Dual lilverter

Rev. 10 — 22 May 2017

Product data sheet

1 General description

The 74LVC2G04 provides the dual inverting buffer.

Inputs can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices 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 the 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 inputs 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)
 - JESD8B/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.



3 Ordering information

Table 1. Ordering information

Type number	Package	Package						
	Temperature range	Name	Description	Version				
74LVC2G04GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363				
74LVC2G04GV	-40 °C to +125 °C	SC-74	plastic surface-mounted package (TSOP6); 6 leads	SOT457				
74LVC2G04GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886				
74LVC2G04GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891				
74LVC2G04GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115				
74LVC2G04GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202				
74LVC2G04GX	-40 °C to +125 °C	X2SON6	plastic thermal extremely thin small outline package; no leads; 6 terminals; body 1 × 0.8 × 0.35 mm	SOT1255				

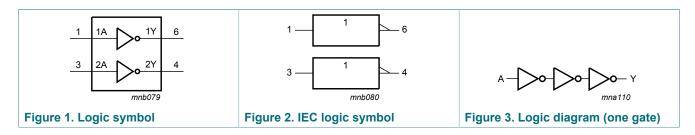
4 Marking

Table 2. Marking

Type number	Marking code ^[1]
74LVC2G04GW	V4
74LVC2G04GV	V04
74LVC2G04GM	V4
74LVC2G04GF	V4
74LVC2G04GN	V4
74LVC2G04GS	V4
74LVC2G04GX	V4

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

5 Functional diagram



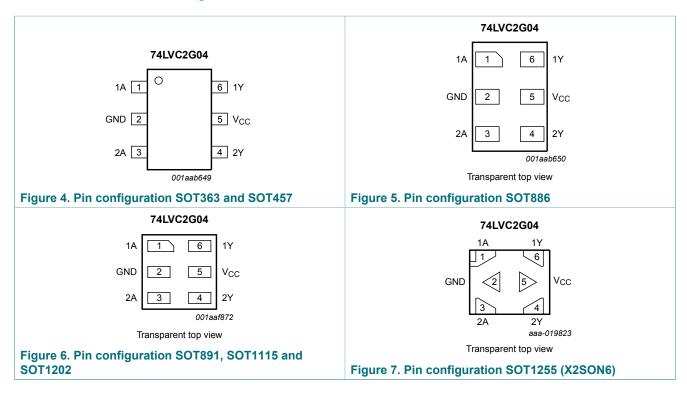
74LVC2G04

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6 Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

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

Functional description

Table 4. Function table [1]

Input	Output
nA	nY
L	Н
Н	L

H = HIGH voltage level; L = LOW voltage level.

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
V _O	output voltage	Active mode	[1] [2]	-0.5	V _{CC} + 0.5	V
		Power-down mode	[1] [2]	-0.5	+6.5	V
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
P _{tot}	total power dissipation	T _{amb} = -40 °C to +125 °C	[3]	-	250	mW
T _{stg}	storage temperature			-65	+150	°C

The input and output voltage ratings may be exceeded if the input and output current ratings are observed. When V_{CC} = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation. For SC-88 and SC-74 packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K. For X2SON6 and XSON6 packages: above 118 °C the value of Ptot derates linearly with 7.8 mW/K.

9 Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	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; V _{CC} = 0 V	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

10 Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	-40	-40 °C to +85 °C			-40 °C to +125 °C	
			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 _{OH} HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}							
	output 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
		$I_O = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	1.9	-	V
		$I_O = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	-	-	2.0	-	V
		I_{O} = -32 mA; V_{CC} = 4.5 V	3.8	-	-	3.4	-	V
V _{OL}	LOW-level output	$V_I = V_{IH}$ or V_{IL}						
	voltage	I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.10	-	0.10	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	-	0.70	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.30	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.40	-	0.60	V

74LVC2G04

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Symbol	Parameter Conditions		-40	-40 °C to +85 °C			-40 °C to +125 °C	
			Min	Typ ^[1]	Max	Min	Max	
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.80	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	-	0.55	-	0.80	V
Iı	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	-	±1	μΑ
I _{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}; V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	±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_{CC} = 2.3 V to 5.5 V; V_{I} = V_{CC} - 0.6 V; I_{O} = 0 A	-	5	500	-	500	μΑ
Cı	input capacitance	V_{CC} = 3.3 V; V_I = GND to V_{CC}	-	2.5	-	-	-	pF

