74LVC1G04

Single inverter

Rev. 17 — 4 August 2023

Product data sheet

1. General description

The 74LVC1G04 is a single inverter. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments. Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times. This device is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially 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
- Overvoltage tolerant inputs to 5.5 V
- · High noise immunity
- · CMOS low power dissipation
- I_{OFF} circuitry provides partial Power-down mode operation
- ±24 mA output drive (V_{CC} = 3.0 V)
- Latch-up performance exceeds 250 mA
- · Direct interface with TTL levels
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 V)
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.



Single inverter

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 × 1.45 × 0.5 mm	SOT886
74LVC1G04GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	<u>SOT1115</u>
74LVC1G04GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 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 × 0.8 × 0.32 mm	SOT1226-3
74LVC1G04GX4	-40 °C to +125 °C	X2SON4	plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 × 0.6 × 0.32 mm	SOT1269-2

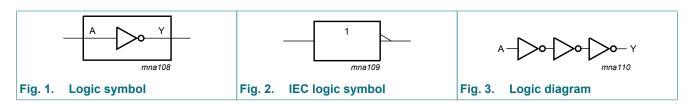
4. Marking

Table 2. Marking

Table 2. Marking				
Type number	Marking code[1]			
74LVC1G04GW	VC			
74LVC1G04GV	V04			
74LVC1G04GM	VC			
74LVC1G04GN	VC			
74LVC1G04GS	VC			
74LVC1G04GX	VC			
74LVC1G04GX4	VC			

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

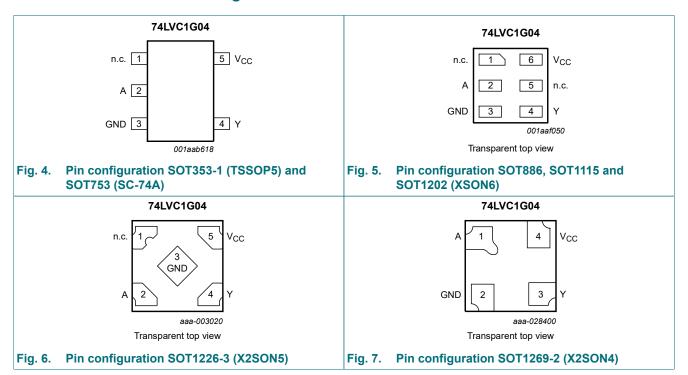
5. Functional diagram



Single inverter

6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin	Pin				
	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 _{CC}	5	6	4	supply voltage		

7. Functional description

Table 4. Function table

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

Input	Output
A	Υ
L	Н
Н	L

Single inverter

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	Active mode	[1]	-0.5	V _{CC} + 0.5	V
		Power-down mode; V _{CC} = 0 V	[1]	-0.5	+6.5	V
Io	output current	$V_O = 0$ 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				
		SOT353-1 (TSSOP5) SOT753 (SC-74A) SOT886 (XSON6) SOT1115 (XSON6) SOT1202 (XSON6) SOT1226-3 (X2SON5) SOT1269-2 (X2SON4)	[2] [3] [4] [5] [6] [7]	- - - -	250 250 250 250 250 250 250	mW mW mW mW mW

- The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- For SOT353-1 (TSSOP5) package: Ptot derates linearly with 3.3 mW/K above 74 °C.
- For SOT753 (SC-74A) package: Ptot derates linearly with 3.8 mW/K above 85 °C. [3]
- For SOT886 (XSON6) package: Ptot derates linearly with 3.3 mW/K above 74 °C.
- [5] For SOT1115 (XSON6) package: Ptot derates linearly with 3.2 mW/K above 71 °C.
- For SOT1202 (XSON6) package: Ptot derates linearly with 3.3 mW/K above 74 °C.
- For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C. For SOT1269-2 (X2SON4) package: P_{tot} derates linearly with 1.7 mW/K above 57 °C.

