74LVC2G02

Dual 2-input NOR gate

Rev. 8 — 20 October 2010

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
- \pm 24 mA output drive (V_{CC} = 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 \times 1.95 \times 0.5 mm	SOT833-1				
74LVC2G02GF	–40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 \times 1 \times 0.5 mm	SOT1089				
74LVC2G02GD	–40 °C to +125 °C	XSON8U	plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body $3\times2\times0.5$ mm	SOT996-2				
74LVC2G02GM	–40 °C to +125 °C	XQFN8U	plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 \times 1.6 \times 0.5 mm	SOT902-1				
74LVC2G02GN	–40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 \times 1.0 \times 0.35 mm	SOT1116				
74LVC2G02GS	–40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body $1.35 \times 1.0 \times 0.35$ mm	SOT1203				

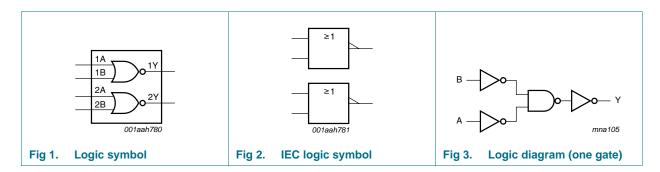
4. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74LVC2G02DP	V02
74LVC2G02DC	V02
74LVC2G02GT	V02
74LVC2G02GF	VB
74LVC2G02GD	V02
74LVC2G02GM	V02
74LVC2G02GN	VB
74LVC2G02GS	VB

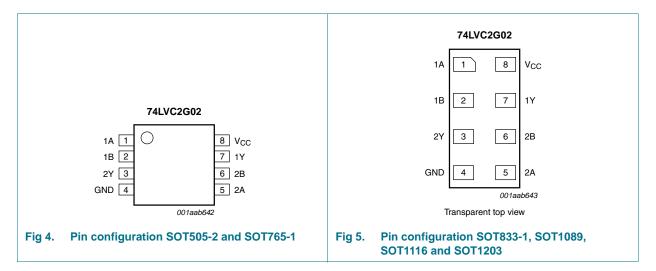
^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

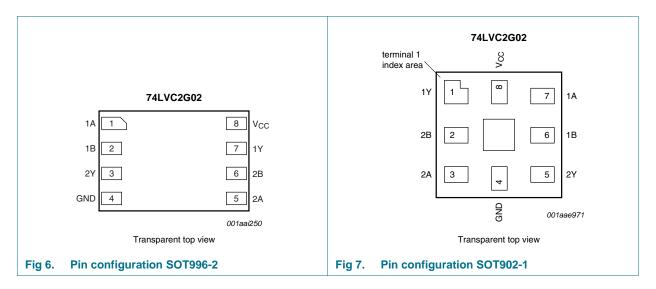


6. Pinning information

6.1 Pinning



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6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description	
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT996-2, SOT1116 and SOT1203	SOT902-1	
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 _{CC}	8	8	supply voltage

7. Functional description

Table 4. Function table[1]

Input	Output	
nA	nB	nY
L	L	Н
X	Н	L
Н	X	L

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

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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
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
Vo	output voltage	Active mode	<u>[1]</u> –0.5	$V_{CC} + 0.5$	V
		Power-down mode	<u>[1][2]</u> –0.5	+6.5	V
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
I _{OK}	output clamping current	$V_O < 0 \text{ V or } V_O > V_{CC}$	-	±50	mA
I _O	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±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	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	<u>[3]</u> _	300	mW

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

9. Recommended operating conditions

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	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	0	5.5	V
T _{amb}	ambient temperature		-40	+125	°C
Δt/ΔV	input transition rise and fall rate	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	-	20	ns/V
		$V_{CC} = 2.7 \text{ V to } 5.5 \text{ V}$	-	10	ns/V

10. Static characteristics

Table 7. Static characteristics

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

Symbo	l Parameter	Conditions	Min	Typ[1]	Max	Unit
T _{amb} =	–40 °C to +85 °C					
V_{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V _{CC} = 4.5 V to 5.5 V	$0.7 \times V_{CC}$	-	-	V
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^[2] When $V_{CC} = 0 \text{ V}$ (Power-down mode), the output voltage can be 5.5 V in normal condition.

