Inverter with open-drain output Rev. 14 — 10 February 2022

1. General description

The 74LVC1G06 is a single inverter with open-drain output. 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
- 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)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 V)
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power dissipation
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Overvoltage tolerant inputs to 5.5 V
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - MM JESD22-A115-A exceeds 200 V
- Specified from -40 °C to +125 °C



3. Ordering information

Table	1.	Ordering	information

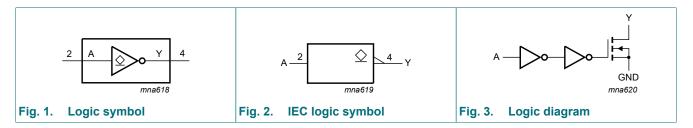
Type number	Package			
	Temperature range Name		Description	Version
74LVC1G06GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G06GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G06GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC1G06GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC1G06GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74LVC1G06GX	-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

4. Marking

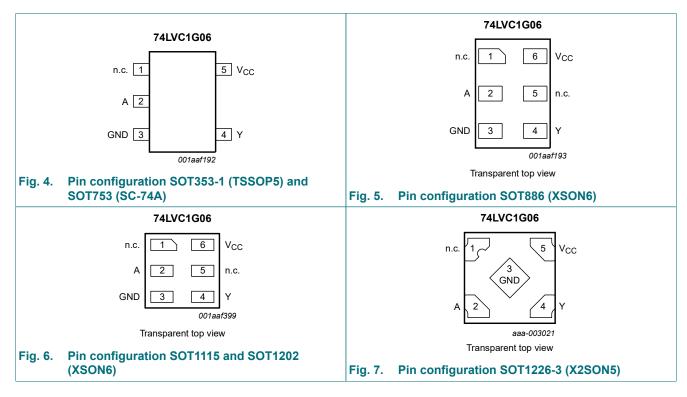
Table 2. Marking codes				
Type number	Marking [1]			
74LVC1G06GW	VR			
74LVC1G06GV	V06			
74LVC1G06GM	VR			
74LVC1G06GN	VR			
74LVC1G06GS	VR			
74LVC1G06GX	VR			

[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

Symbol	Pin	Description	
	TSSOP5 and X2SON5	XSON6	
n.c.	1	1	not connected
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V _{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

Input	Output
Α	Y
L	Z
Н	L

74LVC1G06

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 ₁ < 0 V		-50	-	mA
VI	input voltage		[1]	-0.5	+6.5	V
I _{OK}	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 0 V		-	±50	mA
Vo	output voltage	Active mode and Power-down mode	[1]	-0.5	+6.5	V
I _{O(sink/source)}	output sink or source current	$V_{O} = 0 V \text{ to } V_{CC}$		-	±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.

[2] For SOT353-1 (TSSOP5) package: Ptot 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.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

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	-	5.5	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	°C to +8	5 °C	-40 °C to	+125 °C	Unit
			Min	Тур [1]	Max	Min	Мах	
VIH	HIGH-level input	V _{CC} = 1.65 V to 1.95 V	0.65 × V _{CC}	-	-	0.65 × V _{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	$0.7 \times V_{CC}$	-	-	$0.7 \times V_{CC}$	-	V
V _{IL}	LOW-level input	V _{CC} = 1.65 V to 1.95 V	-	-	0.35 × V _{CC}	-	0.35 × V _{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	-	-	$0.3 \times V_{CC}$	-	$0.3 \times V_{CC}$	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	-	-	0.10	-	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
		I _O = 24 mA; V _{CC} = 3.0 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	μA
I _{OZ}	OFF-state output current	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{O} = V_{CC} \text{ or } GND;$ $V_{CC} = 5.5 \text{ V}$	-	±0.1	±2	-	±2	μA
I _{OFF}	power-off leakage V_{I} or V_{O} = 5.5 V; V_{CC} = 0 V current		-	±0.1	±2	-	±2	μA
I _{CC}	supply current	/ current $V_1 = 5.5 V \text{ or GND}; I_0 = 0 A; V_{CC} = 1.65 V \text{ to } 5.5 V$		0.1	4	-	4	μA
ΔI _{CC}	additional supply current	$V_I = V_{CC} - 0.6 V; I_O = 0 A;$ $V_{CC} = 2.3 V to 5.5 V; per pin$	-	5	500	-	500	μA
Cı	input capacitance	V_{CC} = 3.3 V; V_{I} = GND to V_{CC}	-	5	-	-	-	pF

[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. 9.

