

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.

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3. Ordering information

Table 1. Ordering information

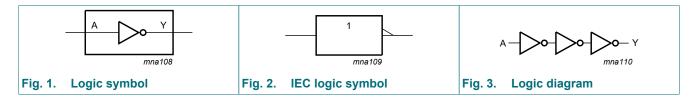
Type number	Package							
	Temperature range	Name	Description	Version				
74LVC1G04GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	<u>SOT353-1</u>				
74LVC1G04GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	<u>SOT753</u>				
74LVC1G04GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	<u>SOT886</u>				
74LVC1G04GN	-40 °C to +125 °C	°C XSON6 extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm						
74LVC1G04GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	<u>SOT1202</u>				
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	<u>SOT1226-3</u>				
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	<u>SOT1269-2</u>				
74LVC1G04GZ	-40 °C to +125 °C	XSON5	plastic thermal enhanced extremely thin small outline package with side-wettable flanks (SWF); no leads; 5 terminals; body 1.1 × 0.85 × 0.5 mm	<u>SOT8065-1</u>				

4. Marking

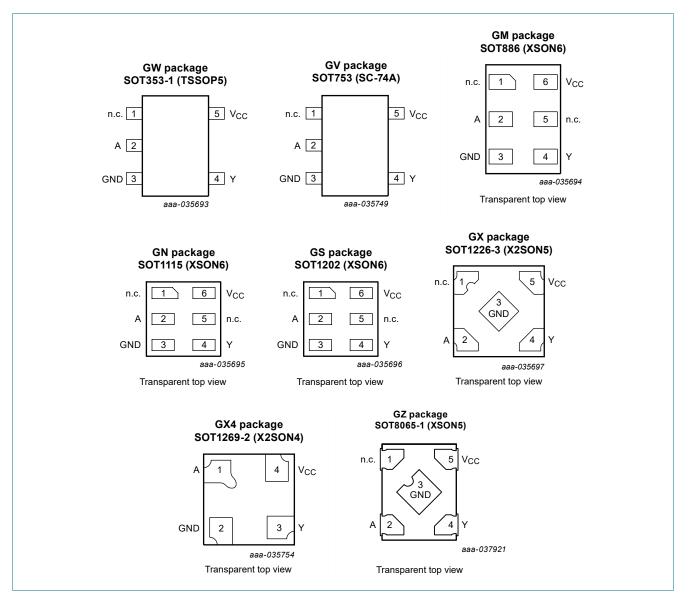
Fable 2. Marking				
Marking code[1]				
VC				
V04				
VC				

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

5. Functional diagram



6. Pinning information



6.1. Pinning

6.2. Pin description

Table 3. Pin description							
Symbol	ymbol Pin						
	TSSOP5, SC-74A, XSON5 and X2SON5	XSON6	X2SON4				
n.c.	1	1, 5	-	not connected			
A	2	2	1	data input			
GND	3	3	2	ground (0 V)			
Y	4	4	3	data output			
V _{CC}	5	6	4	supply voltage			

74LVC1G04

7. Functional description

Table 4. Function table

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

Input	Output
A	Y
L	Н
Н	L

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
Ι _{ΟΚ}	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 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
lo	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) SOT8065-1 (XSON5)	[2]	-	250	mW
		SOT1269-2 (X2SON4)	[3]	-	150	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
 For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.
 For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
 For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.
 For SOT1202 (XSON6) package: P_{tot} 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 SOT8065-1 (XSON5) package: P_{tot} derates linearly with 3.2 mW/K above 72 °C.

[3] For SOT1269-2 (X2SON4) package: Ptot derates linearly with 1.7 mW/K above 57 °C.

9. Recommended operating conditions

Table 6. Recommende	ed 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}	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

10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions	Min	Typ <mark>[1]</mark>	Max	Unit
T _{amb} = -4	0 °C to +85 °C					
VIH	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	-	-	$0.3 \times V_{CC}$	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 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
I	input leakage current	V_{CC} = 0 V to 5.5 V; V _I = 5.5 V or GND	-	±0.1	±1	μA
I _{OFF}	power-off leakage current	$V_{CC} = 0 V; V_1 \text{ or } V_0 = 5.5 V$	-	±0.1	±2	μA
I _{CC}	supply current	$V_{I} = 5.5 V \text{ or GND};$ $V_{CC} = 1.65 V \text{ to } 5.5 V; I_{O} = 0 A$	-	0.1	4	μA