^[3] For TSSOP8 package: above 55 °C the value of P_{tot} derates linearly with 2.5 mW/K.
For VSSOP8 package: above 110 °C the value of P_{tot} derates linearly with 8 mW/K.
For XSON8, XSON8U and XQFN8U packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

Table 7. Static characteristics ...continued
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

J,	Parameter	Conditions	Min	Typ[1]	wax	Uni
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	٧
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	$0.3 \times V_{CC}$	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100 \mu A$; $V_{CC} = 1.65 \text{ V}$ to 5.5 V	$V_{CC}-0.1$	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	1.53	-	٧
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	2.13	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	2.50	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	2.60	-	٧
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	4.10	-	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = 100 μ A; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	0.08	0.45	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	0.14	0.3	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	0.19	0.4	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	0.37	0.55	V
		$I_O = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	0.43	0.55	V
l _l	input leakage current	$V_1 = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	±0.1	±5	μΑ
l _{OFF}	power-off leakage current	V_{I} or $V_{O} = 5.5 \text{ V}$; $V_{CC} = 0 \text{ V}$	-	±0.1	±10	μΑ
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	0.1	10	μΑ
Δl _{CC}	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	-	рF
T _{amb} = -4	40 °C to +125 °C					
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		V _{CC} = 2.3 V to 2.7 V	1.7	-	-	٧
		V _{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V _{CC} = 4.5 V to 5.5 V	$0.7 \times V_{CC}$	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	٧
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	٧
		V _{CC} = 4.5 V to 5.5 V	-	-	$0.3 \times V_{CC}$	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_{O} = -100 \mu A$; $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	V _{CC} - 0.1	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	0.95	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.7	-	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	1.9	-	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.0	-	-	V
		$I_{O} = -32$ mA; $V_{CC} = 4.5$ V	3.4	-	-	V

Dual 2-input NOR gate

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
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_{O} = 100 μ A; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		$I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.70	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.45	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.60	V
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.80	V
		$I_O = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.80	V
I _I	input leakage current	$V_I = 5.5 \text{ V or GND}$; $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	±20	μΑ
I _{OFF}	power-off leakage current	V_I or $V_O = 5.5 \text{ V}$; $V_{CC} = 0 \text{ V}$	-	-	±20	μΑ
I _{CC}	supply current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	-	-	40	μΑ
ΔI_{CC}	additional supply current	per pin; $V_1 = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	-	5000	μΑ

^[1] 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 9.

Symbol	Parameter	Conditions	-40 °C to +85 °C		onditions -40 °C to +85 °C -40 °C to +125 °C		o +125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	nA, nB to nY; see Figure 8	1					
		V _{CC} = 1.65 V to 1.95 V	1.2	3.8	8.9	1.2	11.2	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.8	2.4	5.4	0.8	6.8	ns
		V _{CC} = 2.7 V	0.8	3.2	6.0	0.8	7.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	0.6	2.4	4.9	0.6	6.2	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0.6	1.8	4.3	0.6	5.5	ns

Table 8. Dynamic characteristics ... continued

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[1]	Max	Min	Max	
C_{PD}	power dissipation capacitance	per gate; $V_I = GND$ to V_{CC}	[3]	-	14	-	-	-	pF

- [1] Typical values are measured at nominal V_{CC} and at T_{amb} = 25 °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 μW).

