**Product data sheet** 

## 1 General description

The 74LVC2G02 provides a 2-input NOR 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 a 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 2000 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** 

Type number	Package									
	Temperature range	Name	Description	Version						
74LVC2G02DP	-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						
74LVC2G02DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1						
74LVC2G02GT	-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						
74LVC2G02GF	-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						
74LVC2G02GM	-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						
74LVC2G02GN	-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						
74LVC2G02GS	-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						

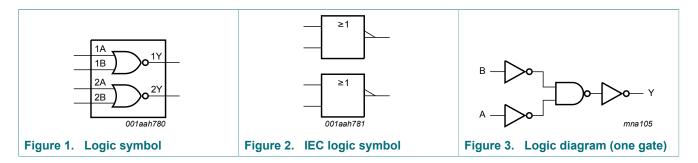
# 4 Marking

Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
74LVC2G02DP	V02
74LVC2G02DC	V02
74LVC2G02GT	V02
74LVC2G02GF	VB
74LVC2G02GM	V02
74LVC2G02GN	VB
74LVC2G02GS	VB

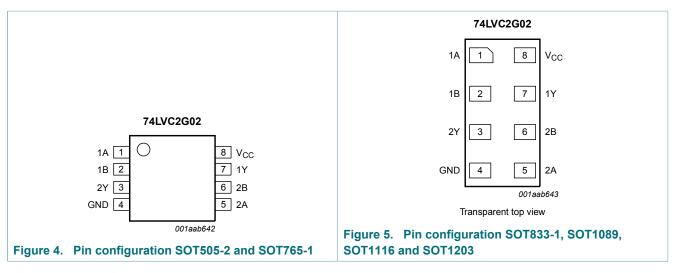
<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

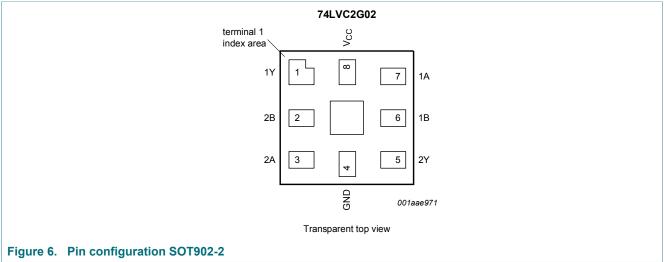
## 5 Functional diagram



## 6 Pinning information

### 6.1 Pinning





74LVC2G02

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## 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Pin							
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT1116 and SOT1203	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

 $H = HIGH \ voltage \ level; \ L = LOW \ voltage \ level; \ X = don't \ care.$ 

Input		Output
nA	nB	nY
L	L	Н
Х	Н	L
Н	X	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).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+6.5	V
VI	input voltage	[1]	-0.5	+6.5	V
V <sub>O</sub>	output voltage	Active mode [1]	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode; V <sub>CC</sub> = 0 V [1]	-0.5 +6.5 V  -0.5 +6.5 V  -0.5 V <sub>CC</sub> + 0.5 V  -0.5 +6.5 V  -0.5 +6.5 V  -50 - mA  - ±50 mA  - ±50 mA  - 100 mA  -100 - mA  -65 +150 °C	V	
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
I <sub>OK</sub>	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$	-	±50	mA
I <sub>O</sub>	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
T <sub>stg</sub>	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$ [2]	-	300	mW

<sup>[1]</sup> The input and output voltage ratings may be exceeded if the input and output current ratings are observed. [2] For TSSOP8 package: above 55 °C the value of P<sub>tot</sub> derates linearly with 2.5 mW/K.

#### 9 **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	$V_{CC}$	V
		Power-down mode; V <sub>CC</sub> = 0 V	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

For VSSOP8 package: above 110  $^{\circ}$ C the value of P<sub>tot</sub> derates linearly with 8 mW/K.