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Symbol			Min	Тур <mark>[1]</mark>	Мах	Unit
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	μA
CI	input capacitance	V_{CC} = 3.3 V; V_{I} = GND to V_{CC}	-	5	-	pF
T _{amb} = -4	0 °C to +125 °C					
VIH	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
VIL	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	-	-	$0.3 \times V_{CC}$	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 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
I _I	input leakage current	V_{CC} = 0 V to 5.5 V; V _I = 5.5 V or GND	-	-	±1	μA
I _{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}; \text{ V}_{I} \text{ or } \text{ V}_{O} = 5.5 \text{ V}$	-	-	±2	μA
I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	-	4	μA
ΔI _{CC}	additional supply current	per pin; $V_{CC} = 2.3 \text{ V}$ to 5.5 V; $V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$	-	-	500	μA

[1] All 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 Fig. 5.

Symbol	mbol Parameter Conditions -40		°C to +8	5 °C	-40 °C to +125 °C		Unit	
			Min	Typ[1]	Max	Min	Мах	
t _{pd}	propagation delay	A to Y; see <u>Fig. 4</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_{I} = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V} $ [3]	-	14	-	-	-	pF

[1] 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.

[2]

 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). [3]

 $P_{D} = C_{PD} \times V_{CC}^{2} \times f_{i} \times N + \sum (C_{L} \times V_{CC}^{2} \times f_{o}) \text{ where:}$

 f_i = input frequency in MHz;

 $f_o = output$ frequency in MHz;

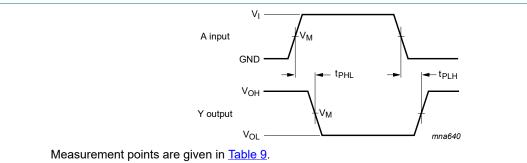
 C_{L} = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1. Waveform and test circuit



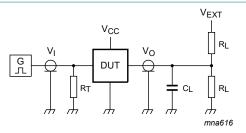
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 4. The input A to output Y propagation delays

Table 9. Measurement points

Supply voltage	Input	Output
V _{cc}	V _M	V _M
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

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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_o of the pulse generator;

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

Fig. 5. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load	V _{EXT}	
V _{cc}	VI	t _r = t _f	CL	RL	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

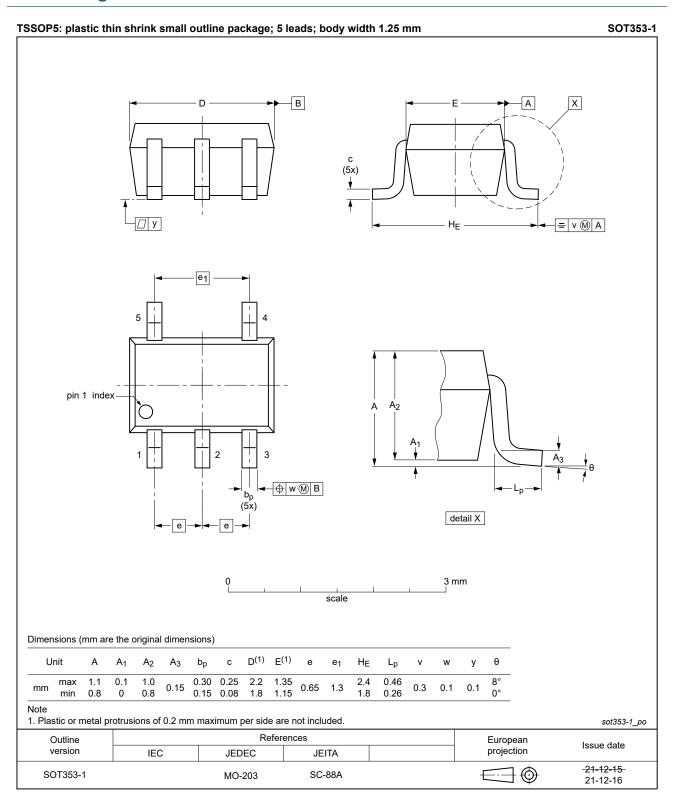


Fig. 6. Package outline SOT353-1 (TSSOP5)