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

12. Waveforms

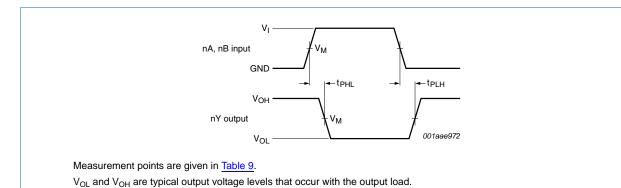
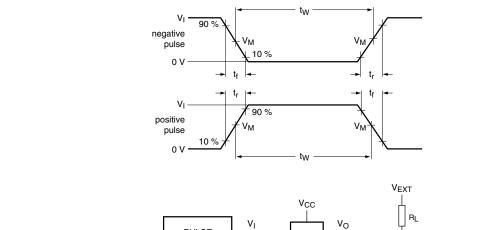


Fig 8. Input (nA, nB) to output (nY) propagation delays

Table 9. Measurement points

Supply voltage	Input	Output
V _{CC}	V _M	V _M
1.65 V to 1.95 V	0.5V _{CC}	0.5V _{CC}
2.3 V to 2.7 V	0.5V _{CC}	0.5V _{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	0.5V _{CC}	0.5V _{CC}



PULSE GENERATOR DUT VO DUT CL RL 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_o of the pulse generator.

 V_{EXT} = Test voltage for switching times.

Fig 9. Load circuitry for switching times

Table 10. Test data

Supply voltage	Input		Load		V _{EXT}
V _{CC}	V _I	t _r , t _f	CL	R_L	t _{PLH} , t _{PHL}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500Ω	open
2.7 V	2.7 V	\leq 2.5 ns	50 pF	$500~\Omega$	open
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500Ω	open
4.5 V to 5.5 V	V_{CC}	≤ 2.5 ns	50 pF	500Ω	open

13. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

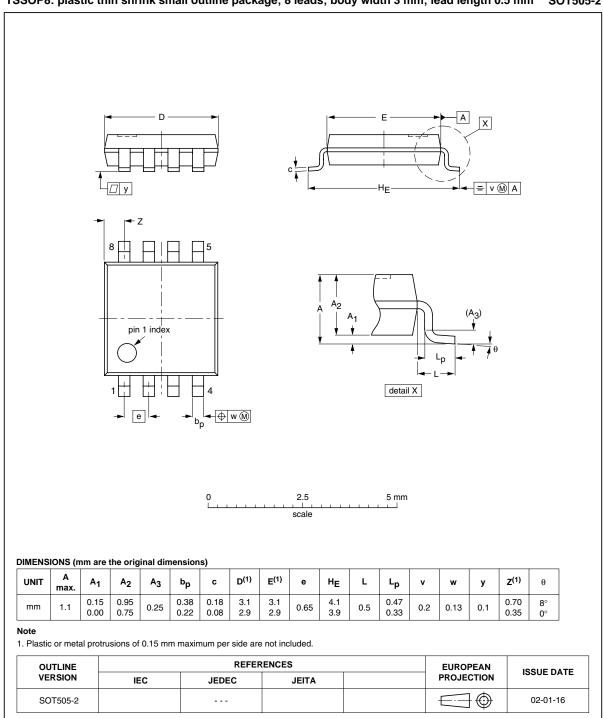


Fig 10. Package outline SOT505-2 (TSSOP8)

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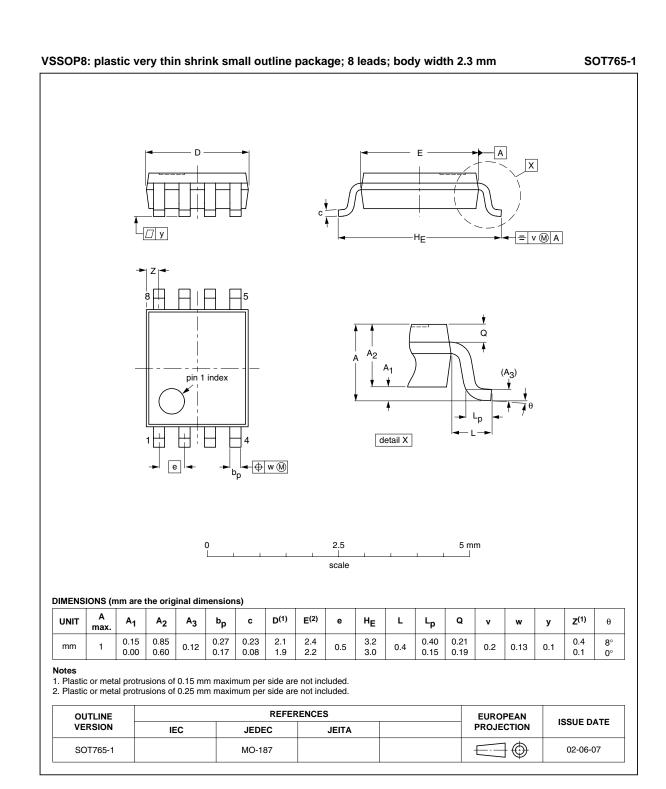


