74LVC2G240

Dual inverting buffer/line driver; 3-state

Rev. 11 — 30 July 2019

Product data sheet

1. General description

The 74LVC2G240 is a dual inverting buffer/line driver with 3-state outputs. The 3-state outputs are controlled by the output enable inputs 1OE and 2OE. A HIGH level at pins nOE causes the outputs to assume a high-impedance OFF-state. Schmitt trigger action at all inputs makes the circuit highly tolerant of slower input rise and fall times.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of the 74LVC2G240 as a translator in a mixed 3.3 V and 5 V environment.

It 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 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)
 - JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- · Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C



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3. Ordering information

Table 1. Ordering information

Type number	Package	Package						
	Temperature range	Name	Description	Version				
74LVC2G240DP	-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				
74LVC2G240DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1				
74LVC2G240GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1				
74LVC2G240GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm	SOT1089				
74LVC2G240GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm	SOT1116				
74LVC2G240GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm	SOT1203				

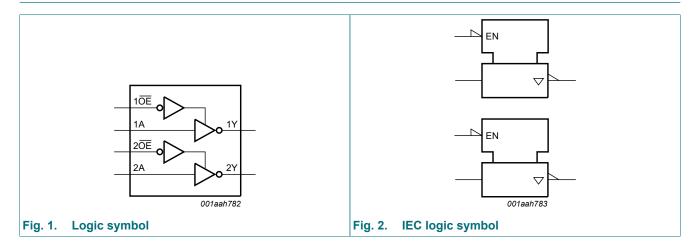
4. Marking

Table 2. Marking codes

Table 2. Marking Codes					
Type number	Marking code [1]				
74LVC2G240DP	V240				
74LVC2G240DC	V40				
74LVC2G240GT	V40				
74LVC2G240GF	V2				
74LVC2G240GN	V2				
74LVC2G240GS	V2				

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

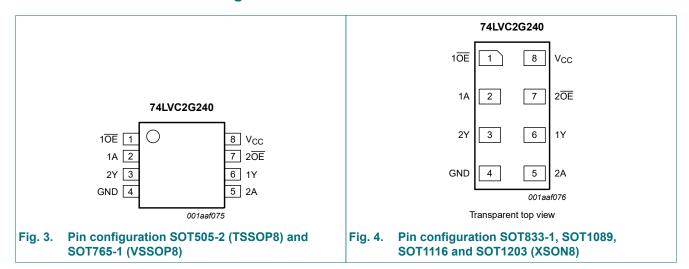
5. Functional diagram



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6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
1OE	1	output enable input 1 OE (active LOW)
1A	2	data input
2Y	3	data output
GND	4	ground (0 V)
2A	5	data input
1Y	6	data output
2OE	7	output enable input 2 OE (active LOW)
V _{CC}	8	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

n OE	Output	
nOE	nA	nY
L	L	Н
L	Н	L
Н	X	Z

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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
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
VI	input voltage	[1]	-0.5	+6.5	V
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$	-	±50	mA
Vo	output voltage	Enable mode [1]	-0.5	V _{CC} + 0.5	V
		Disable mode [1]	-0.5	+6.5	V
		Power-down mode; V _{CC} = 0 V [1]	-0.5	+6.5	V
Io	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	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [2]	-	250	mW

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

For SOT765-1 (VSSOP8) packages: Ptot derates linearly with 4.9 mW/K above 99 °C.

For SOT833-1 (XSON8) packages: Ptot derates linearly with 3.1 mW/K above 68 °C.

For SOT1089 (XSON8) packages: P_{tot} derates linearly with 4.0 mW/K above 88 °C.

For SOT1116 (XSON8) packages: P_{tot} derates linearly with 4.2 mW/K above 90 °C.

For SOT1203 (XSON8) packages: Ptot derates linearly with 3.6 mW/K above 81 °C.

