74LVC2G240

Dual inverting buffer/line driver; 3-state

Rev. 8 — 8 April 2013

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
- \pm 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			
	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 \times 1.95 \times 0.5 mm	SOT833-1
74LVC2G240GF	–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
74LVC2G240GD	–40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 3 \times 2 \times 0.5 mm	SOT996-2
74LVC2G240GM	–40 °C to +125 °C	XQFN8	plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 \times 1.6 \times 0.5 mm	SOT902-2
74LVC2G240GN	–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
74LVC2G240GS	–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

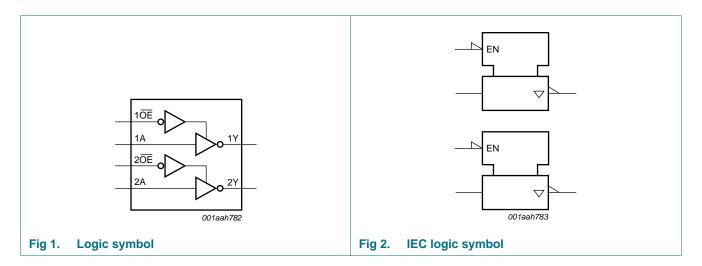
Table 2. Marking codes

Type number	Marking code ^[1]
74LVC2G240DP	V240
74LVC2G240DC	V40
74LVC2G240GT	V40
74LVC2G240GF	V2
74LVC2G240GD	V40
74LVC2G240GM	V40
74LVC2G240GN	V2
74LVC2G240GS	V2

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

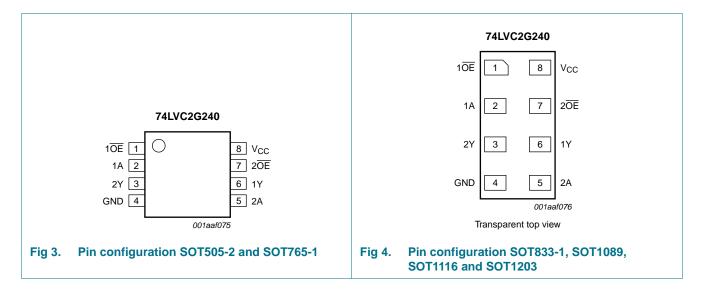
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5. Functional diagram

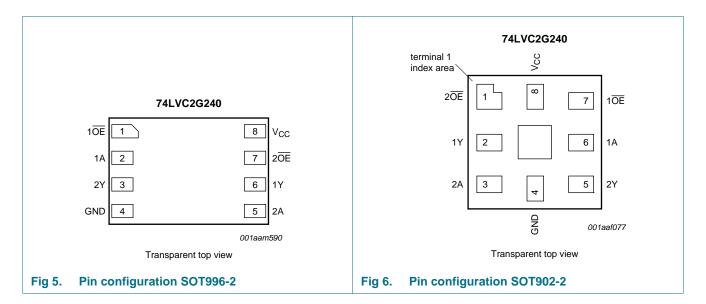


6. Pinning information

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	SOT902-2			
1 OE	1	7	output enable input 1OE (active LOW)		
1A	2	6	data input		
2Y	3	5	data output		
GND	4	4	ground (0 V)		
2A	5	3	data input		
1Y	6	2	data output		
2 <mark>OE</mark>	7	1	output enable input 2OE (active LOW)		
V_{CC}	8	8	supply voltage		

7. Functional description

Table 4. Function table[1]

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

^[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

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		<u>[1]</u> –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	<u>[1]</u> –0.5	$V_{CC} + 0.5$	V
		Disable mode	<u>[1]</u> –0.5	+6.5	V
		Power-down mode	[1][2] -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	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$	<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
V_{I}	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
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65 \text{ V to } 2.7 \text{ V}$	-	20	ns/V
		V _{CC} = 2.7 V to 5.5 V	-	10	ns/V

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

^[3] For TSSOP8 packages: above 55 °C the value of P_{tot} derates linearly at 2.5 mW/K.
For VSSOP8 packages: above 110 °C the value of P_{tot} derates linearly at 8.0 mW/K.
For XSON8 and XQFN8 packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