Fig 11. Package outline SOT765-1 (VSSOP8)

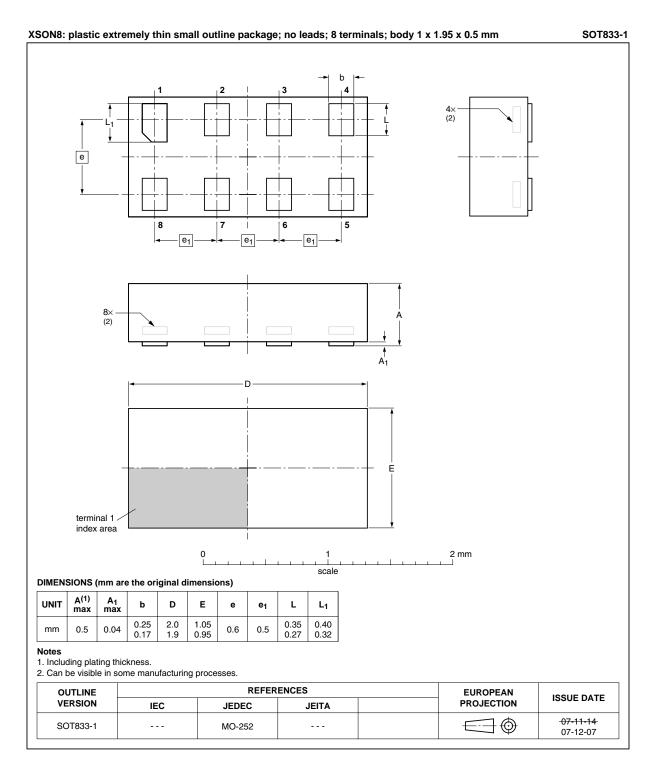


Fig 12. Package outline SOT833-1 (XSON8)

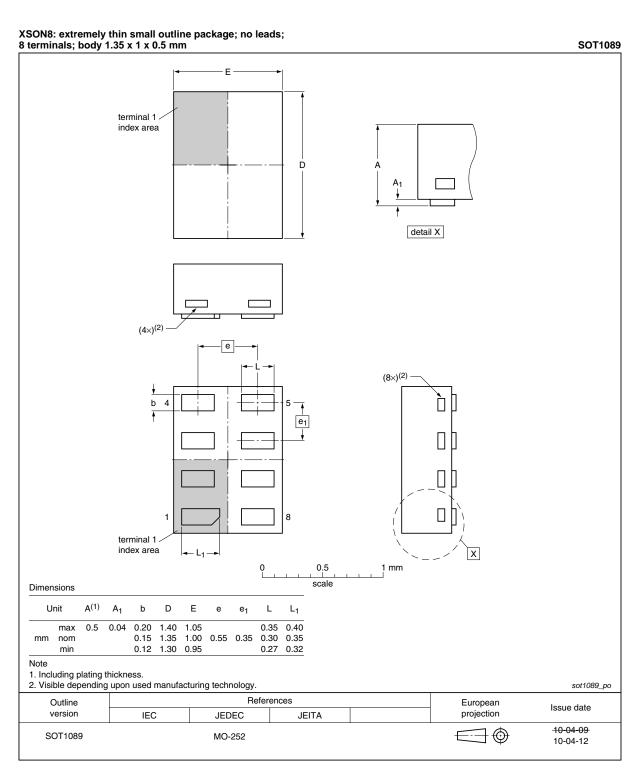


Fig 13. Package outline SOT1089 (XSON8)