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	V _{CC} = 1.65 V to 5.5 V; Enable mode	0	V _{CC}	V
		V _{CC} = 1.65 V to 5.5 V; Disable mode	0	5.5	V
		V _{CC} = 0 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 V to 2.7 V	-	20	ns/V
		V _{CC} = 2.7 V to 5.5 V	-	10	ns/V

^[2] For SOT505-2 (TSSOP8) packages: Ptot derates linearly with 4.6 mW/K above 96 °C.

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10. Static characteristics

Table 7. Static characteristics

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

Symbol Par	Parameter	Conditions	T _{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V _{IH}	HIGH-level input	V _{CC} = 1.65 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	V
	voltage	V _{CC} = 2.3 V to 2.7 V	1.7	-	-	1.7	-	V
	V _{CC} = 2.7 V to 3.6 V	2.0	-	-	2.0	-	V	
		V _{CC} = 4.5 V to 5.5 V	0.7V _{CC}	-	-	0.7V _{CC}	-	V
V _{IL}	LOW-level input	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{CC}	V
	voltage	V _{CC} = 2.3 V to 2.7 V	-	-	0.7	-	0.7	V
		V _{CC} = 2.7 V to 3.6 V	-	-	0.8	-	0.8	V
		V _{CC} = 4.5 V to 5.5 V	-	-	0.3V _{CC}	-	0.3V _{CC}	V
V _{OL}	LOW-level output	V _I = V _{IH} or V _{IL}						
voltage	$I_O = 100 \mu A;$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	-	-	0.1	-	0.1	V	
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.70	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.3	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	-	0.60	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	-	0.80	V
	I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.55	-	0.80	V	
V _{OH}	HIGH-level output	V _I = V _{IH} or V _{IL}				-	-	
	voltage	I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V _{CC} - 0.1	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	0.95	-	V
		I_{O} = -8 mA; V_{CC} = 2.3 V	1.9	-	-	1.7	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	1.9	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	-	-	2.0	-	V
		I_{O} = -32 mA; V_{CC} = 4.5 V	3.8	-	-	3.4	-	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	-	±1	μΑ
l _{OZ}	OFF-state output current	$V_I = V_{IH}$ or V_{IL} ; $V_O = 5.5$ V or GND; $V_{CC} = 3.6$ V	-	±0.1	±2	-	±2	μΑ
I _{OFF}	power-off leakage current	$V_1 \text{ or } V_0 = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	±0.1	±2	-	±2	μΑ
I _{CC}	supply current	V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V	-	0.1	4	-	4	μΑ
ΔI _{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	-	500	μΑ
Cı	input capacitance		-	2	-	-	-	pF

^[1] Typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 $^{\circ}C.$

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11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 7.

Symbol	Parameter	Conditions	T_{amb} = -40 °C to +85 °C			T _{amb} = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Fig. 5 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	4.1	9.5	1.0	11.9	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.6	5.2	0.5	6.5	ns
		V _{CC} = 2.7 V	1.0	3.0	5.5	1.0	6.9	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.5	4.6	0.5	5.8	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.0	4.0	0.5	5.0	ns
t _{en}	enable time	nOE to nY; see Fig. 6 [3]						
		V _{CC} = 1.65 V to 1.95 V	1.5	4.5	10.3	1.5	12.9	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.9	5.6	1.0	7.0	ns
		V _{CC} = 2.7 V	1.5	3.4	5.6	1.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.5	4.7	0.5	5.9	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.0	3.8	0.5	4.8	ns
t _{dis}	disable time	nOE to nY; see Fig. 6 [4]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.5	11.6	1.0	14.1	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	1.9	5.8	0.5	7.6	ns
		V _{CC} = 2.7 V	1.0	2.8	4.5	1.0	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.7	4.4	1.0	5.7	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.9	3.4	0.5	4.6	ns
C _{PD}	power dissipation	per buffer; V _I = GND to V _{CC} [5]						
	capacitance	output enabled	-	18	-	-	-	pF
		output disabled	-	5	-	-	-	pF

