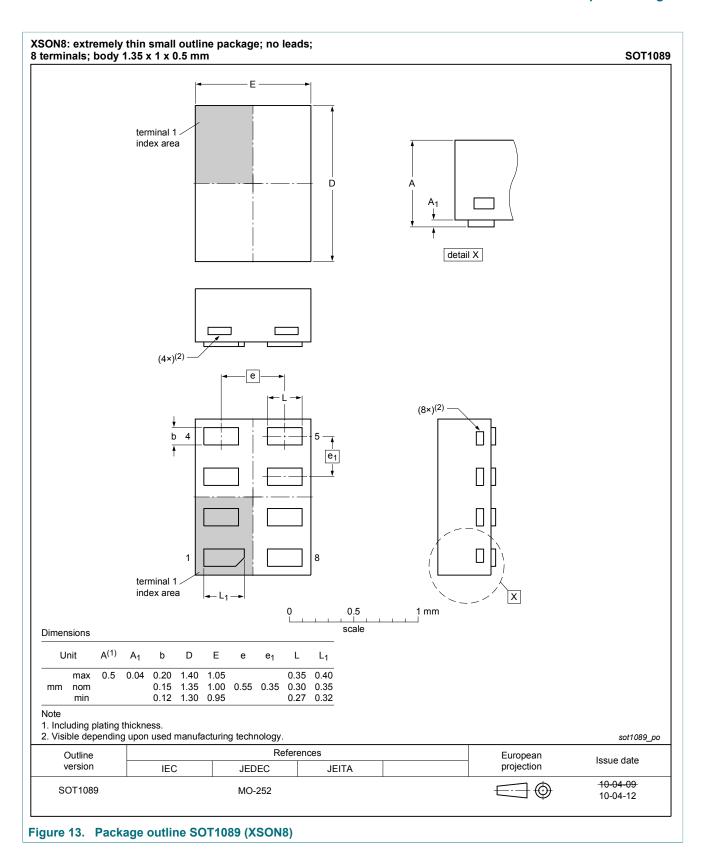
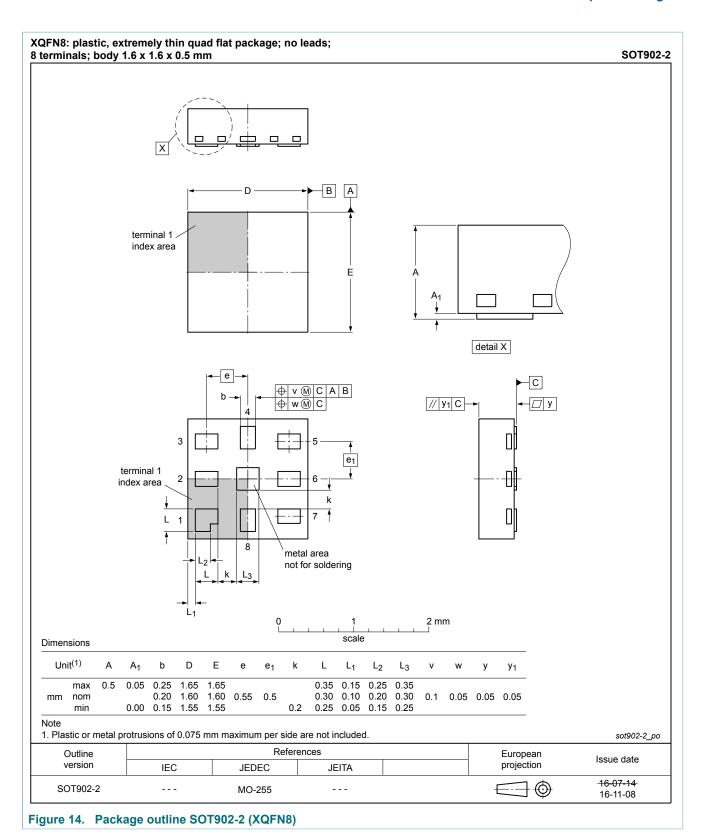
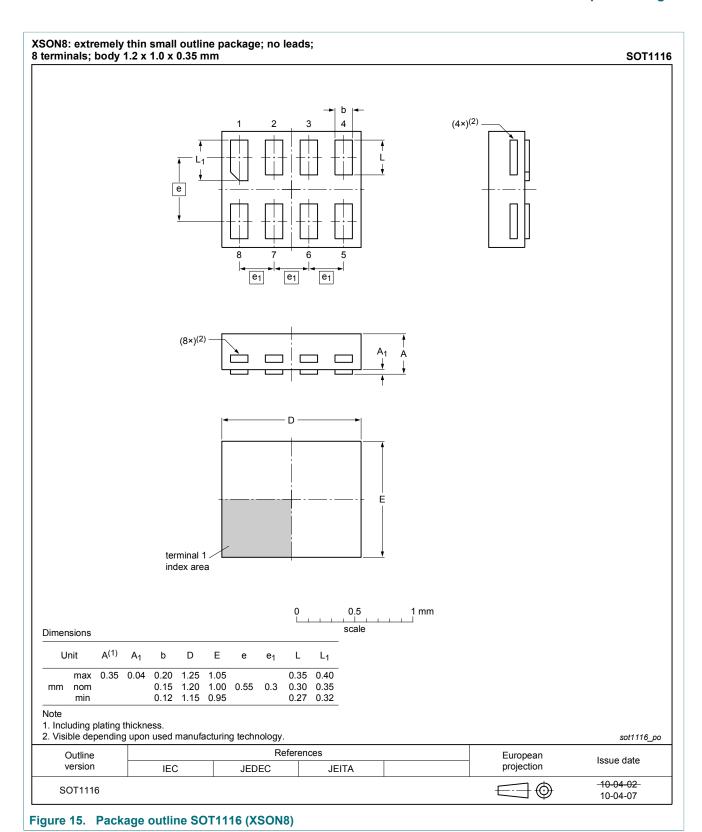