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
V _O	output voltage	Active mode	0	-	V _{CC}	Vo
		Power-down mode; V _{CC} = 0 V	0	-	5.5	Vo
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

Single inverter

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} = -4	10 °C to +85 °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 _{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
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	-	-	0.45	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
l _l	input leakage current	$V_{CC} = 0 \text{ V to } 5.5 \text{ V}; V_{I} = 5.5 \text{ V or GND}$	-	±0.1	±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	μΑ
Icc	supply current	$V_I = 5.5 \text{ V or GND};$ - 0.1 $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}; I_O = 0 \text{ A}$		4	μA	
ΔI _{CC}	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	μA
Cı	input capacitance	$V_{CC} = 3.3 \text{ V}; V_I = \text{GND to } V_{CC}$	-	5	-	pF

Single inverter

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T _{amb} = -4	0 °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 _{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
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 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
l _l	input leakage current	V _{CC} = 0 V to 5.5 V; V _I = 5.5 V or GND	-	-	±1	μΑ
I _{OFF}	power-off leakage current	V _{CC} = 0 V; V _I or V _O = 5.5 V	-	-	±2	μΑ
I _{CC}	supply current	V _I = 5.5 V or GND; 4 V _{CC} = 1.65 V to 5.5 V; I _O = 0 A		4	μΑ	
ΔI _{CC}	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

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

6 / 19

Single inverter

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 9.

Symbol	Parameter	Conditions	-40	°C to +85	5 °C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	A to Y; see <u>Fig. 8</u> [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.0	7.5	1.0	9.5	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.0	5.0	0.5	6.5	ns
		V _{CC} = 2.7 V	0.5	2.3	5.2	0.5	7.0	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.0	4.2	0.5	5.5	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.6	3.7	0.5	5.0	ns
C_{PD}	power dissipation capacitance	$V_1 = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V} [3]$	-	14	-	-	-	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 μW).

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

 f_i = input frequency in MHz;

 f_o = output frequency in MHz;

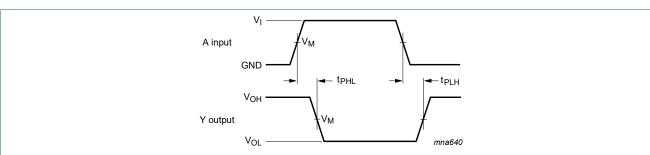
C_L = output load capacitance in pF;

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. Waveform and test circuit



Measurement points are given in Table 9.

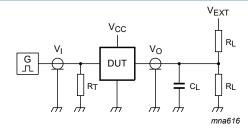
V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

The input A to output Y propagation delays Fig. 8.

Table 9. Measurement points

Supply voltage	Input	Output
V _{CC}	V _M	V _M
1.65 V to 1.95 V	0.5 × V _{CC}	0.5 × V _{CC}
2.3 V to 2.7 V	0.5 × V _{CC}	0.5 × V _{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	0.5 × V _{CC}	0.5 × V _{CC}

Single inverter



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_o 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 _{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

Single inverter

12. Package outline

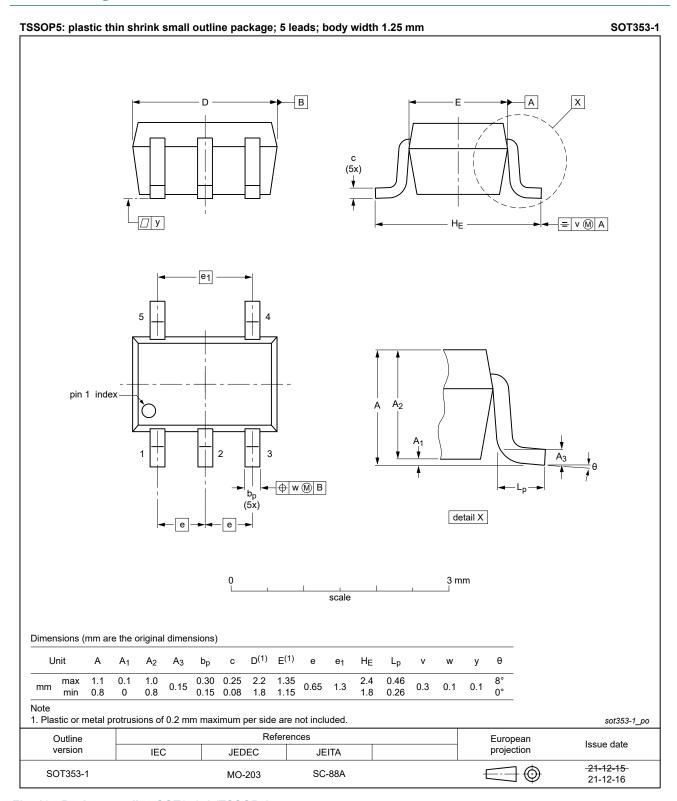


Fig. 10. Package outline SOT353-1 (TSSOP5)