^[1] 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_i = input frequency in MHz;

fo = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

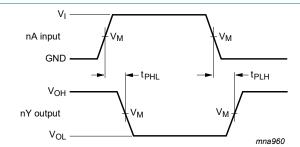
t_{pd} is the same as t_{PLH} and t_{PHL}

t_{en} is the same as t_{PZH} and t_{PZL}

t_{dis} is the same as t_{PLZ} and t_{PHZ}
 C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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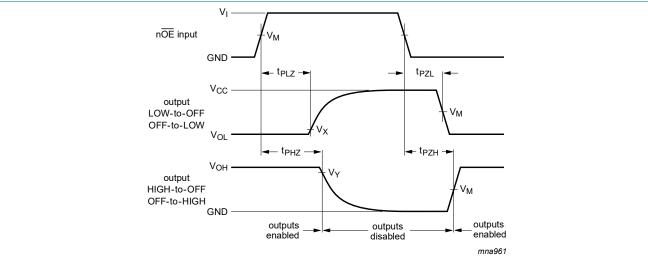
11.1. Waveforms and test circuit



Measurement points are given in Table 9.

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

Fig. 5. The data input (nA) to output (nY) propagation delays



Measurement points are given in Table 9.

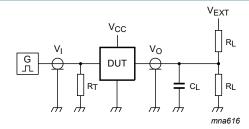
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 6. 3-state enable and disable times

Table 9. Measurement points

Tubio of modern one points						
Supply voltage	Input	Output				
V _{CC}	V _M	V _M	V _X	V _Y		
1.65 V to 1.95 V	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V		
2.3 V to 2.7 V	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 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	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V		

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Test data is given in <u>Table 10</u>.

Definitions for test circuit:

 R_L = Load resistance.

 $\ensuremath{C_L}$ = 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_{EXT} = External voltage for measuring switching times.

Fig. 7. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input	Load		V _{EXT}	V _{EXT}		
V _{CC}	Vı	CL	R _L	t _{PLH} , t _{PHL}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}	
1.65 V to 1.95 V	V_{CC}	30 pF	1 kΩ	open	GND	2 × V _{CC}	
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	2 × V _{CC}	
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V	
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V	
4.5 V to 5.5 V	V _{CC}	50 pF	500 Ω	open	GND	2 × V _{CC}	

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12. Package outline

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

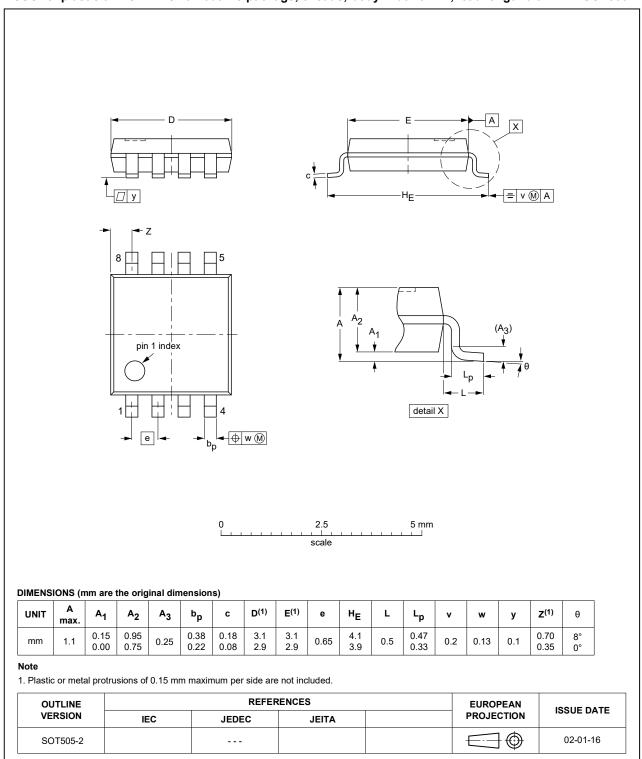


Fig. 8. Package outline SOT505-2 (TSSOP8)