For XSON8 and XQFN8 packages: above 118  $^{\circ}\text{C}$  the value of P  $_{tot}$  derates linearly with 7.8 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	10 °C to +85 °C					1
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
T <sub>amb</sub> = -40 °  V <sub>IH</sub> HI  V <sub>IL</sub> LC		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
	Parameter  -40 °C to +85 °C  HIGH-level input voltage  LOW-level output voltage  LOW-level output voltage  LOW-level output voltage	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 × V <sub>CC</sub>	-	-	V
$V_{IL}$	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × 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 × 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 <sub>O</sub> = -8 mA; V <sub>CC</sub> = 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 <sub>OL</sub>	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	μA
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	±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; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$ ; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	5	500	μΑ
Cı	input capacitance		-	2.5	-	pF

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
T <sub>amb</sub> = -4	10 °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 × 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 × 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 × 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 × V <sub>CC</sub>	V
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_{O}$ = -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 <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	$V_I = V_{IH}$ 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 <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 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 <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	±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	-	-	±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; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$ ; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	-	500	μΑ

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

## 11 Dynamic characteristics

**Table 8. Dynamic characteristics** 

Voltages are referenced to GND (ground 0 V); for test circuit see Figure 8.

Symbol	Parameter	Conditions	-40	°C to +85	°C	-40 °C to	Unit	
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA, nB to nY; see Figure 7	]					
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.2	3.8	8.9	1.2	11.2	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.8	2.4	5.4	0.8	6.8	ns
		V <sub>CC</sub> = 2.7 V	0.8	3.2	6.0	0.8	7.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.6	2.4	4.9	0.6	6.2	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.6	1.8	4.3	0.6	5.5	ns
C <sub>PD</sub>	power dissipation capacitance	per gate; $V_I = GND$ to $V_{CC}$	_	14	-	-	-	pF

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

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

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

 $f_o$  = output frequency in MHz;

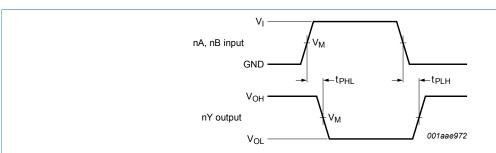
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

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

### 11.1 Waveforms and test circuit



Measurement points are given in Table 9.

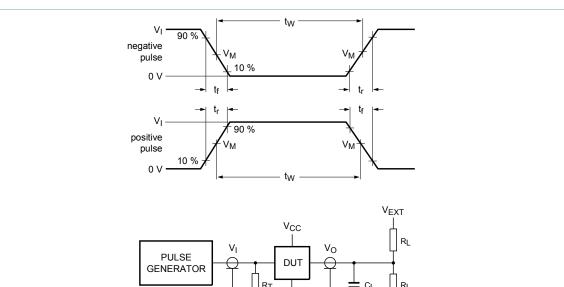
V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Figure 7. Input (nA, nB) to output (nY) propagation delays

 <sup>(2)</sup> 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).

Table 9. Measurement points

Supply voltage	Input	Output
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>
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>



001aae235

Test data is given in Table 10.

Definitions for test circuit:

 $R_L$  = Load resistor.

 $C_L$  = 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 8. Test circuit for measuring switching times