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

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 +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Figure 8 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.5	8.0	1.0	9.5	ns
		V _{CC} = 2.3 V to 2.7 V	1.0	2.2	4.4	1.0	5.4	ns
		V _{CC} = 2.7 V	1.0	2.7	5.2	1.0	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.7	4.1	0.5	5.5	ns
		V _{CC} = 4.5 V to 5.5 V	1.0	1.9	3.2	1.0	3.8	ns
C _{PD}	power dissipation capacitance	$V_1 = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$ [3]	-	13.5	-	-	-	pF

- Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.
- t_{pd} is the same as t_{PLH} and t_{PHL} . C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum_i (C_L \times V_{CC}^2 \times f_o)$ where:

f_i = input frequency in MHz;

f_o = output frequency in MHz;

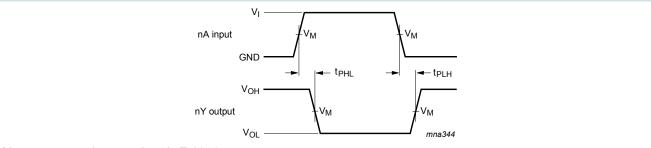
C_L = output load capacitance in pF;

 V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1 Waveforms and test circuit



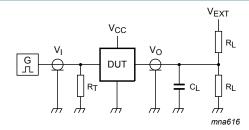
Measurement points are given in Table 9.

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

Figure 8. The input nA 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}



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

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.

Figure 9. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V _{EXT}
V _{CC}	VI	$t_r = t_f$	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	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 _{CC}	≤ 2.5 ns	50 pF	500 Ω	open

12 Package outline

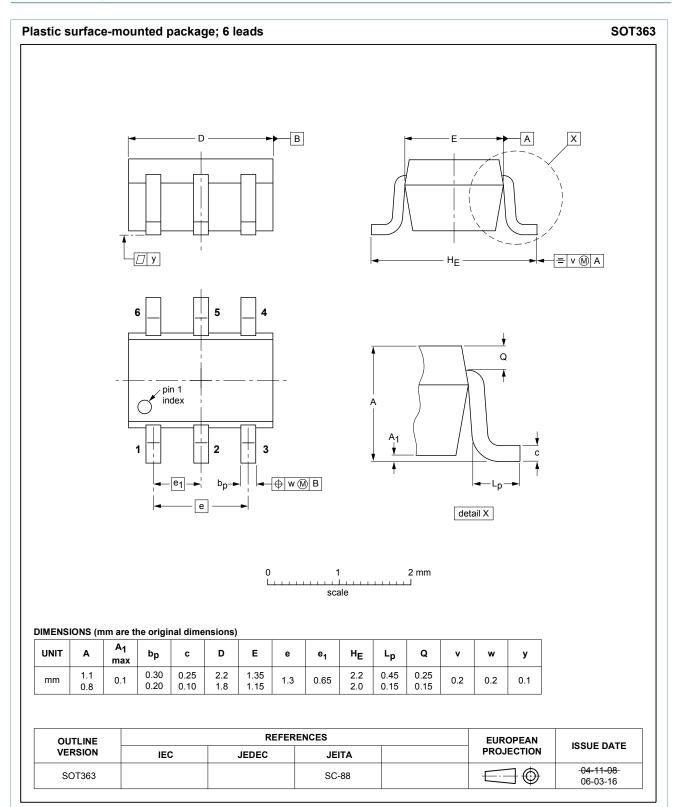


Figure 10. Package outline SOT363 (SC-88)

