74LVC2G241

Dual buffer/line driver; 3-state

Rev. 16 — 31 July 2019

Product data sheet

1. General description

The 74LVC2G241 is a dual non-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 pin 1OE causes output 1Y to assume a high-impedance OFF-state.
- A LOW level at pin 2OE causes output 2Y 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 74LVC2G241 as a translator 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 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



Dual buffer/line driver; 3-state

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC2G241DP	-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
74LVC2G241DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74LVC2G241GT	-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
74LVC2G241GF	-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
74LVC2G241GN	-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
74LVC2G241GS	-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

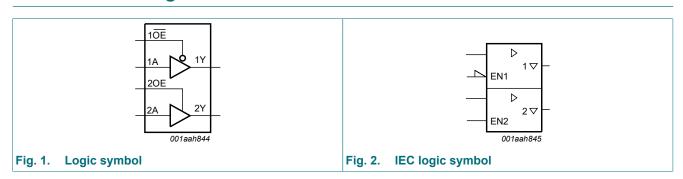
4. Marking

Table 2. Marking codes

Marking code[1]
V241
V41
V41
V1
V1
V1

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

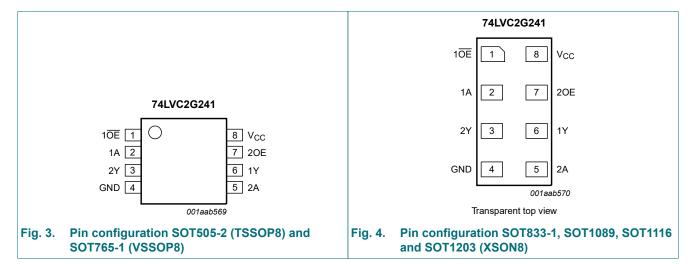
5. Functional diagram



Dual buffer/line driver; 3-state

6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Description
Symbol	FIII	Description
1 OE	1	output enable input (active LOW)
1A, 2A	2, 5	data input
GND	4	ground (0 V)
1Y, 2Y	6, 3	data output
20E	7	output enable input (active HIGH)
V _{CC}	8	supply voltage

7. Functional description

Table 4. Function table

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

Input		Output			
1 OE	1A	20E	2A	1Y	2Y
L	L	Н	L	L	L
L	Н	Н	Н	Н	Н
Н	X	L	Х	Z	Z

3 / 18

Dual buffer/line driver; 3-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		[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
		V _{CC} = 0 V; Power-down mode	[1]	-0.5	+6.5	V
Io	output current	V _O = 0 V 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 °C to +125 °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: P_{tot} derates linearly with 3.6 mW/K above 81 $^{\circ}\text{C}.$

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.

Dual buffer/line driver; 3-state

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} = -2	40 °C to +85 °C			1		
V _{IH} HIGH-level input voltage		V _{CC} = 1.65 V to 1.95 V	0.65 × 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 × V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	V
		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 × V _{CC}	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.3	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.55	V
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.9	-	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	-	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	-	-	V
II	input leakage current	$V_{I} = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	±0.1	±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	μΑ
I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	±0.1	±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	μΑ
ΔI _{CC}	additional supply current	per pin; $V_I = V_{CC}$ - 0.6 V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	5	500	μΑ
Cı	input capacitance		-	2	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T _{amb} = -4	10 °C to +125 °C			'		
V _{IH}	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65 × 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 × V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	V
		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 × V _{CC}	V
V _{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.70	V
		I _O = 8 mA; V _{CC} = 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
V _{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V
		I _O = -4 mA; V _{CC} = 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 _O = -24 mA; V _{CC} = 3.0 V	2.0	-	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.4	-	-	V
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	±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	-	-	±2	μA
I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	-	±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	-	-	4	μA
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	-	-	500	μΑ