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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 _{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
V_{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		V _{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		$V_{CC} = 2.7 \text{ V to } 3.6 \text{ V}$	-	-	0.8	V
		V _{CC} = 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}				
		I_{O} = 100 μ A; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		$I_{O} = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.3	V
		I_{O} = 12 mA; V_{CC} = 2.7 V	-	-	0.4	V
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.55	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100~\mu A;~V_{CC} = 1.65~V$ to $5.5~V$	$V_{CC}-0.1$	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	-	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	-	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	-	-	V
I _I	input leakage current	$V_I = 5.5 \text{ V or GND}$; $V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	•	±0.1	±5	μΑ
I _{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	±10	μΑ
I _{OFF}	power-off leakage current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	±0.1	±10	μΑ
I _{CC}	supply current	$V_I = 5.5 \text{ V or GND}; I_O = 0 \text{ A};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	-	0.1	10	μА
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	μА
C_{I}	input capacitance		-	2	-	pF

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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	Uni
T _{amb} = -	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	-	-	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
V_{IL}	LOW-level input voltage	V _{CC} = 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 _{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_{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
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_{O} = -100 \mu A$; $V_{CC} = 1.65 V \text{ to } 5.5 V$	$V_{CC}-0.1$	-	-	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
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.4	-	-	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
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	-	-	±20	μΑ
I _{OFF}	power-off leakage current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	-	±20	μΑ
I _{CC}	supply current	$V_{I} = 5.5 \text{ V or GND}; I_{O} = 0 \text{ A};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	-	-	40	μА
Δl _{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	-	-	5	mΑ

^[1] 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 9.

Symbol	Parameter	Conditions		-40	°C to +85	°C	-40 °C to	Unit	
				Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Figure 7	[2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	4.1	9.5	1.0	11.9	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.5	2.6	5.2	0.5	6.5	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	3.0	5.5	1.0	6.9	ns
	$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		0.5	2.5	4.6	0.5	5.8	ns	
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	2.0	4.0	0.5	5.0	ns
t _{en}	enable time	nOE to nY; see Figure 8	[3]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.5	4.5	10.3	1.5	12.9	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.0	2.9	5.6	1.0	7.0	ns
		$V_{CC} = 2.7 \text{ V}$		1.5	3.4	5.6	1.5	7.0	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		0.5	2.5	4.7	0.5	5.9	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	2.0	3.8	0.5	4.8	ns
t _{dis}	disable time	nOE to nY; see Figure 8	[4]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.0	3.5	11.6	1.0	14.1	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.5	1.9	5.8	0.5	7.6	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	2.8	4.5	1.0	5.8	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	2.7	4.4	1.0	5.7	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		0.5	1.9	3.4	0.5	4.6	ns
C_{PD}	power dissipation	per buffer; $V_I = GND$ to V_{CC}	<u>[5]</u>						
	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:

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.

^[2] $\;\;t_{pd}$ is the same as t_{PLH} and t_{PHL}

^[3] t_{en} is the same as t_{PZH} and t_{PZL}

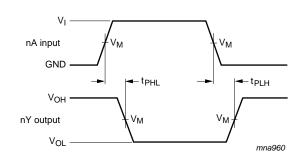
^[4] t_{dis} is the same as t_{PLZ} and t_{PHZ}

^[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

 f_i = input frequency in MHz;

f_o = output frequency in MHz;

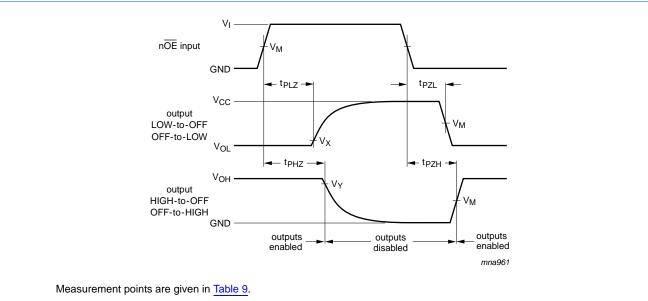
12. Waveforms



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



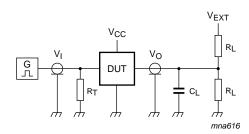
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load. 3-state enable and disable times

Table 9. **Measurement points**

Supply voltage	Input	Output	Output				
V _{CC}	V _M	V _M	V _X	V _Y			
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{\text{CC}}$	V _{OL} + 0.15 V	V _{OH} – 0.15 V			
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{\text{CC}}$	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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V _{OL} + 0.3 V	$V_{OH} - 0.3 V$			

Fig 8.

