# 74LVC1G04

### Single inverter

Rev. 15 — 8 June 2018

**Product data sheet** 

### 1 General description

The 74LVC1G04 provides one inverting buffer.

Input 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.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall time.

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)
  - JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM: ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2000 V
  - MM: JESD22-A115-A exceeds 200 V
- ±24 mA output drive (V<sub>CC</sub> = 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			
	Temperature range	Name	Description	Version
74LVC1G04GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G04GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G04GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm	SOT886
74LVC1G04GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm	SOT891
74LVC1G04GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm	SOT1115
74LVC1G04GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm	SOT1202
74LVC1G04GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm	SOT1226
74LVC1G04GX4	-40 °C to +125 °C	X2SON4	plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 x 0.6 x 0.32 mm	SOT1269-2

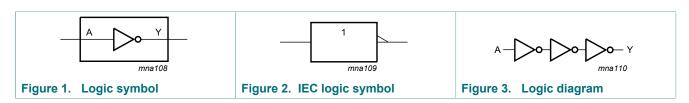
### 4 Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC1G04GW	VC
74LVC1G04GV	V04
74LVC1G04GM	VC
74LVC1G04GF	VC
74LVC1G04GN	VC
74LVC1G04GS	VC
74LVC1G04GX	VC
74LVC1G04GX4	VC

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

### 5 Functional diagram



74LVC1G04

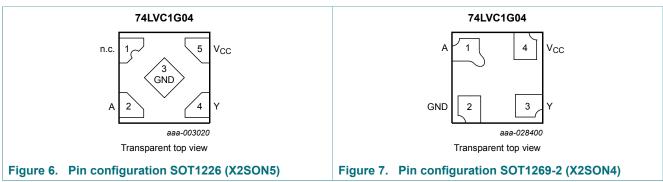
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### 6 Pinning information

#### 6.1 Pinning





#### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description		
	TSSOP5, SC-74A and X2SON5	XSON6	X2SON4	
n.c.	1	1, 5	-	not connected
A	2	2	1	data input
GND	3	3	2	ground (0 V)
Υ	4	4	3	data output
V <sub>CC</sub>	5	6	4	supply voltage

### **Functional description**

#### Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input	Output
A	Y
L	Н
Н	L

### **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 <sub>CC</sub>	supply voltage			-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V		-50	-	mA
VI	input voltage		[1]	-0.5	+6.5	٧
l <sub>OK</sub>	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
Vo	output voltage	Active mode	[1]	-0.5	V <sub>CC</sub> + 0.5	V
		Power-down mode; V <sub>CC</sub> = 0 V	[1]	-0.5	+6.5	٧
Io	output current	V <sub>O</sub> = 0 to V <sub>CC</sub>		-	±50	mA
I <sub>CC</sub>	supply current			-	100	mA
I <sub>GND</sub>	ground current			-100	-	mA
T <sub>stg</sub>	storage temperature			-65	+150	°C
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> = -40 °C to +125 °C				
		TSSOP5, SC-74A, XSON6 and X2SON5 package	[2]	-	250	mW
		X2SON4 package	[3]	-	150	mW

<sup>[1]</sup> The input and output voltage ratings may be exceeded if the input and output current ratings are observed. [2] For TSSOP5 and SC-74A packages: above 87.5 °C the value of Ptot derates linearly with 4.0 mW/K. For XSON6 and X2SON5 package: above 118 °C the value of Ptot derates linearly with 7.8 mW/K.

<sup>[3]</sup> For X2SON4 packages: above 57 °C the value of Ptot derates linearly with 1.7 mW/K.