74LVC1G04

Single inverter



SOT753

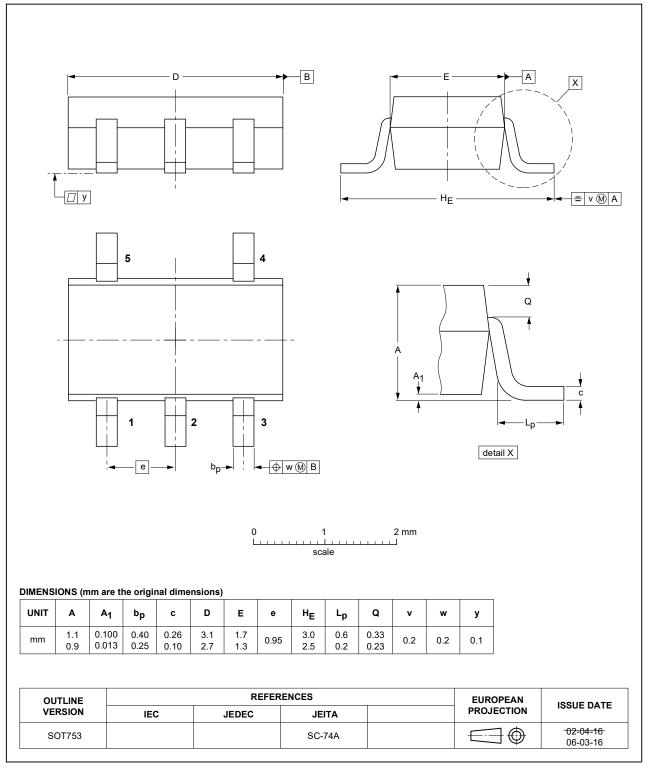


Fig. 7. Package outline SOT753 (SC-74A)

Product data sheet

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Single inverter

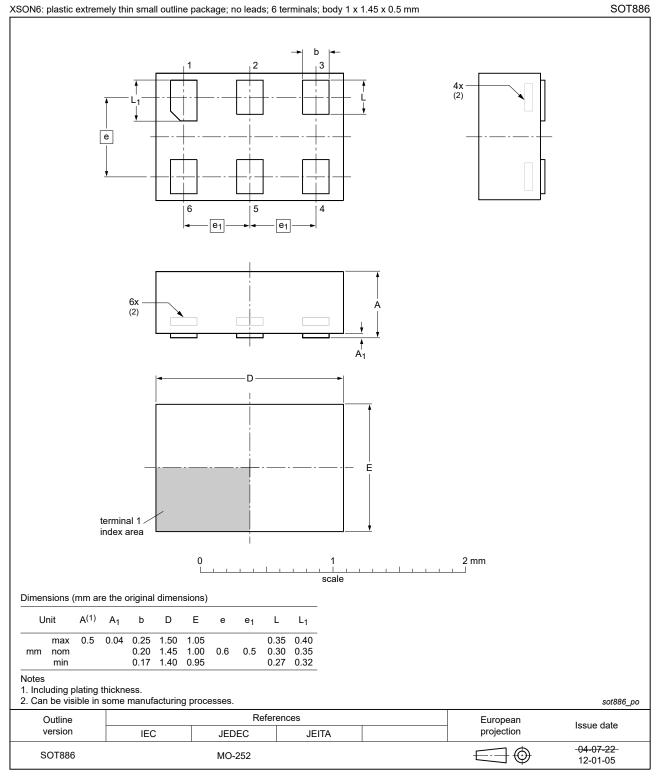
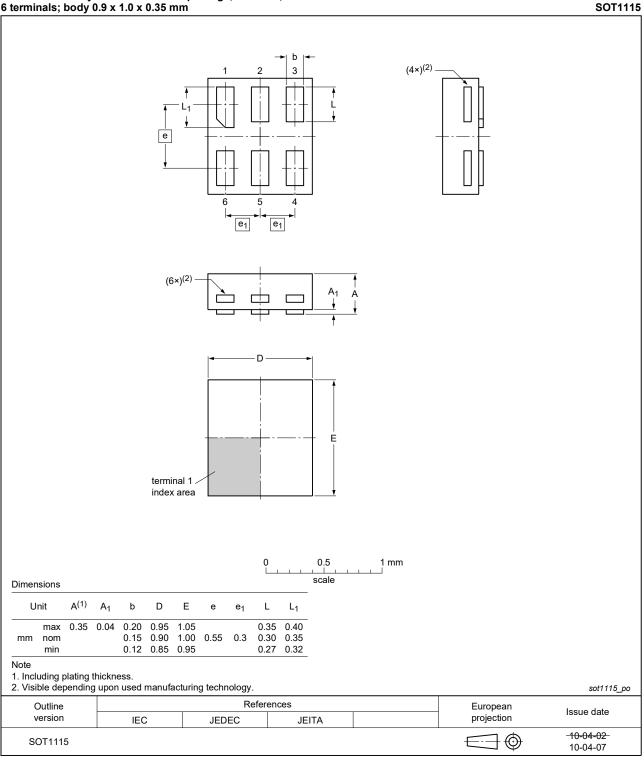