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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_{EXT} = External voltage for measuring switching times.

Fig 9. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input	Load		V _{EXT}	V _{EXT}			
	VI	C _L 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	$2\times V_{CC}$		
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	$2\times V_{CC}$		
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	$2 \times V_{CC}$		

13. Package outline

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

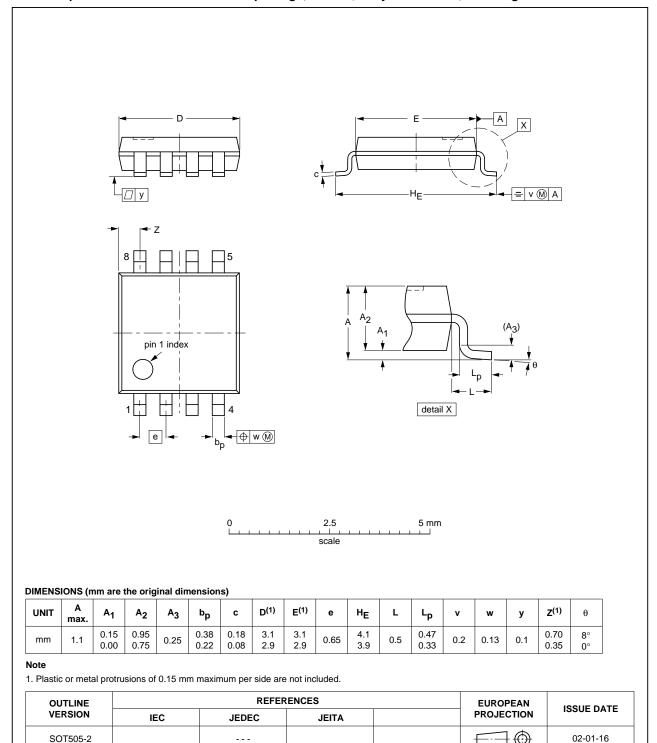
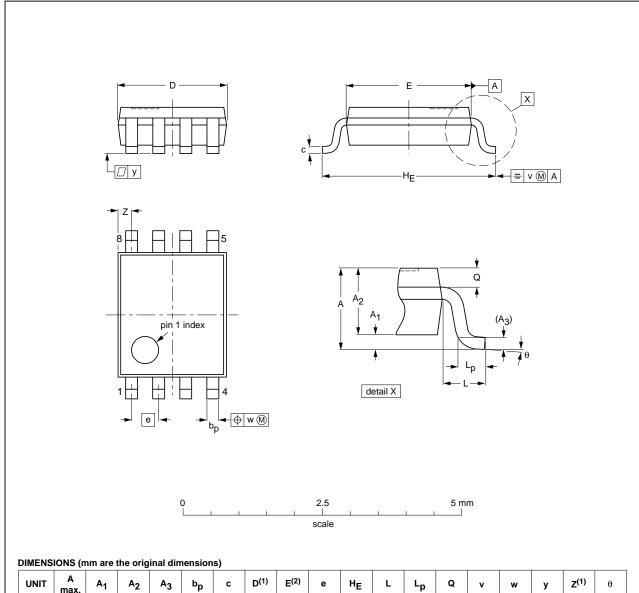


Fig 10. Package outline SOT505-2 (TSSOP8)

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VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1



UNIT	A max.	A ₁	A ₂	А3	bp	С	D ⁽¹⁾	E ⁽²⁾	е	HE	L	Lp	Q	٧	w	у	Z ⁽¹⁾	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