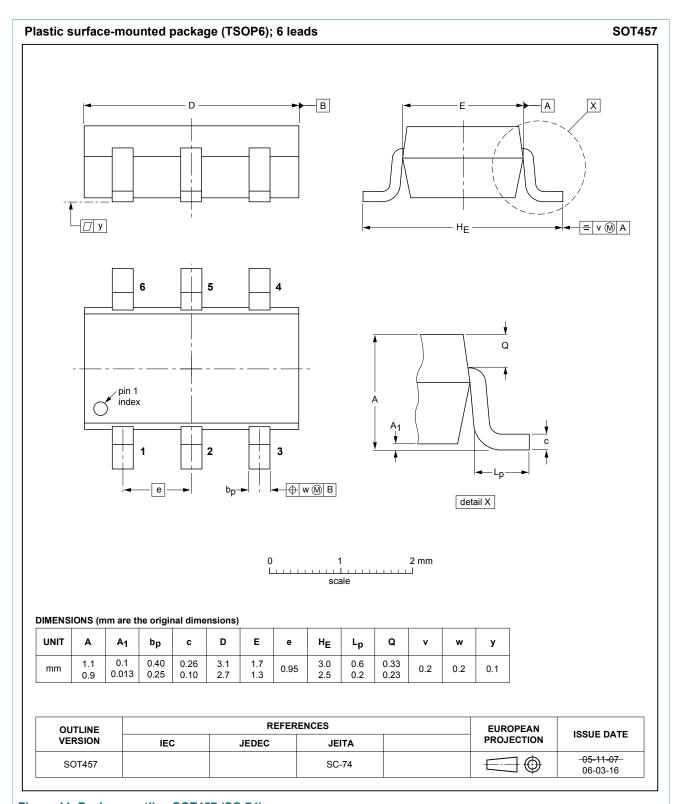
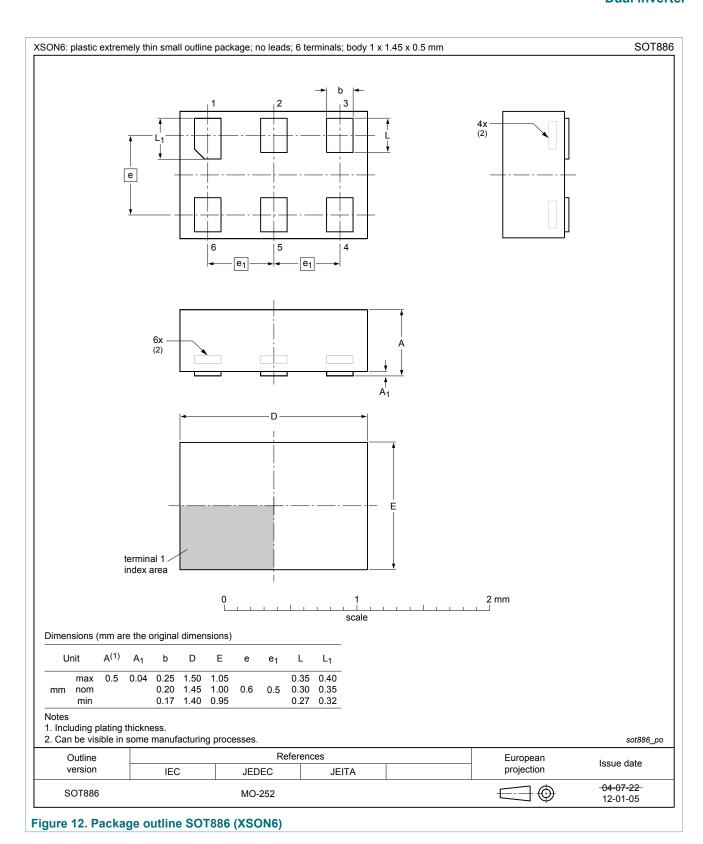


Figure 11. Package outline SOT457 (SC-74)