## 9 Recommended operating conditions

#### Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V
VI	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage	Active mode	0	-	V <sub>CC</sub>	Vo
		Power-down mode; V <sub>CC</sub> = 0 V	0	-	5.5	Vo
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and fall rate	V <sub>CC</sub> = 1.65 V to 2.7 V	-	-	20	ns/V
		V <sub>CC</sub> = 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	Min	Typ <sup>[1]</sup>	Max	Unit
T <sub>amb</sub> = -4	0 °C to +85 °C			<u>'</u>		
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	٧
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3 × V <sub>CC</sub>	V
V <sub>OH</sub>	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 <sub>CC</sub> - 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
		$I_{\rm O}$ = -32 mA; $V_{\rm CC}$ = 4.5 V	3.8	-	-	V
V <sub>OL</sub>	LOW-level output voltage	$V_{I} = V_{IH}$ or $V_{IL}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 $V$ to 5.5 $V$	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	V
		$I_{O}$ = 8 mA; $V_{CC}$ = 2.3 V	-	-	0.3	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	V
		$I_{O}$ = 32 mA; $V_{CC}$ = 4.5 V	-	-	0.55	V
I <sub>I</sub>	input leakage current	V <sub>CC</sub> = 0 V to 5.5 V; V <sub>I</sub> = 5.5 V or GND	-	±0.1	±1	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_{CC} = 0 \text{ V}; V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	±0.1	±2	μΑ
I <sub>CC</sub>	supply current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	D; - 0.1		4	μΑ
ΔI <sub>CC</sub>	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V};$ $V_{I} = V_{CC} - 0.6 \text{ V}; I_{O} = 0 \text{ A}$	-	5	500	μΑ
Cı	input capacitance	$V_{CC}$ = 3.3 V; $V_{I}$ = GND to $V_{CC}$	-	5	-	pF

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
T <sub>amb</sub> = -4	10 °C to +125 °C					
V <sub>IH</sub>	HIGH-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	0.65 × V <sub>CC</sub>	-	-	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.7	-	-	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	2.0	-	-	V
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7 × V <sub>CC</sub>	-	-	V
V <sub>IL</sub>	LOW-level input voltage	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	0.35 × V <sub>CC</sub>	V
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	-	0.7	V
		V <sub>CC</sub> = 2.7 V to 3.6 V	-	-	0.8	V
V		V <sub>CC</sub> = 4.5 V to 5.5 V	-	-	0.3 × V <sub>CC</sub>	V
V <sub>OH</sub>	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 <sub>CC</sub> - 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
$V_{OL}$	LOW-level output voltage	$V_{I} = V_{IH}$ or $V_{IL}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 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 <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.80	V
		$I_{O}$ = 32 mA; $V_{CC}$ = 4.5 V	-	-	0.80	V
I <sub>I</sub>	input leakage current	$V_{CC} = 0 \text{ V to } 5.5 \text{ V}; V_{I} = 5.5 \text{ V or GND}$	-	-	±1	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_{CC} = 0 \text{ V}; V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	-	±2	μΑ
I <sub>CC</sub>	supply current	$V_I = 5.5 \text{ V or GND};$ $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$	-	-	4	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V};$ $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}$	-	-	500	μΑ

<sup>[1]</sup> All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25  $^{\circ}$ 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	
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Figure 8 [2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	3.0	7.5	1.0	9.5	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	2.0	5.0	0.5	6.5	ns
		V <sub>CC</sub> = 2.7 V	0.5	2.3	5.2	0.5	7.0	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	2.0	4.2	0.5	5.5	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	1.6	3.7	0.5	5.0	ns
C <sub>PD</sub>	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$ [3]	-	14	-	-	-	pF

<sup>[1]</sup> 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.

 $P_D = C_{PD} x V_{CC}^2 x f_i x N + \sum (C_L x V_{CC}^2 x f_o)$  where:

f<sub>i</sub> = input frequency in MHz;

fo = output frequency in MHz;

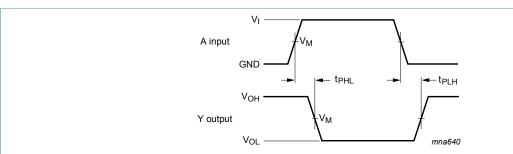
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = 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 Waveform and test circuit



Measurement points are given in Table 9.

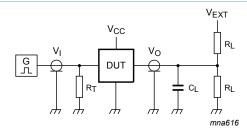
V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage levels that occur with the output load.

Figure 8. The input A to output Y propagation delays

 $t_{pl}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu$ W).

Table 9. Measurement points

Supply voltage	Input	Output				
V <sub>cc</sub>	V <sub>M</sub>	V <sub>M</sub>				
1.65 V to 1.95 V	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				
2.3 V to 2.7 V	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				
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	0.5 x V <sub>CC</sub>	0.5 x V <sub>CC</sub>				



Test data is given in Table 10.