Notes

- Plastic or metal protrusions of 0.15 mm maximum per side are not included.
- 2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE	REFERENCES				EUROPEAN	ISSUE DATE
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE
SOT765-1		MO-187				02-06-07

Fig 11. Package outline SOT765-1 (VSSOP8)

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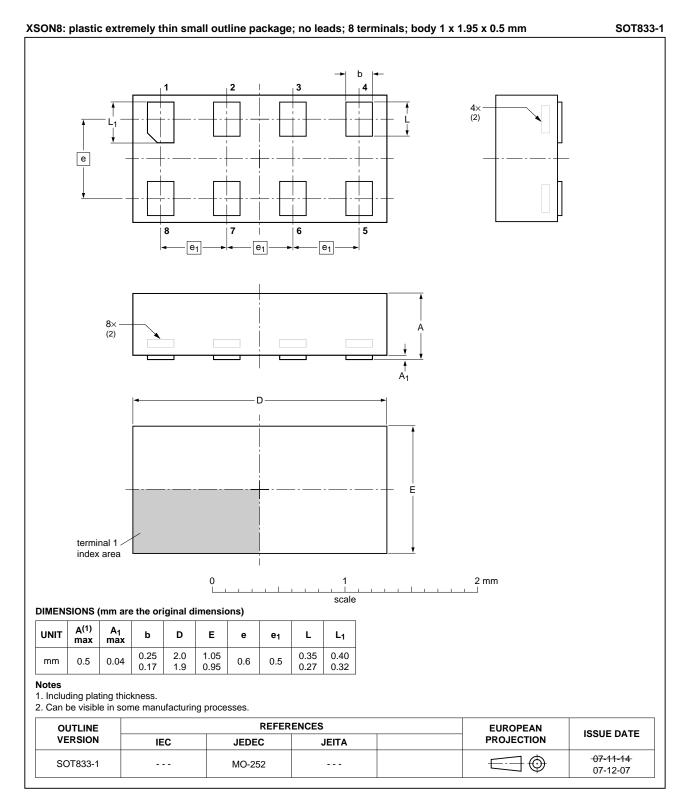


Fig 12. Package outline SOT833-1 (XSON8)

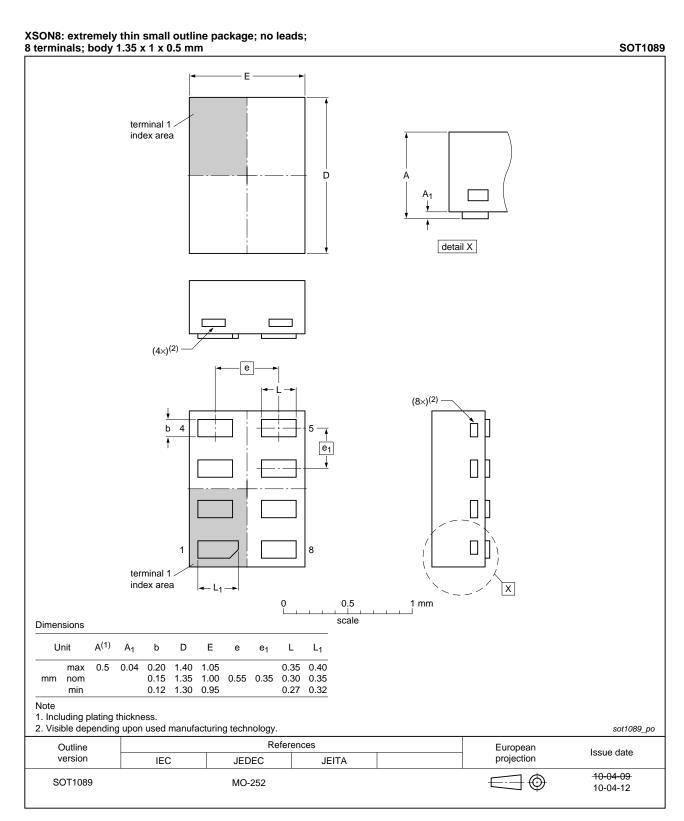


Fig 13. Package outline SOT1089 (XSON8)