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

Dual buffer/line driver; 3-state

11. Dynamic characteristics

Table 8. Dynamic characteristics

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

Symbol	Parameter	Conditions	-40	°C to +85	C	-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	4.5	8.8	1.0	11.0	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.8	4.9	0.5	6.3	ns
		V _{CC} = 2.7 V	1.0	2.8	4.7	1.0	5.9	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.6	4.3	0.5	5.4	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.1	3.7	0.5	4.6	ns
t _{en}	enable time	1 OE to 1Y; see <u>Fig. 6</u> [2]						
		V _{CC} = 1.65 V to 1.95 V	1.5	5.2	9.9	1.5	12.4	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	3.1	5.6	1.0	7.0	ns
		V _{CC} = 2.7 V	1.5	3.2	5.5	1.5	6.9	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.7	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
		2OE to 2Y; see Fig. 7 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	4.3	8.8	1.0	11.0	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.7	4.7	1.0	5.9	ns
		V _{CC} = 2.7 V	1.0	2.7	4.6	1.0	5.8	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.5	4.1	1.0	5.1	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.9	3.3	0.5	4.1	ns
t _{dis}	disable time	1 OE to 1Y; see <u>Fig. 6</u> [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.2	11.6	1.0	14.1	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.2	5.8	0.5	7.6	ns
		V _{CC} = 2.7 V	1.0	2.8	4.6	1.0	5.9	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.6	4.4	1.0	5.7	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.0	3.4	0.5	4.6	ns
		2OE to 2Y; see Fig. 7 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.6	12.5	1.0	15.2	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.0	5.2	0.5	6.9	ns
		V _{CC} = 2.7 V	1.5	3.2	4.9	1.5	6.3	ns
		V _{CC} = 3.0 V to 3.6 V	1.0	2.8	4.2	1.0	5.4	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.0	3.3	0.5	4.4	ns
C _{PD}	power dissipation	per buffer; V_I = GND to V_{CC} [3]						
	capacitance	output enabled	-	20	-	-	-	pF
		output disabled	-	5	-	-	-	pF

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

 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} . t_{PD} is used to determine the dynamic power dissipation (t_{PD} in t_{PD}). $t_{PD} = t_{PD} \times t_{$

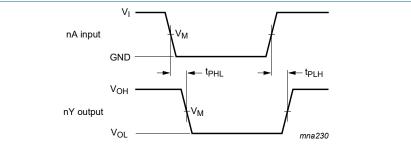
 f_i = input frequency in MHz; f_o = output frequency in MHz; C_L = output load capacitance in pF;

V_{CC} = supply voltage in V; N = number of inputs switching;

 $[\]Sigma(C_L \times V_{CC}^2 \times f_o) = \text{sum of outputs.}$

Dual buffer/line driver; 3-state

11.1. Waveforms and test circuit



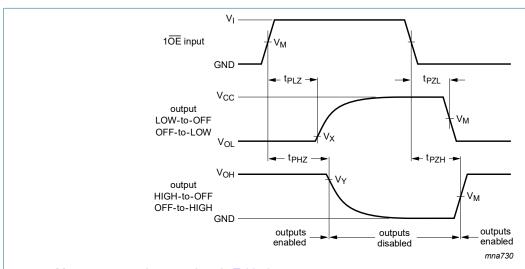
Measurement points are given in Table 9.

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

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 x V _{CC}	0.5 x V _{CC}	V _{OL} + 0.15 V	V _{OH} - 0.15 V		
2.3 V to 2.7 V	0.5 x V _{CC}	0.5 x 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 x V _{CC}	0.5 x V _{CC}	V _{OL} + 0.3 V	V _{OH} - 0.3 V		



Measurement points are given in <u>Table 9</u>.