Symbol	Parameter	Parameter Conditions		-40 °C to +85 °C			-40 °C to +125 °C	
			Min	Typ [1]	Max	Min	Мах	
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	6.5	1.0	8.5	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	1.9	4	0.5	5.5	ns
		V _{CC} = 2.7 V	0.5	2.5	4.5	0.5	6	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.3	4	0.5	5.5	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.7	3	0.5	4	ns
C _{PD}	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$ [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. [1]

[2]

 t_{pd} is the same as t_{PLZ} and t_{PZL} . C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$ where: [3]

 f_i = input frequency in MHz;

 $f_o = output$ frequency in MHz;

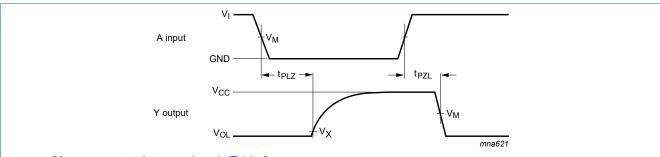
 C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1. Waveforms and test circuit



Measurement points are given in Table 9.

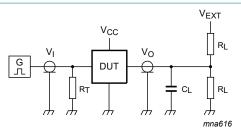
V_{OL} is the typical output voltage level that occurs with the output load.

The input A to output Y propagation delay times Fig. 8.

Table 9. Measurement points

Supply voltage	Input	Output	Output		
V _{cc}	V _M	V _M	Vx		
1.65 V to 1.95 V	0.5 × V _{CC}	0.5 × V _{CC}	V _{OL} + 0.15 V		
2.3 V to 2.7 V	$0.5 \times V_{CC}$	0.5 × V _{CC}	V _{OL} + 0.15 V		
2.7 V	1.5 V	1.5 V	V _{OL} + 0.3 V		
3.0 V to 3.6 V	1.5 V	1.5 V	V _{OL} + 0.3 V		
4.5 V to 5.5 V	$0.5 \times V_{CC}$	0.5 × V _{CC}	V _{OL} + 0.3 V		

Inverter with open-drain output



Test data is given in Table 10.

Definitions test circuit:

R_L = Load resistance;

 C_L = Load capacitance including jig and probe capacitance;

 R_T = Termination resistance should be equal to 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	RL	t _{PZL} , t _{PLZ}
1.65 V to 1.95 V	V _{CC}	≤ 2.0 ns	30 pF	1 kΩ	2 × V _{CC}
2.3 V to 2.7 V	V _{CC}	≤ 2.0 ns	30 pF	500 Ω	2 × V _{CC}
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	6 V
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	6 V
4.5 V to 5.5 V	V _{CC}	≤ 2.5 ns	50 pF	500 Ω	$2 \times V_{CC}$

12. Package outline

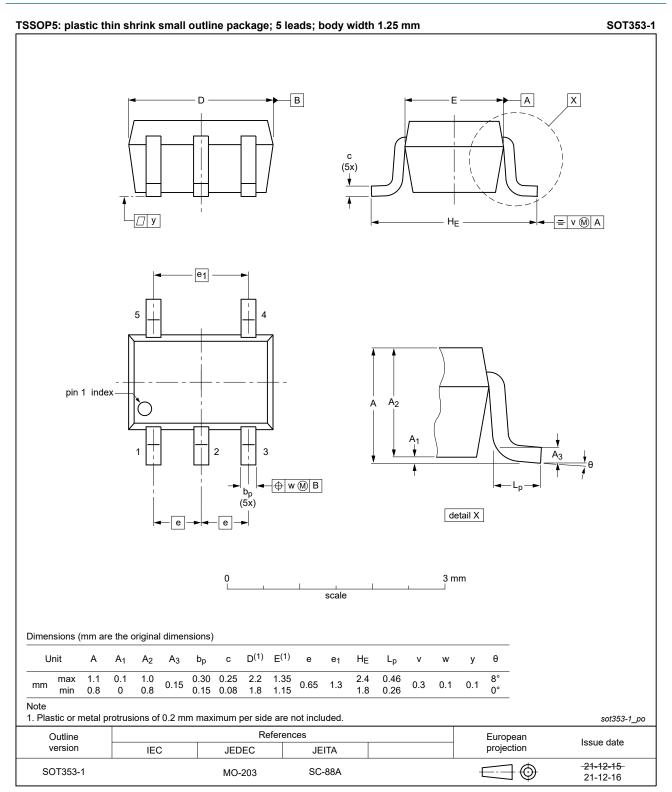


Fig. 10. Package outline SOT353-1 (TSSOP5)