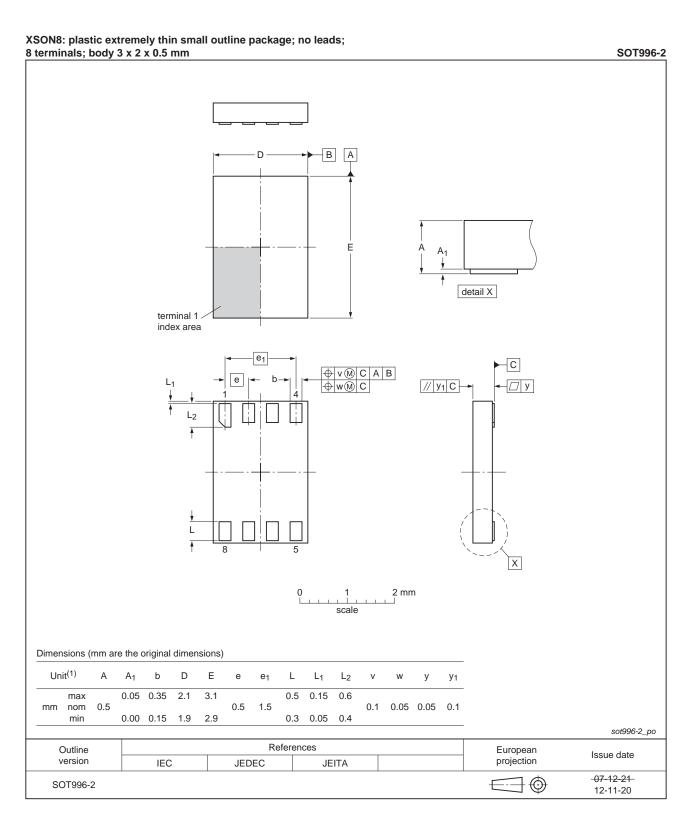


Fig 14. Package outline SOT996-2 (XSON8)

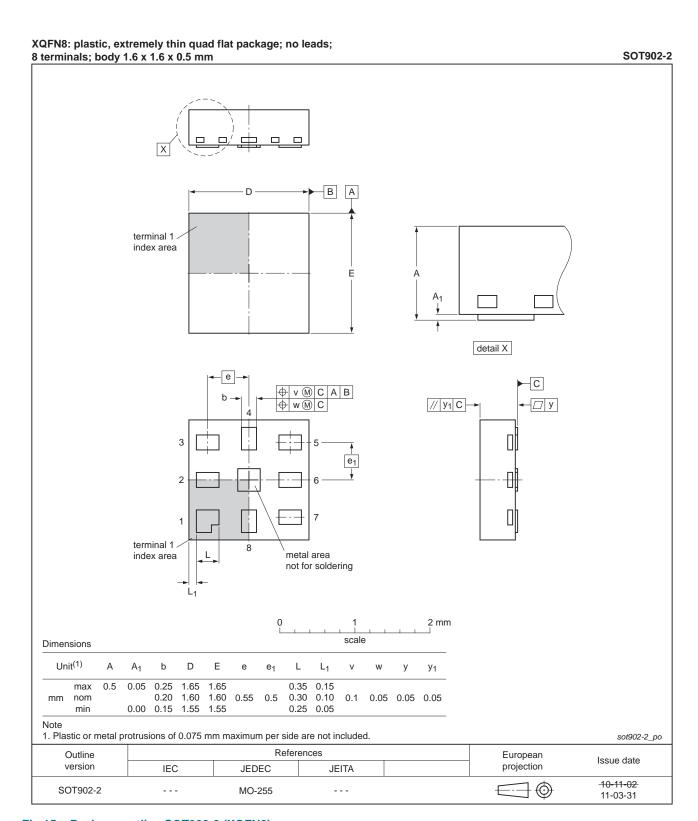


Fig 15. Package outline SOT902-2 (XQFN8)