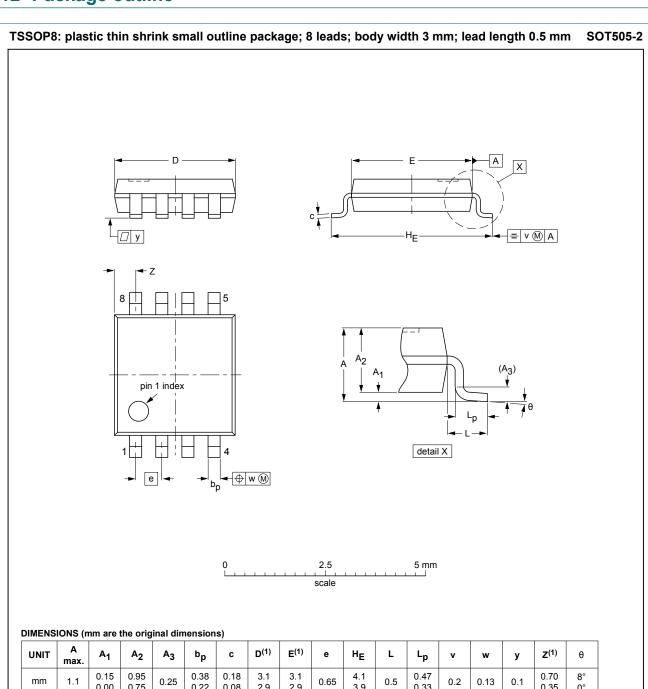
Table 10. Test data

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

74LVC2G02

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# 12 Package outline



UNI	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°

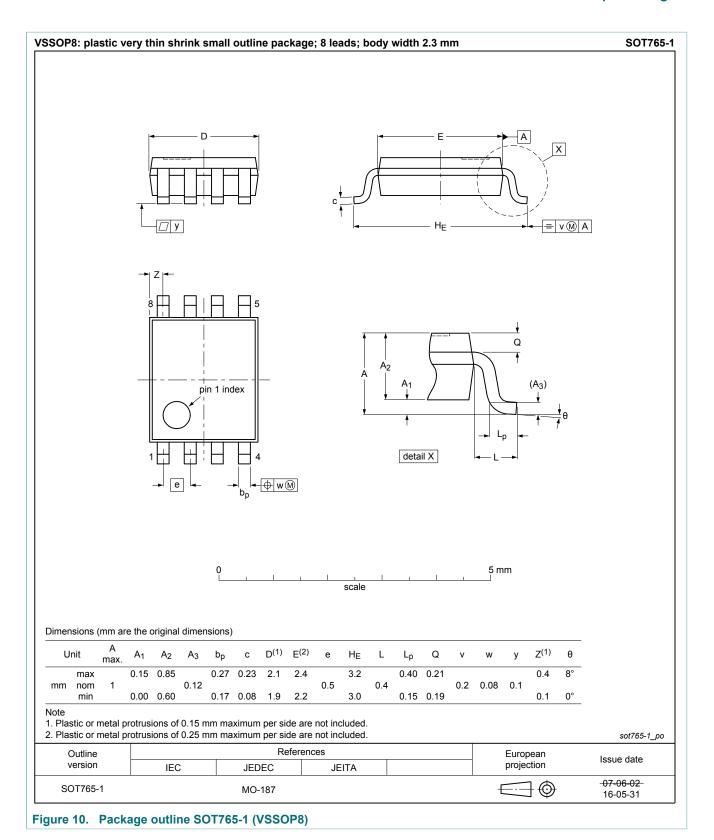
#### Note

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

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

Figure 9. Package outline SOT505-2 (TSSOP8)