Fig. 8. Package outline SOT886 (XSON6)

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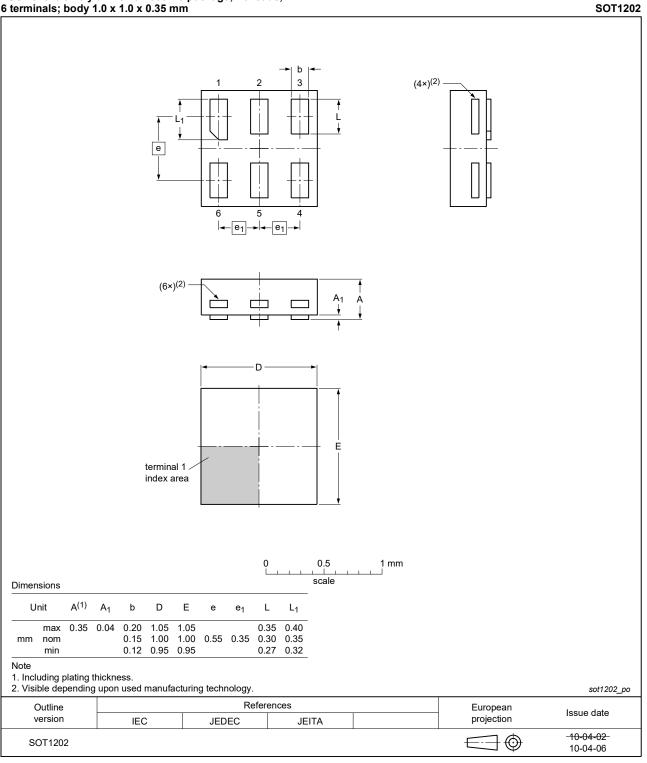
XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm





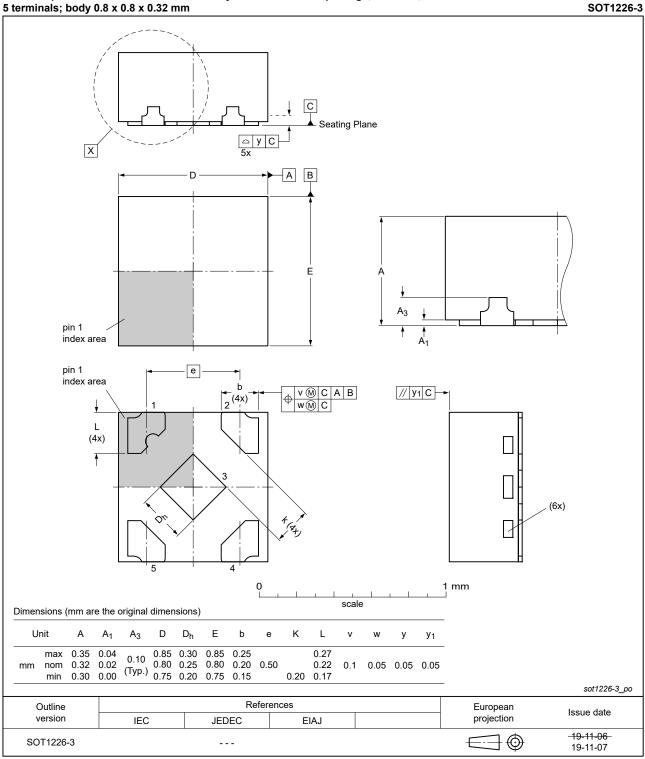
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XSON6: extremely thin small outline package; no leads;	
6 terminals; body 1.0 x 1.0 x 0.35 mm	