Single inverter

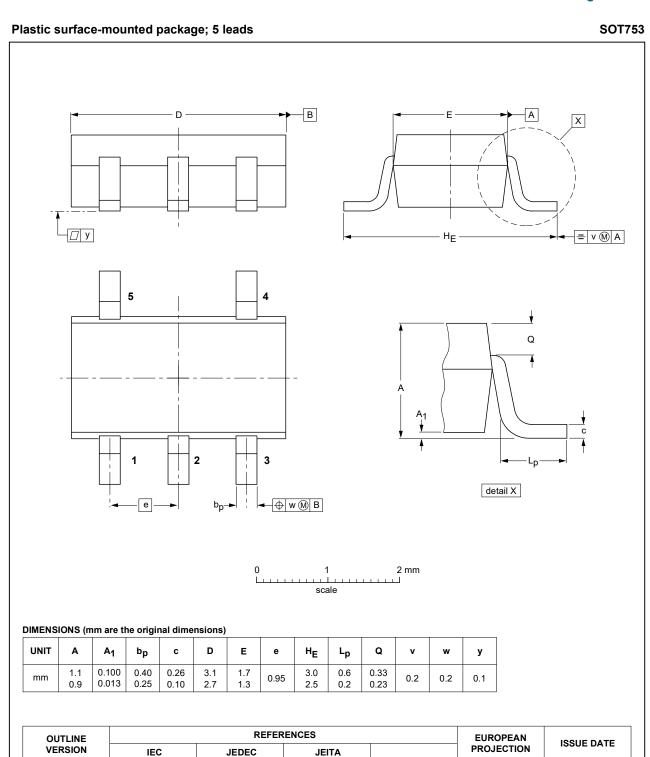


Fig. 11. Package outline SOT753 (SC-74A)

SOT753

SC-74A

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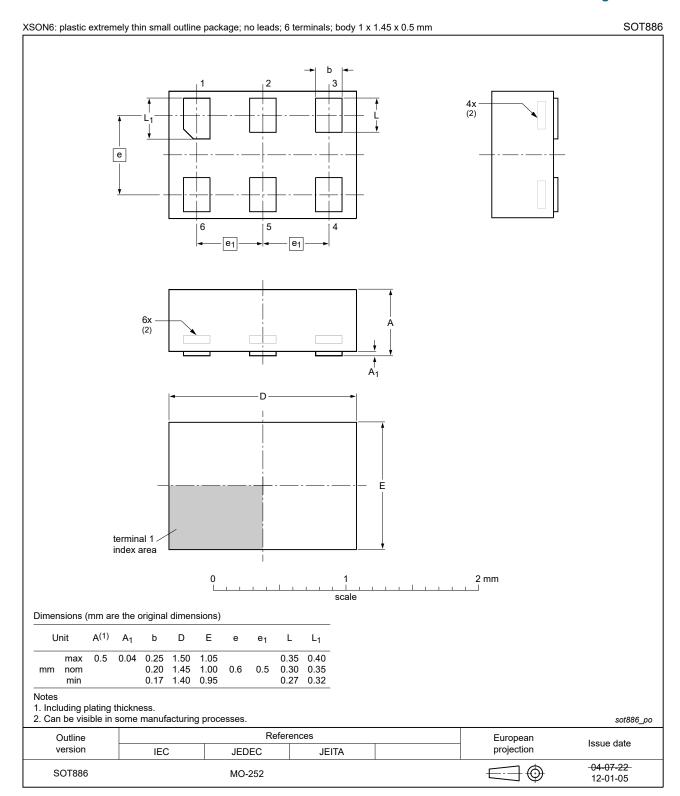


Fig. 12. Package outline SOT886 (XSON6)