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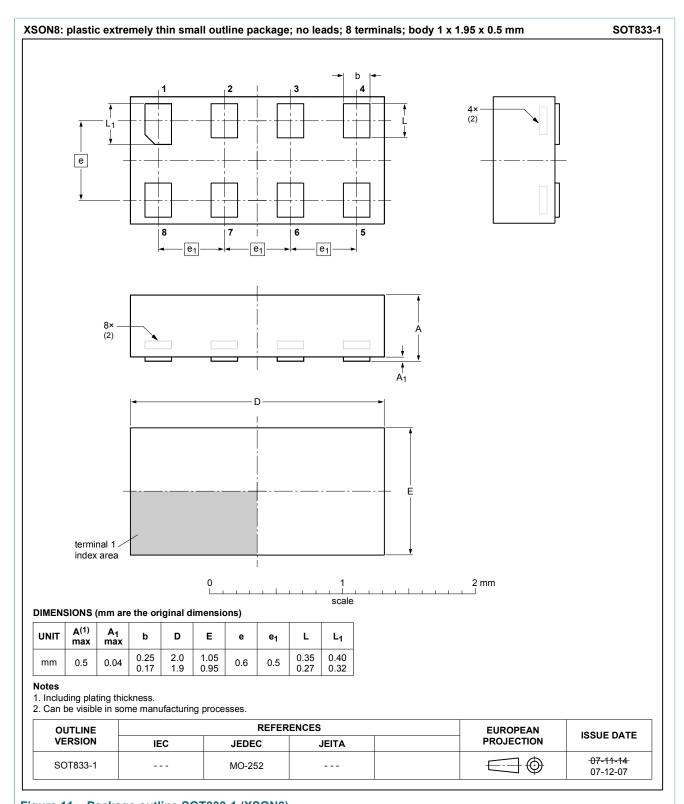
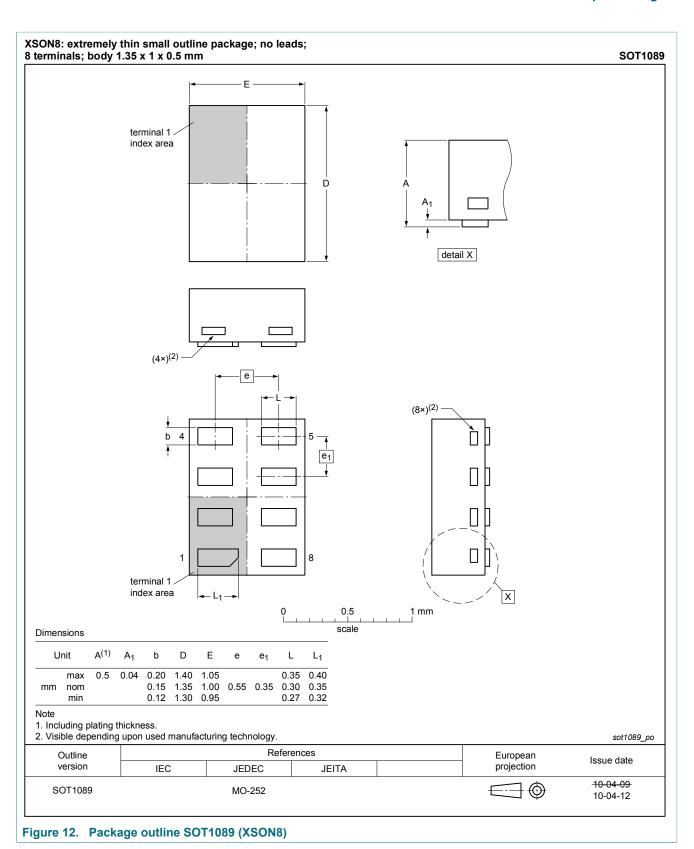
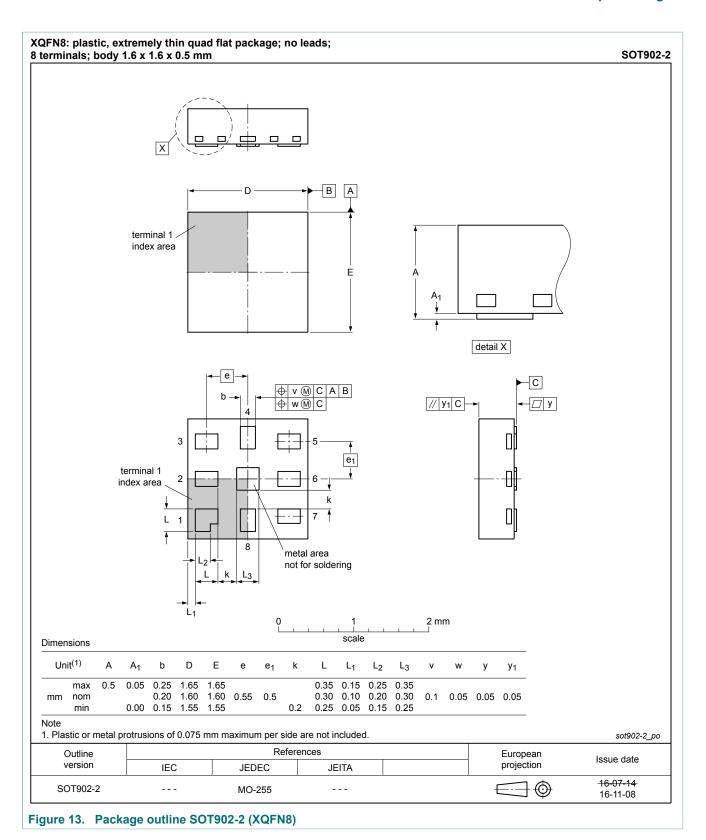


Figure 11. Package outline SOT833-1 (XSON8)