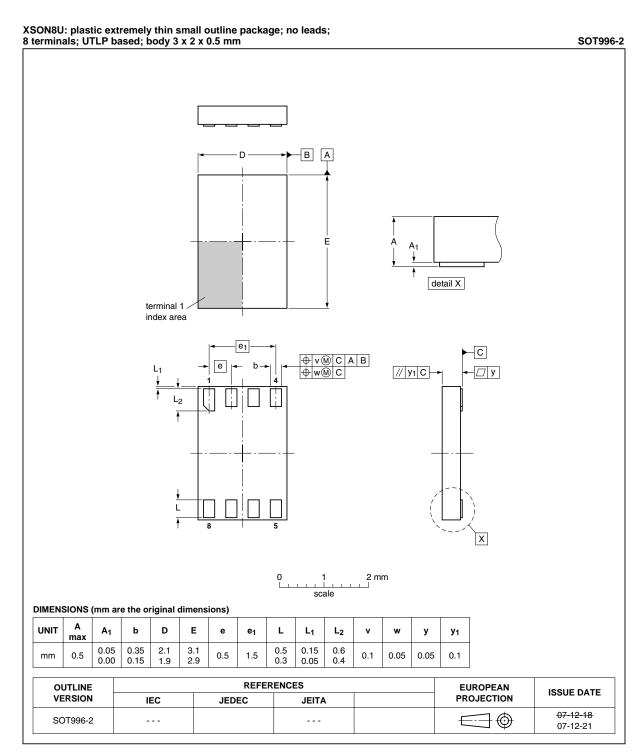


Fig 14. Package outline SOT996-2 (XSON8U)

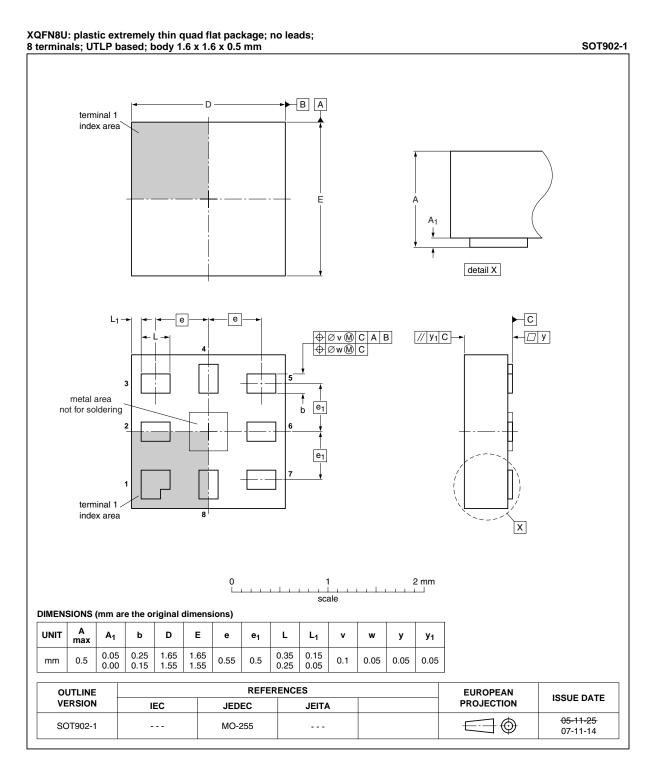


Fig 15. Package outline SOT902-1 (XQFN8U)