Figure 12. Package outline SOT833-1 (XSON8)







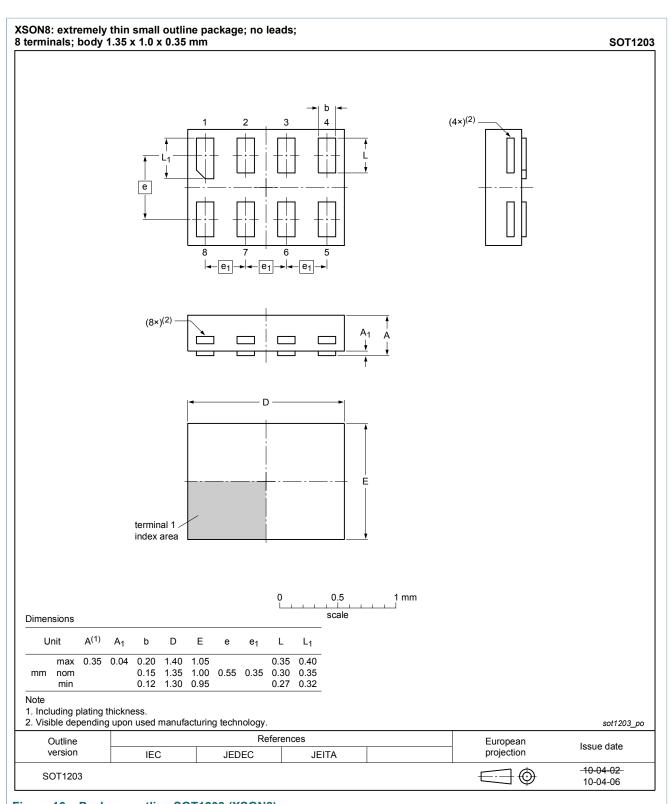
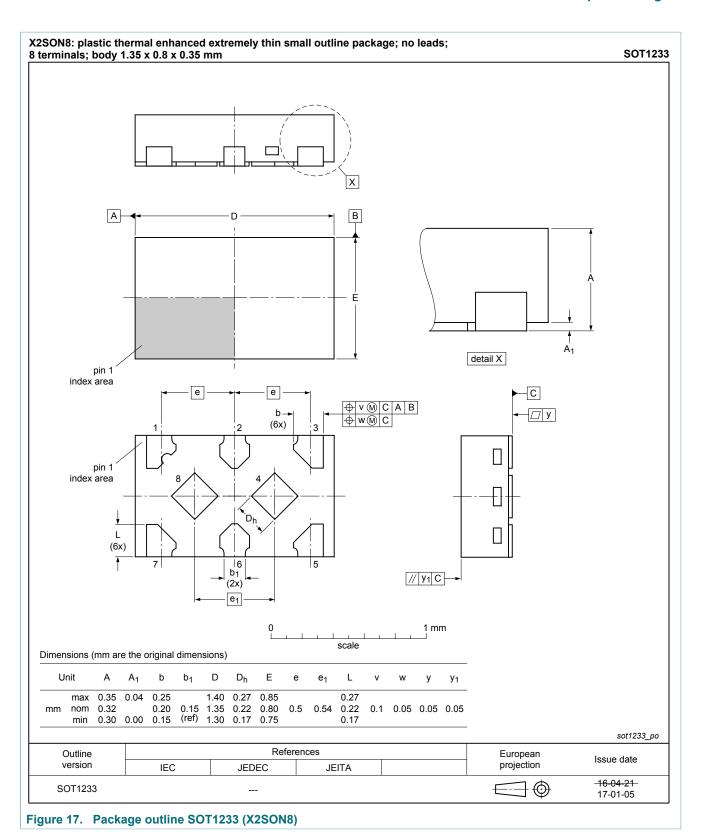