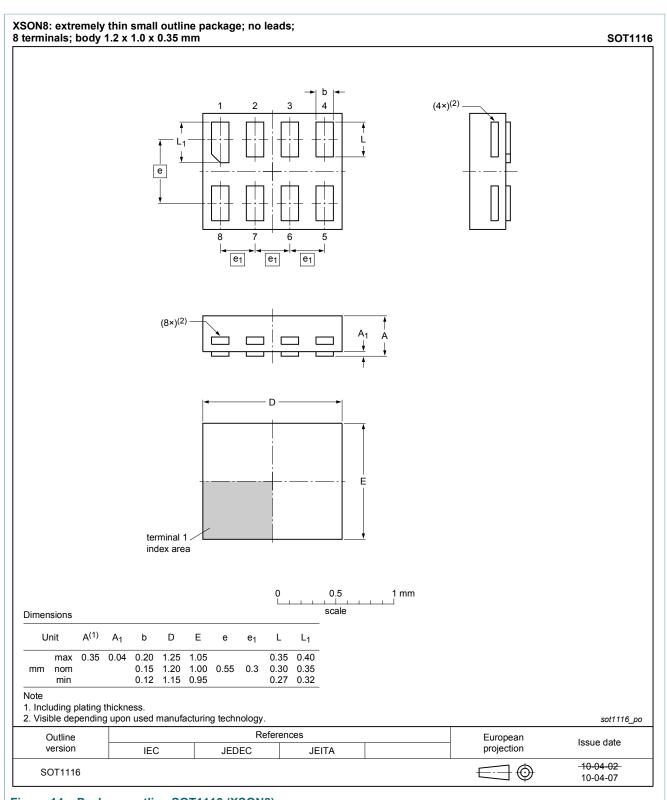


Figure 14. Package outline SOT1116 (XSON8)

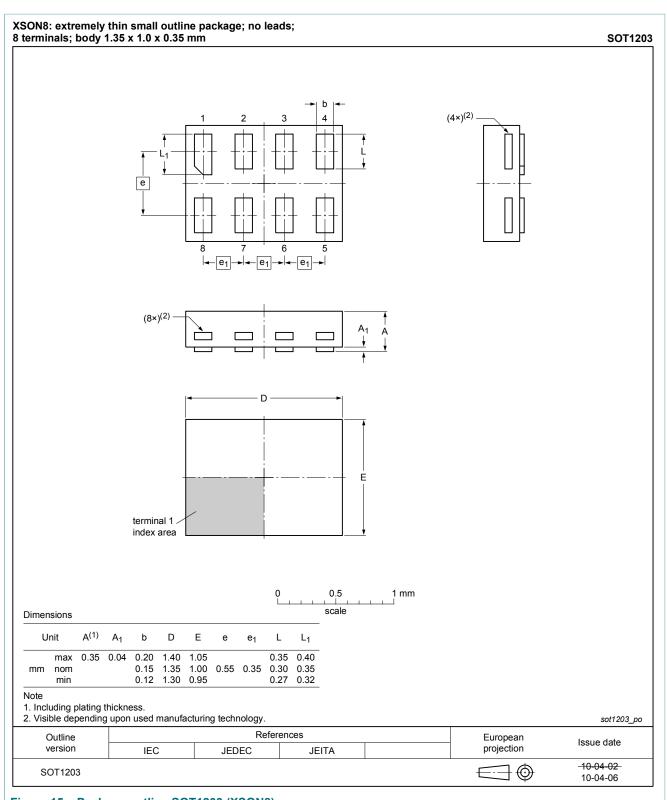


Figure 15. Package outline SOT1203 (XSON8)

## 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		
74LVC2G02 v.13	20180420	Product data sheet	-	74LVC2G02 v.12		
Modifications:	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>Type number 74LVC2G02GD (SOT996-2) removed.</li> </ul>					
74LVC2G02 v.12	20161212	Product data sheet	-	74LVC2G02 v.11		
Modifications:	Table 7: The maximum limits for leakage current and supply current have changed.					
74LVC2G02 v.11	20130408	Product data sheet	-	74LVC2G02 v.10		
Modifications:	For type numb	For type number 74LVC2G02GD XSON8U has changed to XSON8.				
74LVC2G02 v.10	20120622	Product data sheet	-	74LVC2G02 v.9		
Modifications:	For type numb	For type number 74LVC2G02GM the SOT code has changed to SOT902-2.				
74LVC2G02 v.9	20111130	Product data sheet	-	74LVC2G02 v.8		
Modifications:	Legal pages u	pdated.				
74LVC2G02 v.8	20101020	Product data sheet	-	74LVC2G02 v.7		
74LVC2G02 v.7	20080606	Product data sheet	-	74LVC2G02 v.6		
74LVC2G02 v.6	20080222	Product data sheet	-	74LVC2G02 v.5		
74LVC2G02 v.5	20070904	Product data sheet	-	74LVC2G02 v.4		
74LVC2G02 v.4	20060515	Product data sheet	-	74LVC2G02 v.3		
74LVC2G02 v.3	20050201	Product specification	-	74LVC2G02 v.2		
74LVC2G02 v.2	20040915	Product specification	-	74LVC2G02 v.1		
74LVC2G02 v.1	20031015	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]
- 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.

#### 15.2 Definitions

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