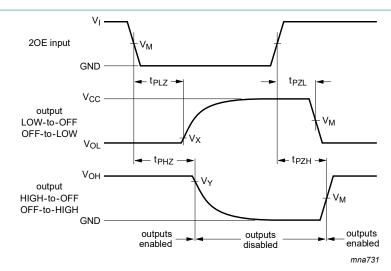
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 6. Enable and disable times for input 1 OE

Product data sheet

8 / 18

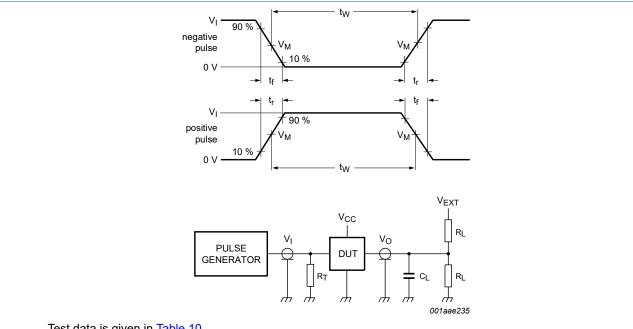
Dual buffer/line driver; 3-state



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.

Enable and disable times for input 20E Fig. 7.



Test data is given in Table 10.

Definitions for test circuit:

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

C_L = Load capacitance including jig and probe capacitance; R_L = Load resistance.

Test circuit for measuring switching times Fig. 8.

Table 10. Test data

Supply voltage	Input	Load		V _{EXT}		
	V _I	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 x V _{CC}
2.3 V to 2.7 V	V _{CC}	30 pF	500 Ω	open	GND	2 x 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 x V _{CC}

Dual buffer/line driver; 3-state

12. Package outline

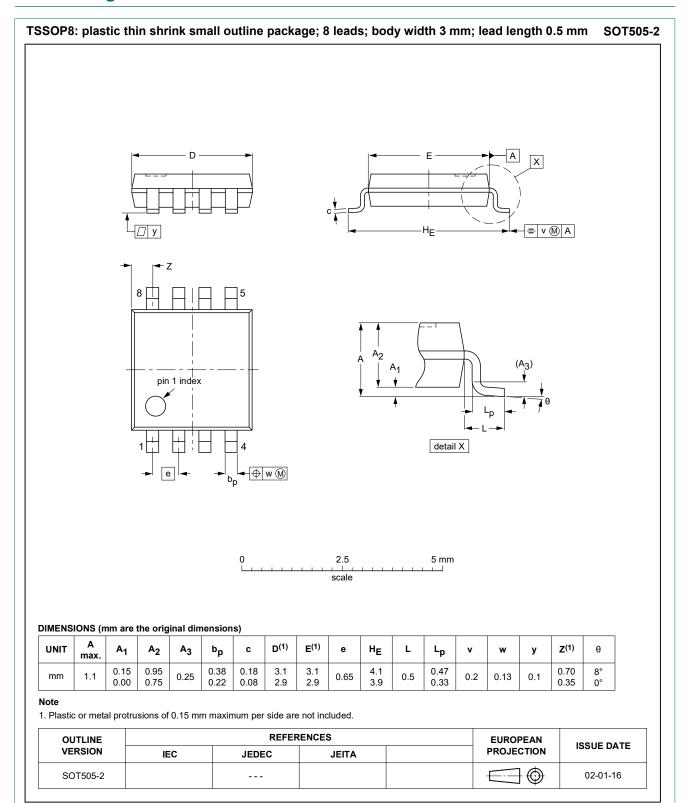


Fig. 9. Package outline SOT505-2 (TSSOP8)