Definitions for test circuit:

R<sub>L</sub> = 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 <sub>EXT</sub>	
V <sub>CC</sub>	VI	$t_r = t_f$	CL	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open

### 12 Package outline

### TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm SOT353-1 = v (M) A detail X DIMENSIONS (mm are the original dimensions) D(1) E<sup>(1)</sup> Z<sup>(1)</sup> UNIT С ΗE Lp θ max. 0.30 0.25 1.35 2.25 0.46 0.60 0.1 1.0 2.25 0.15 0.65 0.425 mm 1.1 0.15 0.08 1.85 1.15

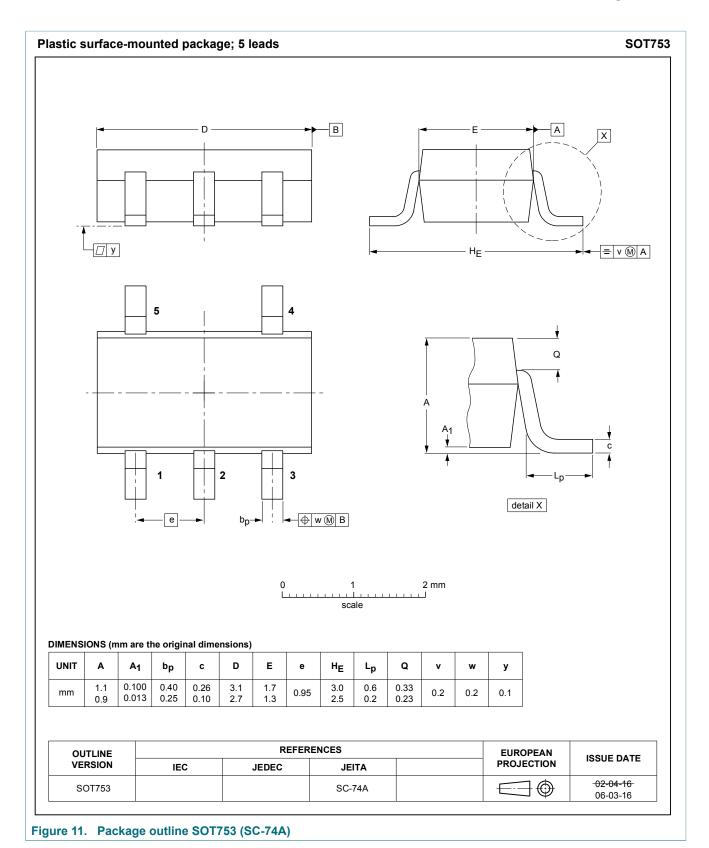
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

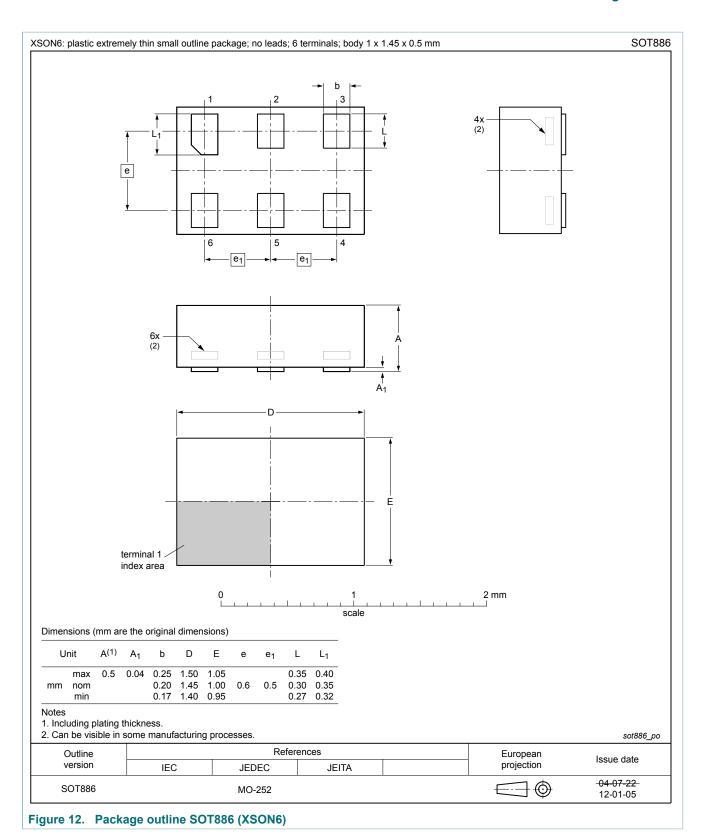
OUTLINE	REFERENCES			EUROPEAN	ISSUE DATE		
VERSION	IEC	JEDEC	JEITA		PROJECTION	ISSUE DATE	
SOT353-1		MO-203	SC-88A			<del>-00-09-01-</del> 03-02-19	