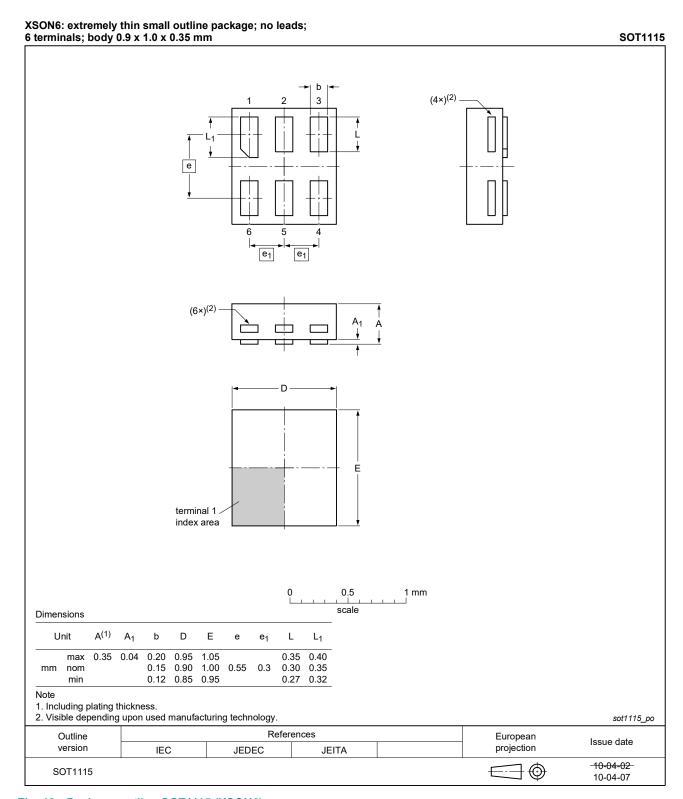


Fig. 13. Package outline SOT1115 (XSON6)

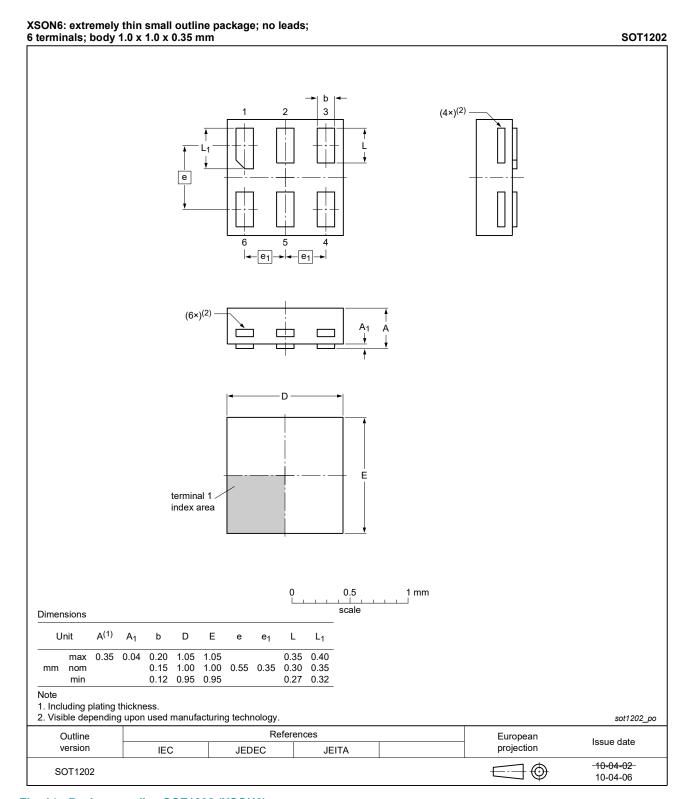


Fig. 14. Package outline SOT1202 (XSON6)