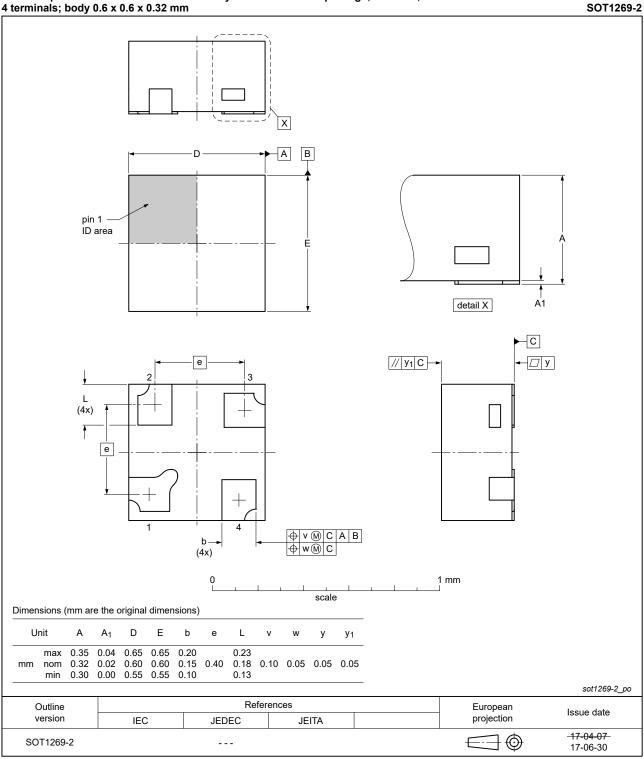
Single inverter



X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.32 mm

Fig. 11. Package outline SOT1226-3 (X2SON5)

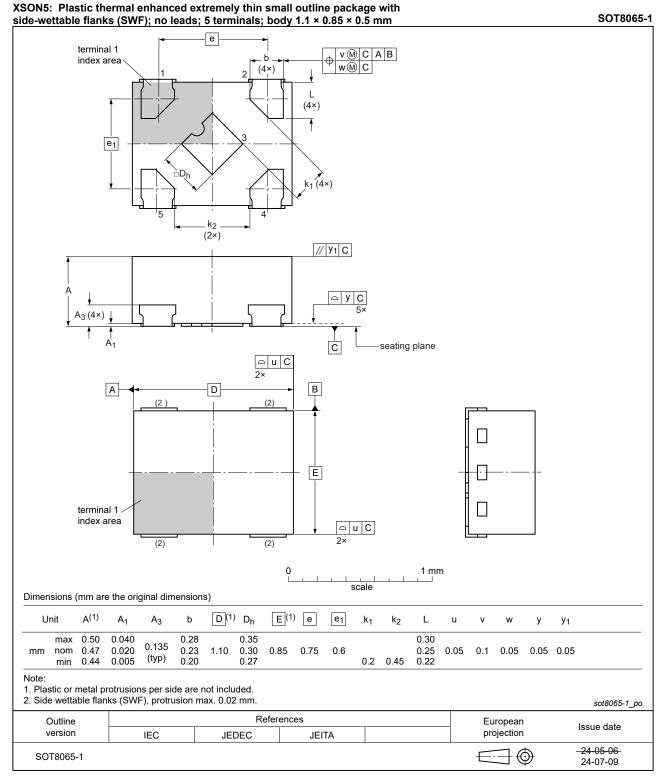
Single inverter



X2SON4: plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 x 0.6 x 0.32 mm

Fig. 12. Package outline SOT1269-2 (X2SON4)

Single inverter





13. Abbreviations

Table 11. Abbreviations				
Acronym	Description			
ANSI	American National Standards Institute			
CMOS	Complementary Metal Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
ESDA	ElectroStatic Discharge Association			
HBM	Human Body Model			
JEDEC	Joint Electron Device Engineering Council			
TTL	Transistor-Transistor Logic			

14. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74LVC1G04 v.18	20240711	Product data sheet	-	74LVC1G04 v.17		
Modifications:	Type numb	Type number 74LVC1G04GZ (SOT8065-1/XSON5) added.				
74LVC1G04 v.17	20230804	Product data sheet	-	74LVC1G04 v.16		
Modifications:	Section 2: I	ESD specification update	ed according to the la	atest JEDEC standard.		
74LVC1G04 v.16	20220209	Product data sheet	-	74LVC1G04 v.15		
Modifications:	 Fig. 6: Pack Type numb Table 5: De 	 Fig. 6: 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. 				
74LVC1G04 v.15	20180608	Product data sheet	-	74LVC1G04 v.14		
Modifications:	Added type	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. 8) modified. 				
74LVC1G04 v.10	20111207	Product data sheet	-	74LVC1G04 v.9		
Modifications:	Legal pages updated.					
74LVC1G04 v.9	20101026	Product data sheet	-	74LVC1G04 v.8		
74LVC1G04 v.8	20090427	Product data sheet	-	74LVC1G04 v.7		

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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".

[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 <u>https://www.nexperia.com</u>.

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