Figure 10. Package outline SOT353-1 (TSSOP5)

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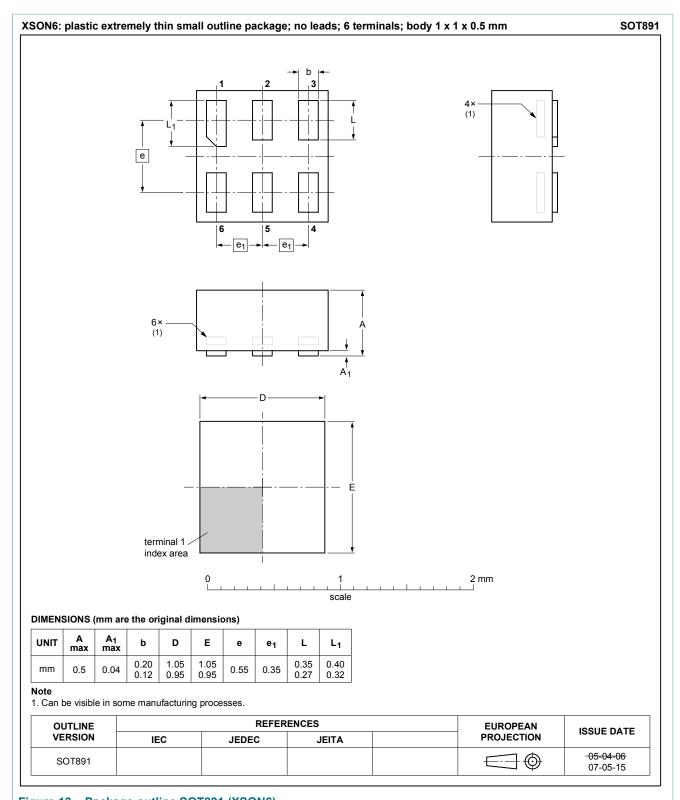


Figure 13. Package outline SOT891 (XSON6)