Figure 16. Package outline SOT1203 (XSON8)



## 13 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

## 14 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes				
74LVC2G00 v.15	20170703	Product data sheet	-	74LVC2G00 v.14				
Modifications:	Nexperia. • Legal texts hav • <u>Figure 17</u> : Pacl	nis data sheet has been redesine been adapted to the new corkage outline drawing for SOT124LVC2G00GD removed.	mpany name where					
74LVC2G00 v.14	20161212	Product data sheet	-	74LVC2G00 v.13				
Modifications:	• Table 7: The m	aximum limits for leakage curre	ent and supply curre	nt have changed.				
74LVC2G00 v.13	20161028	Product data sheet	-	74LVC2G00 v.12				
Modifications:	Added type nur	mber 74LVC2G00GX (SOT123	3/X2SON8)					
74LVC2G00 v.12	20130408	Product data sheet	-	74LVC2G00 v.11				
Modifications:	For type number 74LVC2G00GD XSON8U has changed to XSON8.							
74LVC2G00 v.11	20120622	Product data sheet	-	74LVC2G00 v.10				
Modifications:	For type number	er 74LVC2G00GM the SOT co	de has changed to S	OT902-2.				
74LVC2G00 v.10	20111130	Product data sheet	-	74LVC2G00 v.9				
Modifications:	<ul> <li>Legal pages up</li> </ul>	dated.						
74LVC2G00 v.9	20100608	Product data sheet	-	74LVC2G00 v.8				
74LVC2G00 v.8	20091026	Product data sheet	-	74LVC2G00 v.7				
74LVC2G00 v.7	20080610	Product data sheet	-	74LVC2G00 v.6				
74LVC2G00 v.6	20080220	Product data sheet	-	74LVC2G00 v.5				
74LVC2G00 v.5	20070904	Product data sheet	-	74LVC2G00 v.4				
74LVC2G00 v.4	20060515	Product data sheet	-	74LVC2G00 v.3				
74LVC2G00 v.3	20050201	Product specification	-	74LVC2G00 v.2				
74LVC2G00 v.2	20040923	Product specification	-	74LVC2G00 v.1				
74LVC2G00 v.1	20031117	Product specification	-	-				

### 15 Legal information

#### 15.1 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.

- Please consult the most recently issued document before initiating or completing a design.
- The term 'short data sheet' is explained in section "Definitions". [2] [3]
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### **Contents**

1	General description	1
2	Features and benefits	
3	Ordering information	1
4	Marking	2
5	Functional diagram	
6	Pinning information	3
6.1	Pinning	3
6.2	Pin description	
7	Functional description	
8	Limiting values	5
9	Recommended operating conditions	5
10	Static characteristics	
11	Dynamic characteristics	8
11.1	Waveforms and test circuit	
12	Package outline	10
13	Abbreviations	
14	Revision history	
15	Legal information	

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