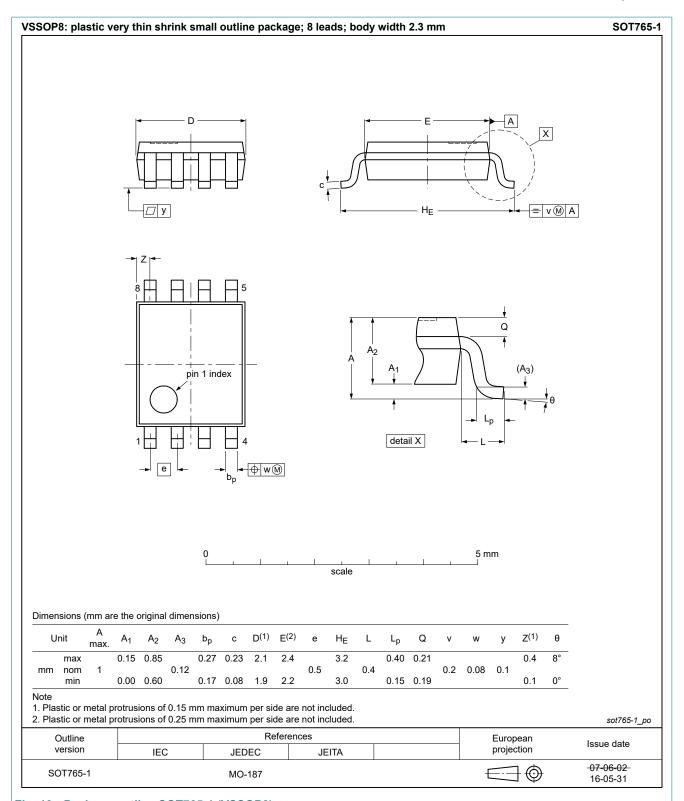


Fig. 10. Package outline SOT765-1 (VSSOP8)

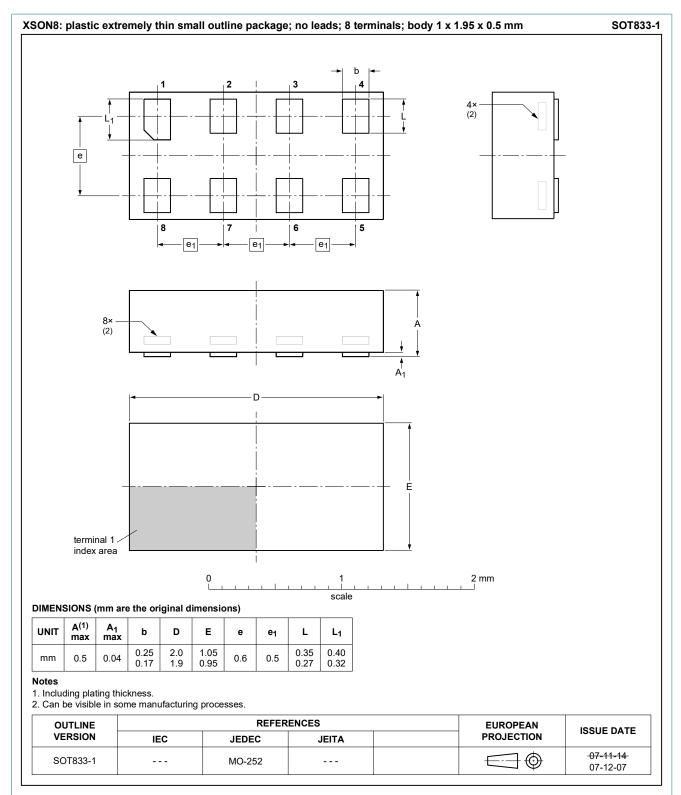


Fig. 11. Package outline SOT833-1 (XSON8)