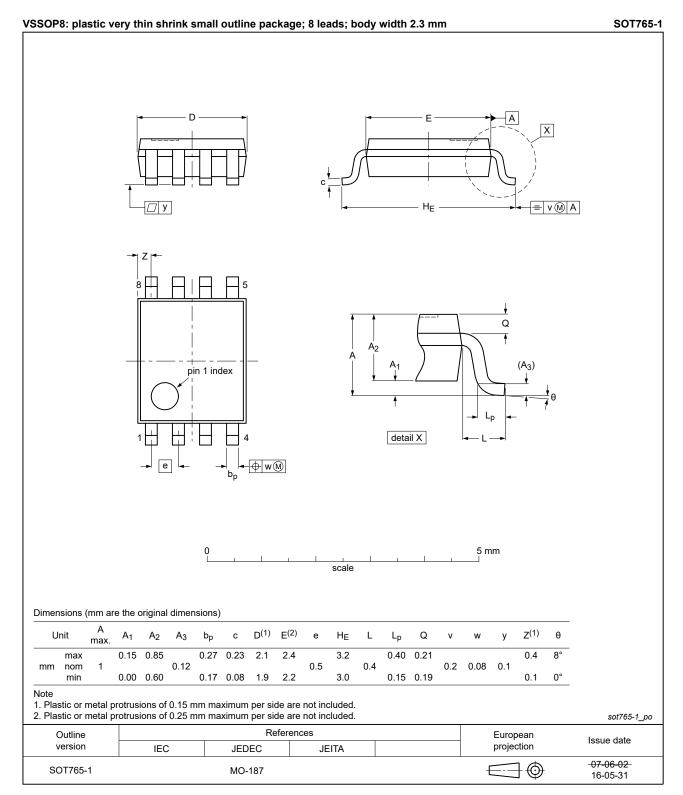


Fig. 9. Package outline SOT765-1 (VSSOP8)

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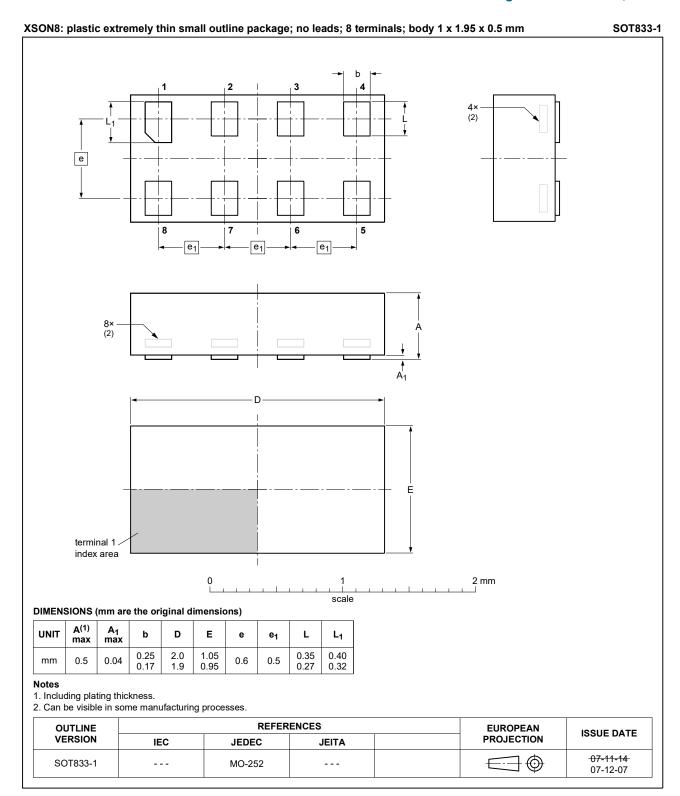