Inverter with open-drain output



SOT753

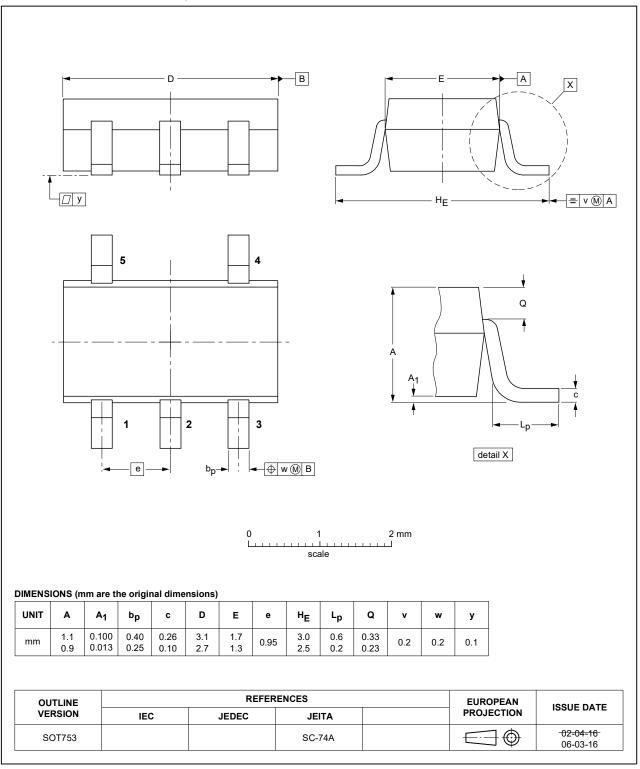


Fig. 11. Package outline SOT753 (SC-74A)

Inverter with open-drain output

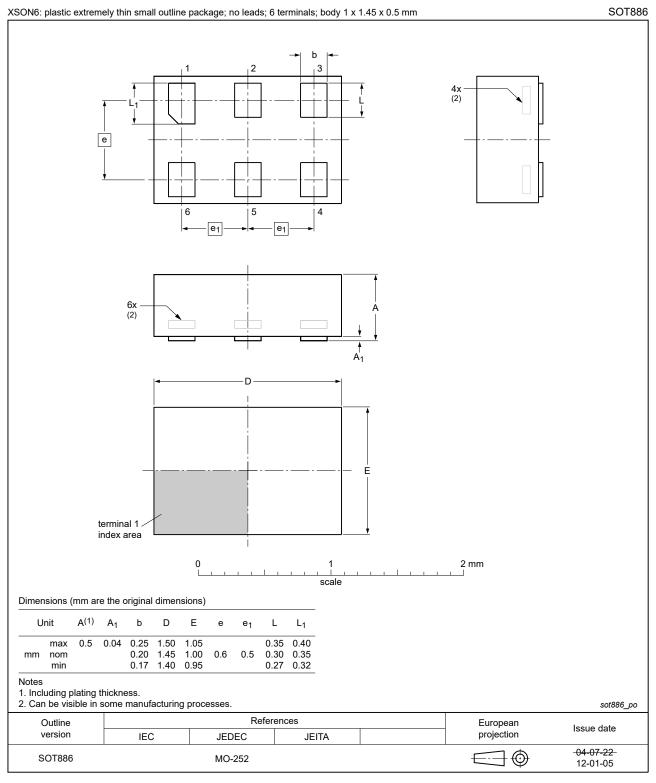


Fig. 12. Package outline SOT886 (XSON6)

Inverter with open-drain output

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

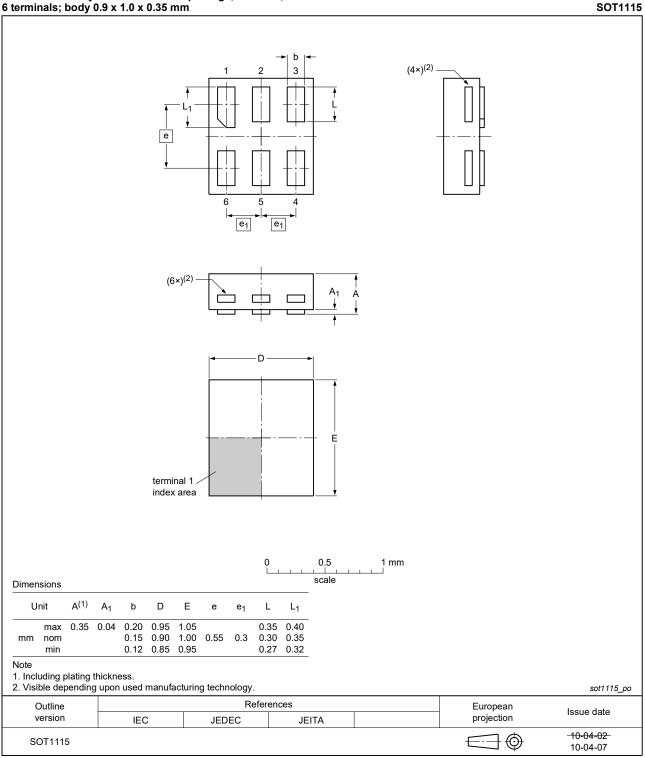


Fig. 13. Package outline SOT1115 (XSON6)