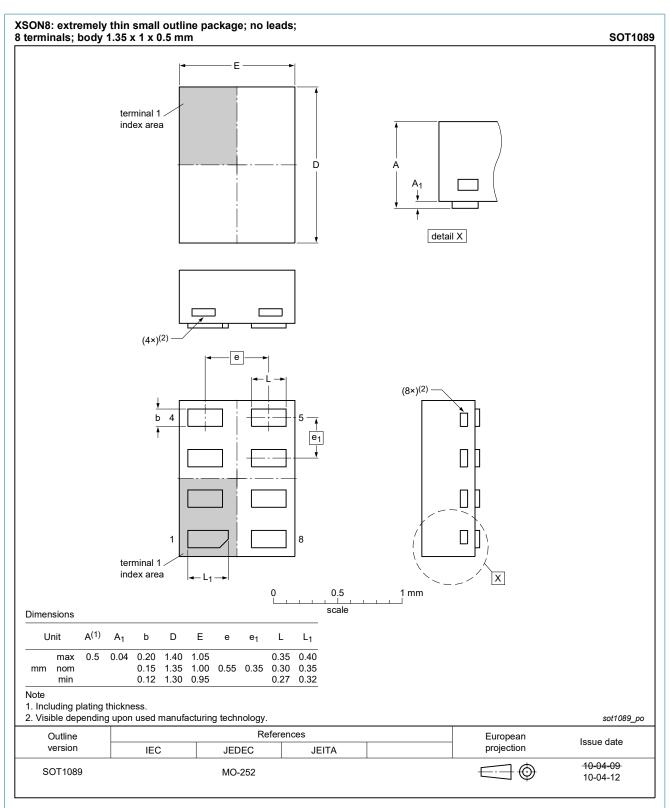


Fig. 12. Package outline SOT1089 (XSON8)

Dual buffer/line driver; 3-state

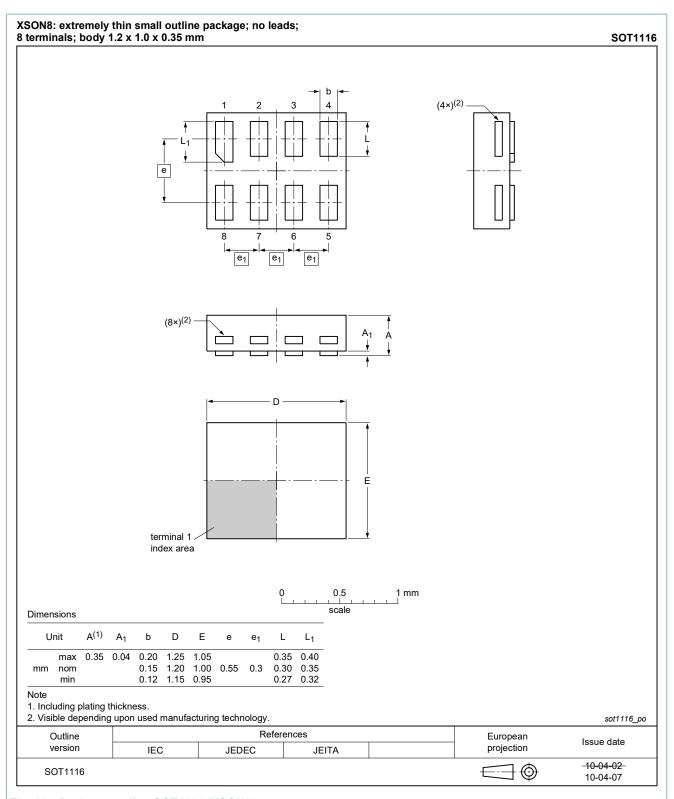


Fig. 13. Package outline SOT1116 (XSON8)