Fig. 10. Package outline SOT833-1 (XSON8)

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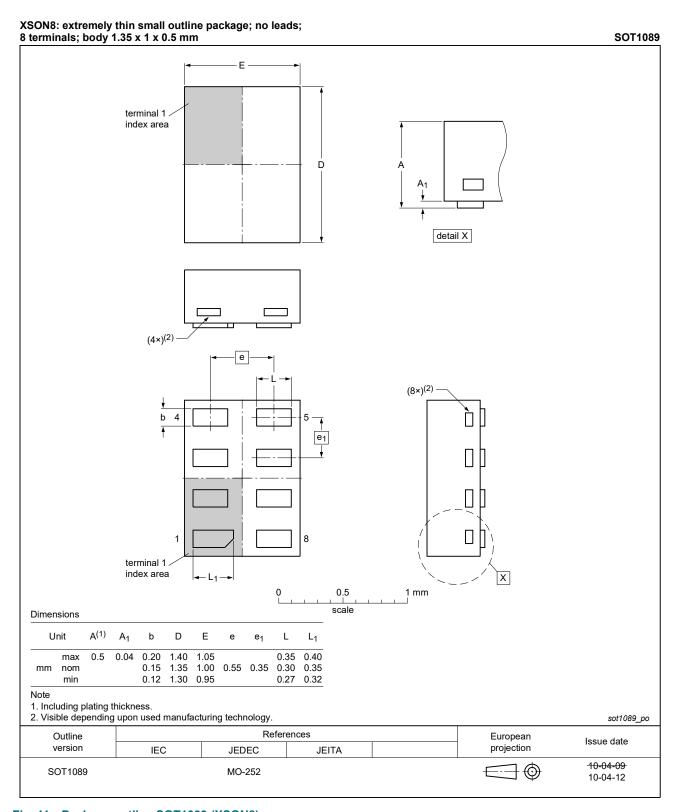


Fig. 11. Package outline SOT1089 (XSON8)

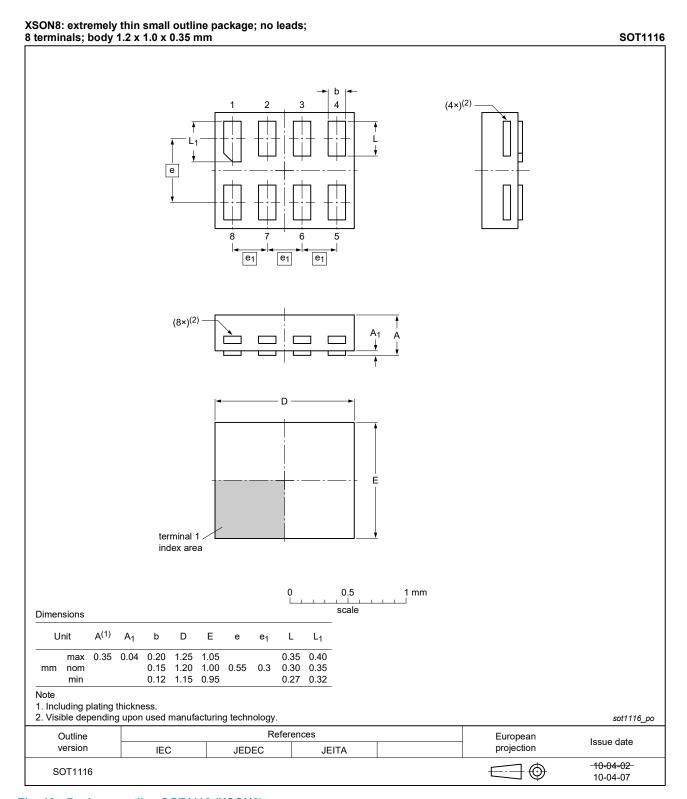


Fig. 12. Package outline SOT1116 (XSON8)