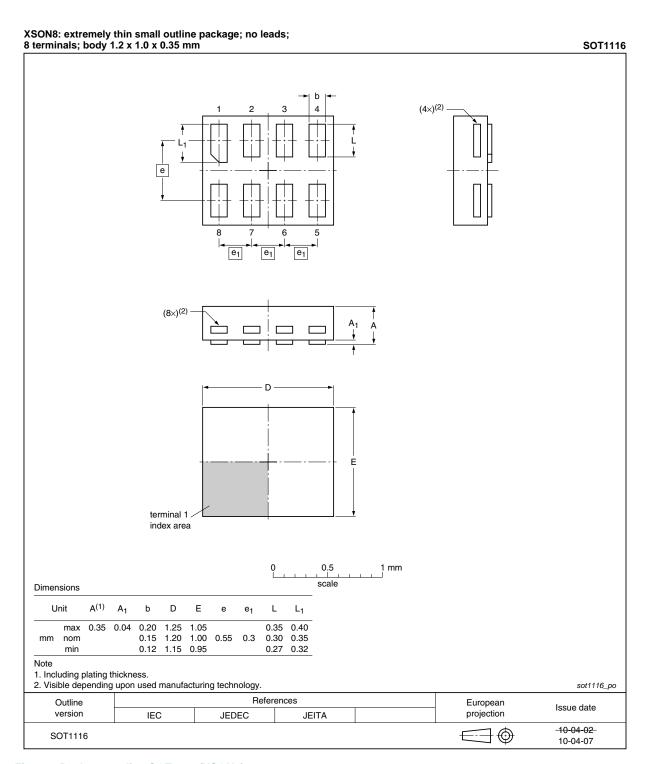


Fig 16. Package outline SOT1116 (XSON8)

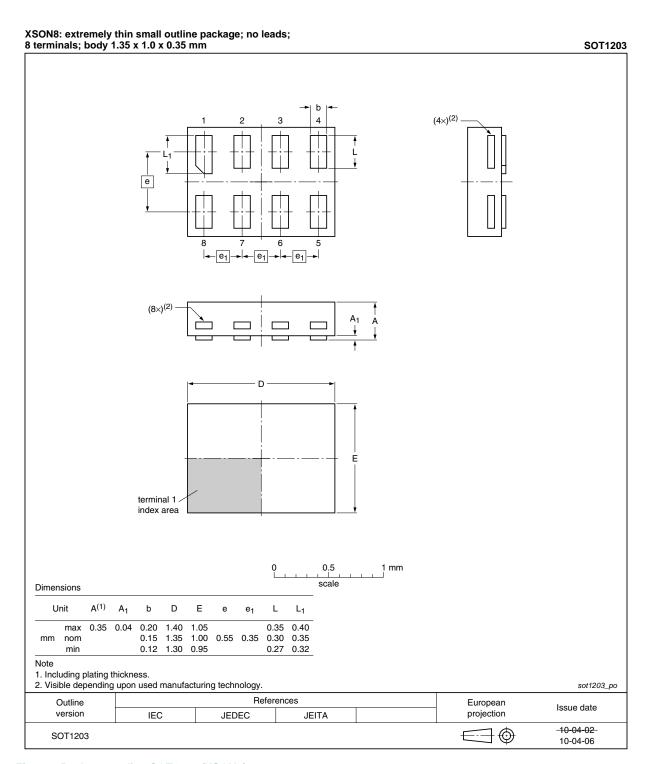


Fig 17. Package outline SOT1203 (XSON8)

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

15. Revision history

Table 12. Revision history

	•			
Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G02 v.8	20101020	Product data sheet	-	74LVC2G02 v.7
Modifications:	 Added type 	number 74LVC2G02GF (SC	OT1089/XSON8 packaç	ge)
	 Added type 	number 74LVC2G020GN (S	SOT1116/XSON8 packa	age).
	 Added type 	number 74LVC2G02GS (SC	OT1203/XSON8 packaç	ge).
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	-	-

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"
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Date of release: 20 October 2010 Document identifier: 74LVC2G02