14 / 18

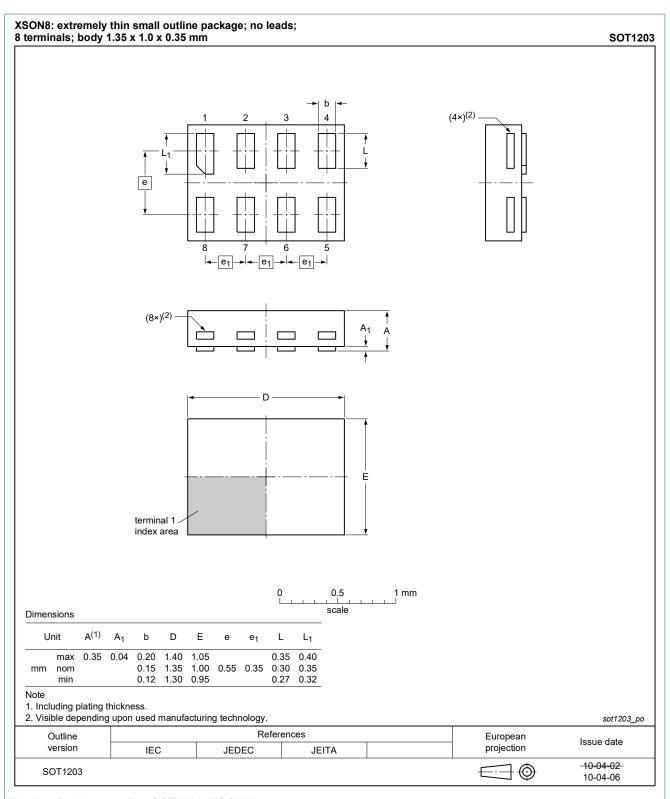


Fig. 14. Package outline SOT1203 (XSON8)

Dual buffer/line driver; 3-state

13. Abbreviations

Table 11. Abbreviations

Acronym	escription			
CMOS	Complementary Metal-Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
HBM	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	
74LVC2G241 v.16	20190731	Product data sheet	-	74LVC2G241 v.15	
Modifications:	 Type number 74LVC2G241GM (SOT902-2/XQFN8) removed. <u>Table 5</u>: Derating values for P_{tot} total power dissipation updated. 				
74LVC2G241 v.15	20181122	Product data sheet	-	74LVC2G241 v.14	
Modifications:	 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 numbers 74LVC2G241GD (SOT996-2/XSON8) removed. 				
74LVC2G241 v.14	20161215	Product data sheet	-	74LVC2G241 v.13	
Modifications:	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.				
74LVC2G241 v.13	20130408	Product data sheet	-	74LVC2G241 v.12	
Modifications:	For type number 74LVC2G241GD XSON8U has changed to XSON8.				
74LVC2G241 v.12	20120622	Product data sheet	-	74LVC2G241 v.11	
Modifications:	For type number 74LVC2G241GM the SOT code has changed to SOT902-2.				
74LVC2G241 v.11	20111129	Product data sheet	-	74LVC2G241 v.10	
Modifications:	Legal pages updated.				
74LVC2G241 v.10	20100806	Product data sheet	-	74LVC2G241 v.9	
74LVC2G241 v.9	20080610	Product data sheet	-	74LVC2G241 v.8	
74LVC2G241 v.8	20080312	Product data sheet	-	74LVC2G241 v.7	
74LVC2G241 v.7	20071005	Product data sheet	-	74LVC2G241 v.6	
74LVC2G241 v.6	20060922	Product data sheet	-	74LVC2G241 v.5	
74LVC2G241 v.5	20050202	Product specification	-	74LVC2G241 v.4	
74LVC2G241 v.4	20040922	Product specification	-	74LVC2G241 v.3	
74LVC2G241 v.3	20030311	Product specification	-	74LVC2G241 v.2	
74LVC2G241 v.2	20030129	Product specification	-	74LVC2G241 v.1	
74LVC2G241 v.1	20021030	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 buffer/line driver; 3-state

Contents

1. General description	1
2. Features and benefits	1
3. Ordering information	2
4. Marking	2
5. Functional diagram	2
6. Pinning information	3
6.1. Pinning	3
6.2. Pin description	3
7. Functional description	3
8. Limiting values	4
9. Recommended operating conditions	4
10. Static characteristics	5
11. Dynamic characteristics	7
11.1. Waveforms and test circuit	8
12. Package outline	10
13. Abbreviations	16
14. Revision history	
15. Legal information	
•	

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