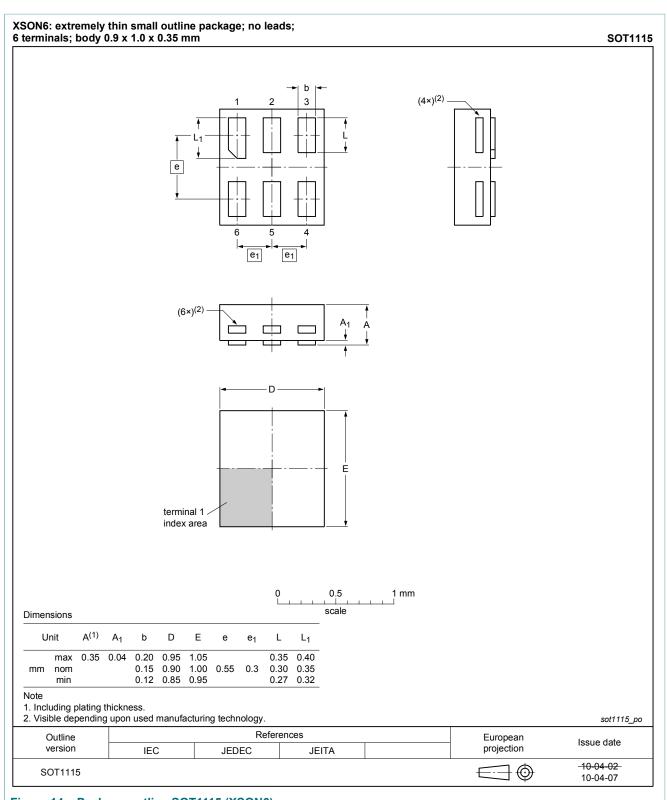
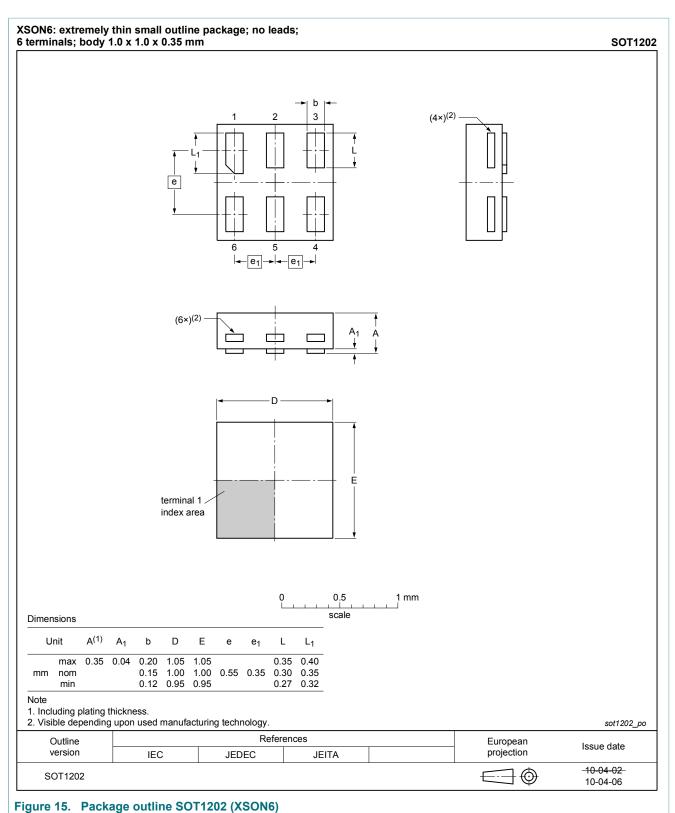
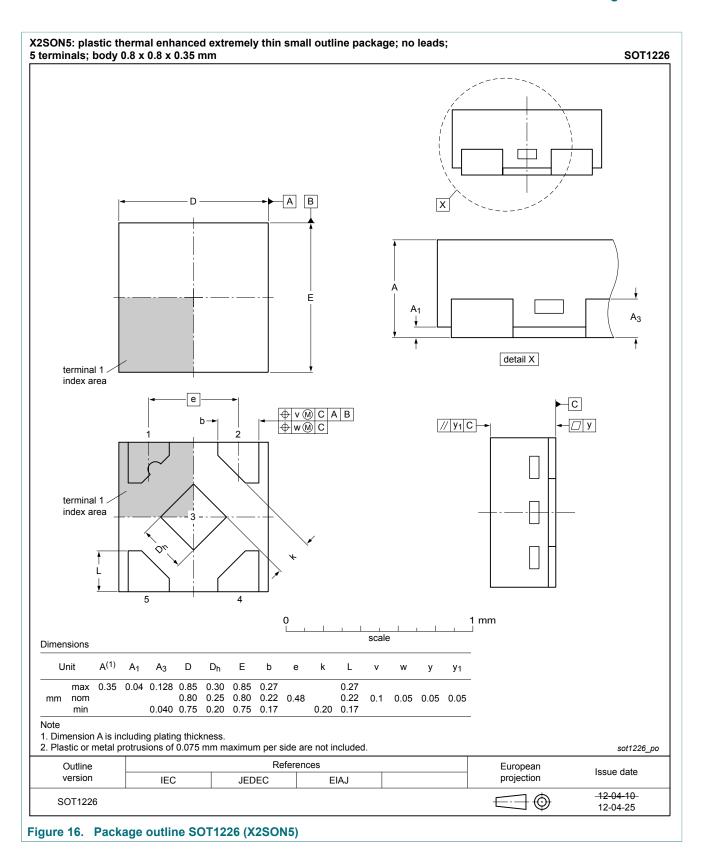
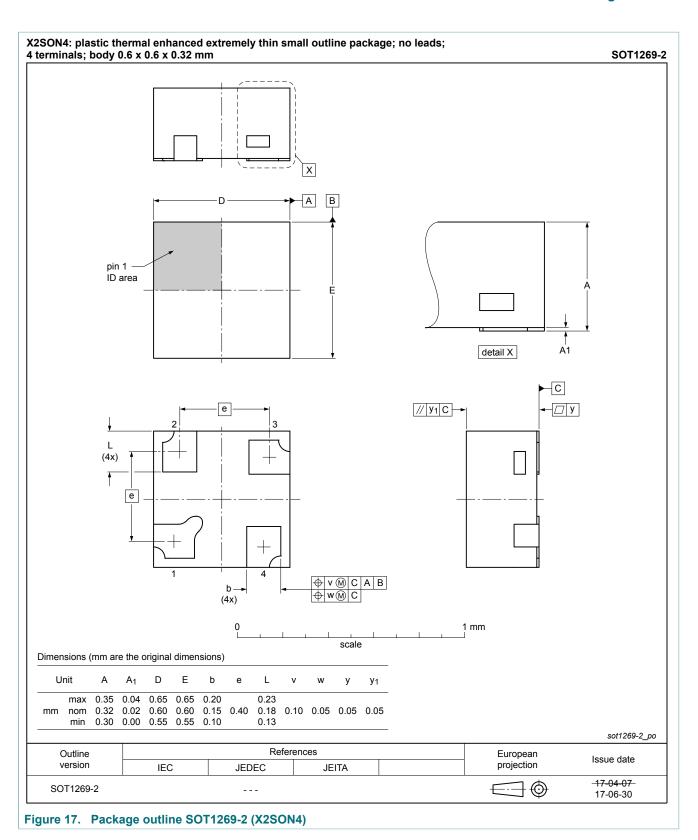