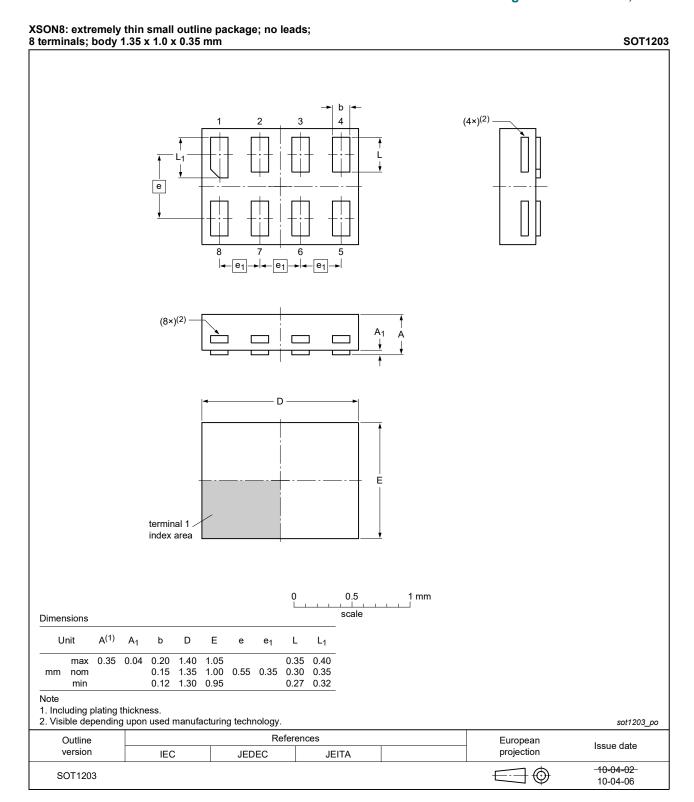


Fig. 13. Package outline SOT1203 (XSON8)

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13. Abbreviations

Table 11. Abbreviations

Acronym	Description			
CMOS	omplementary Metal-Oxide Semiconductor			
DUT	evice 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					
74LVC2G240 v.11	20190730	Product data sheet	-	74LVC2G240 v.10					
Modifications:	• •	 Type number 74LVC2G240GM (SOT902-2/XQFN8) removed. Table 5: Derating values for P_{tot} total power dissipation updated. 							
74LVC2G240 v.10	20181101	Product data sheet	-	74LVC2G240 v.9					
Modifications:	of Nexperia. • Legal texts I	 The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. Type number 74LVC2G240GD (SOT996-2) removed. 							
74LVC2G240 v.9	20161215	Product data sheet	-	74LVC2G240 v.8					
Modifications:	• <u>Table 7</u> : The	maximum limits for leaka	ge current and sup	ply current have changed.					
74LVC2G240 v.8	20130408	Product data sheet	-	74LVC2G240 v.7					
Modifications:	For type nur	nber 74LVC2G240GD XS	ON8U has change	d to XSON8.					
74LVC2G240 v.7	20120622	Product data sheet	-	74LVC2G240 v.6					
Modifications:	For type nur	nber 74LVC2G240GM the	SOT code has cha	anged to SOT902-2.					
74LVC2G240 v.6	20111128	Product data sheet	-	74LVC2G240 v.5					
Modifications:	Legal pages	updated.	,						
74LVC2G240 v.5	20100915	Product data sheet	-	74LVC2G240 v.4					
74LVC2G240 v.4	20080229	Product data sheet	-	74LVC2G240 v.3					
74LVC2G240 v.3	20071005	Product data sheet	-	74LVC2G240 v.2					
74LVC2G240 v.2	20060728	Product data sheet	-	74LVC2G240 v.1					
74LVC2G240 v.1	20030311	Product specification	-	-					

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15. Legal information

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.

- 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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Dual inverting buffer/line driver; 3-state

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