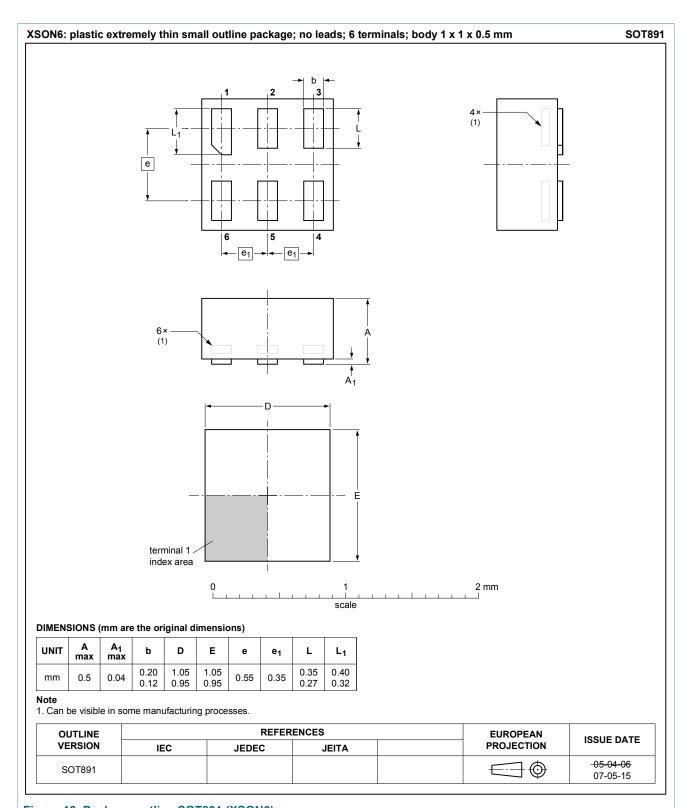
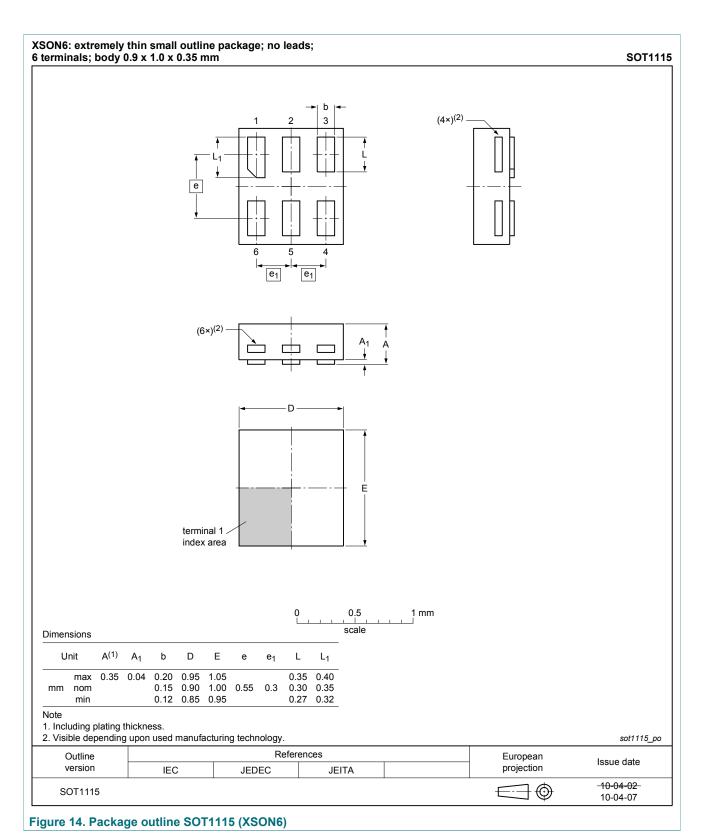
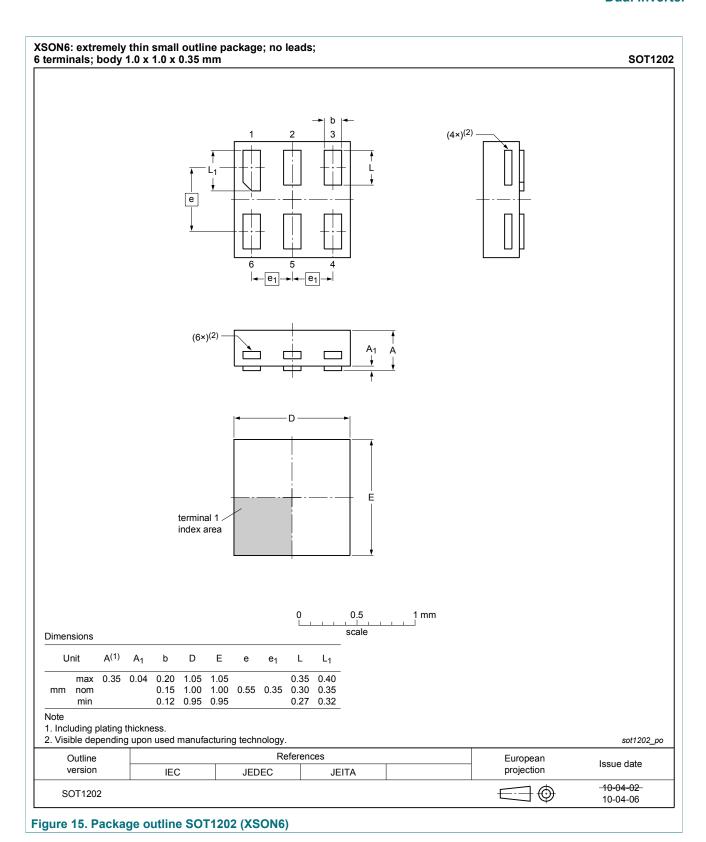
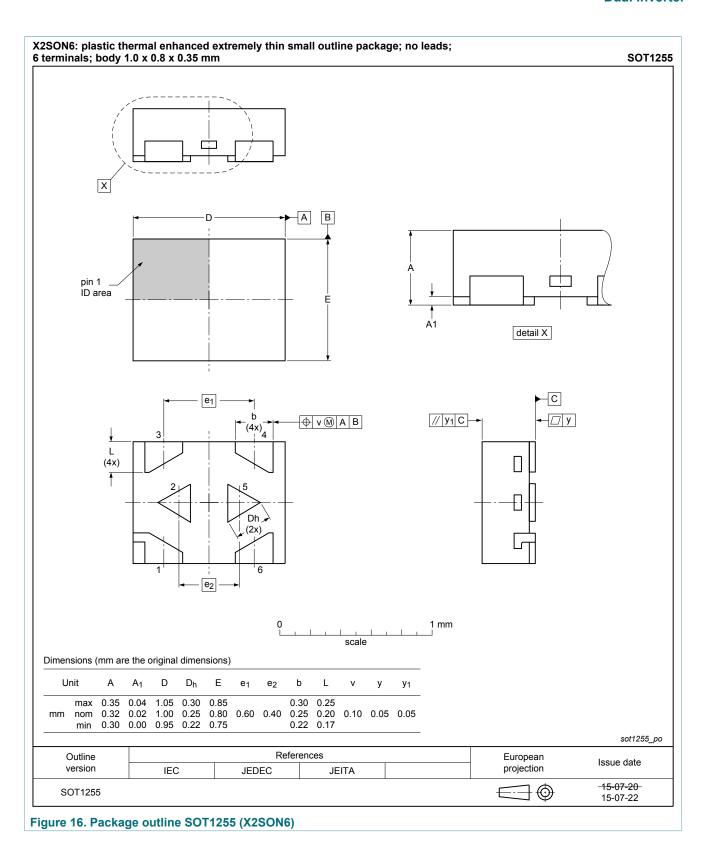


Figure 13. Package outline SOT891 (XSON6)







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	
74LVC2G04 v.10	20170522	Product data sheet	-	74LVC2G04 v.9	
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. Pin 6 description updated. <u>Section 6.2</u> 				
74LVC2G04 v.9	20161212	Product data sheet	-	74LVC2G04 v.8	
Modifications:	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.				
74LVC2G04 v.8	20150917	Product data sheet	-	74LVC2G04 v.7	
Modifications:	Added type number 74LVC2G04GX (SOT1255/X2SON6).				
74LVC2G04 v.7	20140910	Product data sheet	-	74LVC2G04 v.6	
Modifications:	Package outline drawing of SOT886 (Figure 12) modified.				
74LVC2G04 v.6	20111206	Product data sheet	-	74LVC2G04 v.5	
74LVC2G04 v.5	20100805	Product data sheet	-	74LVC2G04 v.4	
74LVC2G04 v.4	20070725	Product data sheet	-	74LVC2G04 v.3	
74LVC2G04 v.3	20070216	Product data sheet	-	74LVC2G04 v.2	
74LVC2G04 v.2	20040915	Product specification	-	74LVC2G04 v.1	
74LVC2G04 v.1	20030722	Product specification	-	-	

15 Legal information

15.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
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