Figure 14. Package outline SOT1115 (XSON6)



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74LVC1G04

### 13 Abbreviations

#### **Table 11. Abbreviations**

Acronym	Description
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		
74LVC1G04 v.15	20180608	Product data sheet	-	74LVC1G04 v.14		
Modifications:	Added type number 74LVC1G04GX4 (SOT1269-2)					
74LVC1G04 v.14	20171101	Product data sheet	-	74LVC1G04 v.13		
Modifications:	Nexperia.	<ul> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>				
74LVC1G04 v.13	20161128	Product data sheet	-	74LVC1G04 v.12		
Modifications:	• <u>Table 7</u> : The maximum limits for leakage current and supply current have changed.					
74LVC1G04 v.12	20120806	Product data sheet	-	74LVC1G04 v.11		
Modifications:	Package outline	Package outline drawing of SOT1226 (Figure 16) modified.				
74LVC1G04 v.11	20120412	Product data sheet	-	74LVC1G04 v.10		
Modifications:	<ul> <li>Added type number 74LVC1G04GX (SOT1226)</li> <li>Package outline drawing of SOT886 (Figure 12) modified.</li> </ul>					
74LVC1G04 v.10	20111207	Product data sheet	-	74LVC1G04 v.9		
Modifications:	Legal pages upo	Legal pages updated.				
74LVC1G04 v.9	20101026	Product data sheet	-	74LVC1G04 v.8		
74LVC1G04 v.8	20090427	Product data sheet	-	74LVC1G04 v.7		
74LVC1G04 v.7	20070827	Product data sheet	-	74LVC1G04 v.6		
74LVC1G04 v.6	20070202	Product data sheet	-	74LVC1G04 v.5		
74LVC1G04 v.5	20040907	Product specification	-	74LVC1G04 v.4		
74LVC1G04 v.4	20021002	Product specification	-	74LVC1G04 v.3		
74LVC1G04 v.3	20020513	Product specification	-	74LVC1G04 v.2		
74LVC1G04 v.2	20010119	Product specification	-	74LVC1G04 v.1		
74LVC1G04 v.1	20011121	Product specification	-	-		

### 15 Legal information

#### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.
- The term 'short data sheet' is explained in section "Definitions". [2] [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.nexperia.com.

#### 15.2 Definitions

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Single inverter

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