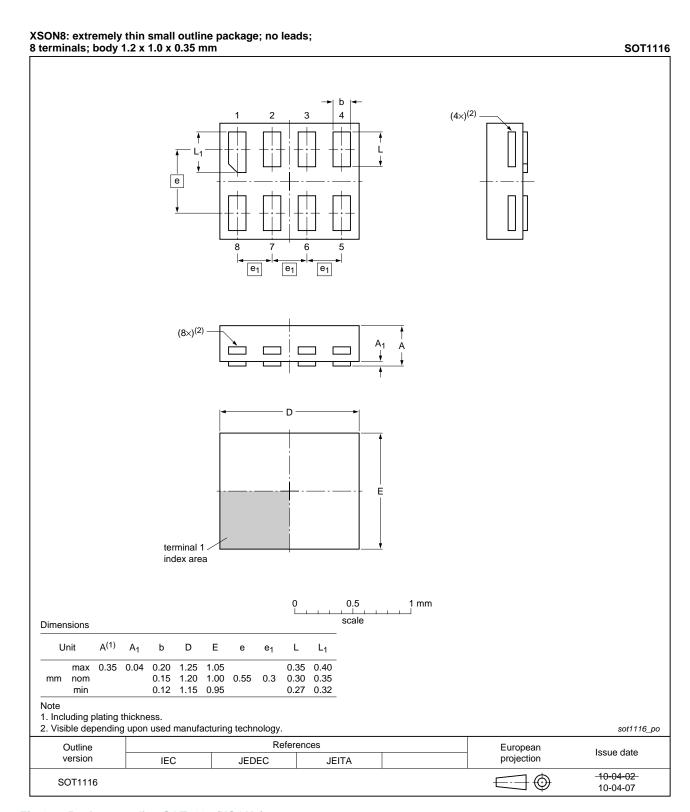


Fig 16. Package outline SOT1116 (XSON8)

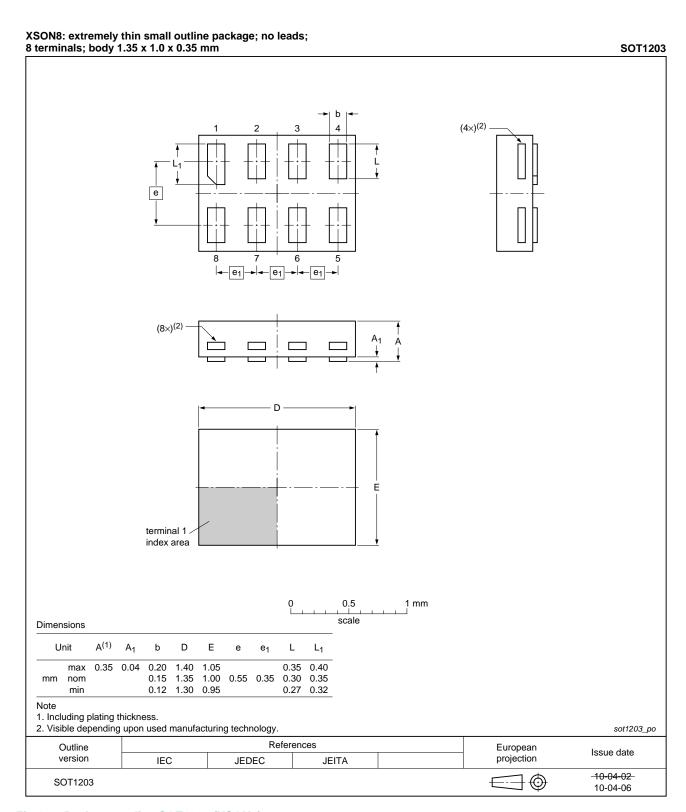


Fig 17. Package outline SOT1203 (XSON8)

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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
74LVC2G240 v.8	20130408	Product data sheet	-	74LVC2G240 v.7
Modifications:	 For type nu 	mber 74LVC2G240GD XSC	N8U has changed to X	SON8.
74LVC2G240 v.7	20120622	Product data sheet	-	74LVC2G240 v.6
Modifications:	 For type nu 	mber 74LVC2G240GM the	SOT code has changed	I to SOT902-2.
74LVC2G240 v.6	20111128	Product data sheet	-	74LVC2G240 v.5
Modifications:	 Legal pages 	s 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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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 http://www.nxp.com.

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