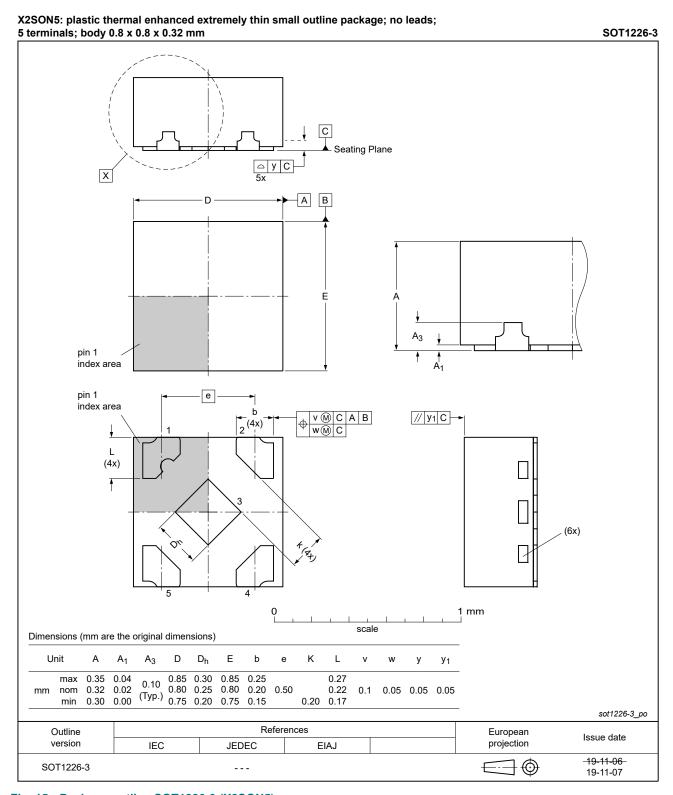


Fig. 15. Package outline SOT1226-3 (X2SON5)

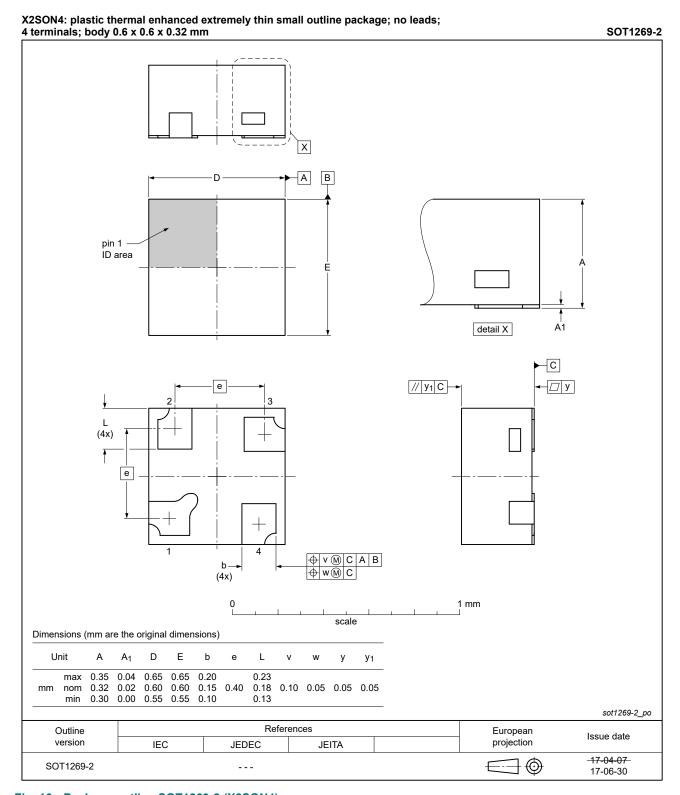


Fig. 16. Package outline SOT1269-2 (X2SON4)

Single inverter

13. Abbreviations

Table 11. Abbreviations

Acronym	Description	
CMOS	Complementary Metal Oxide Semiconductor	
DUT	evice Under Test	
ESD	ElectroStatic Discharge	
НВМ	Human Body Model	
TTL	Transistor-Transistor Logic	

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVC1G04 v.17	20230804	Product data sheet	-	74LVC1G04 v.16	
Modifications:	<u>Section 2</u> : ESD specification updated according to the latest JEDEC standard.				
74LVC1G04 v.16	20220209	Product data sheet	-	74LVC1G04 v.15	
Modifications:	 SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. Fig. 10: Package outline drawing for SOT353-1 (TSSOP5) package has changed. Type number 74LVC1G04GF (SOT891/XSON6) removed. Table 5: Derating values for P_{tot} total power dissipation updated. Section 1 and Section 2 updated. 				
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:	 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. 				
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 drawing of SOT1226 modified.				
74LVC1G04 v.11	20120412	Product data sheet	-	74LVC1G04 v.10	
Modifications:	 Added type number 74LVC1G04GX (SOT1226) Package outline drawing of SOT886 (Fig. 12) modified. 				
74LVC1G04 v.10	20111207	Product data sheet	-	74LVC1G04 v.9	
Modifications:	 Legal pages 	updated.			

Document ID	Release date	Data sheet status	Change notice	Supersedes
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	-	-

Single inverter

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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Single inverter

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. Waveform and test circuit	7
12. Package outline	9
13. Abbreviations	16
14. Revision history	16
15. Legal information	18

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