Inverter with open-drain output

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

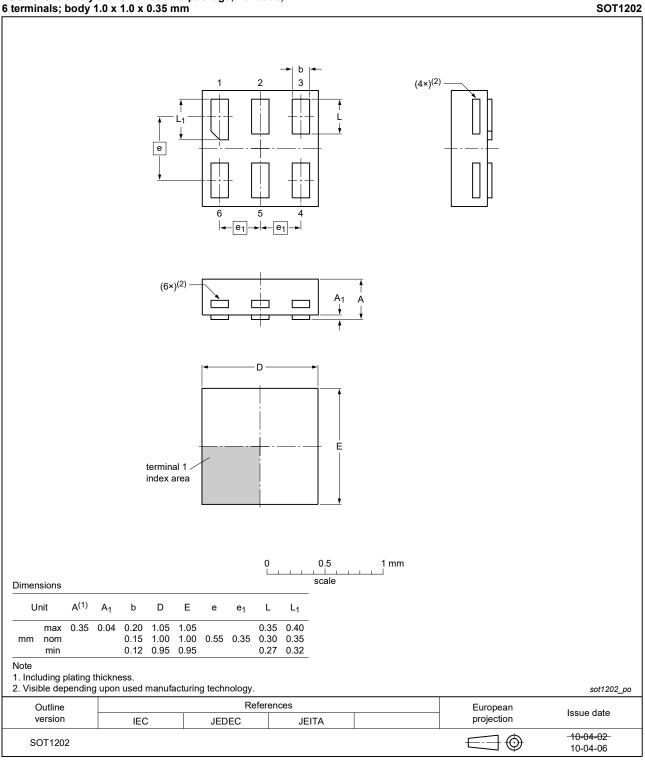
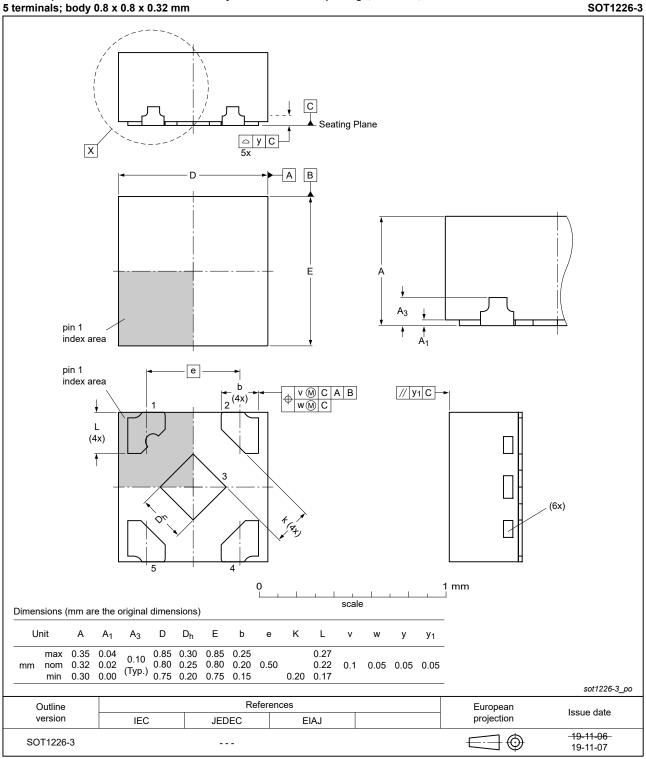


Fig. 14. Package outline SOT1202 (XSON6)

Inverter with open-drain output



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

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

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 hist Document ID	Release date	Data sheet status	Change notice	Supersedes	
			Change notice	•	
74LVC1G06 v.14	20220210	Product data sheet	-	74LVC1G06 v.13	
Modifications:	• Fig. 10: Package outline drawing for SOT353-1 (TSSOP5) has changed.				
74LVC1G06 v.13	20210924	Product data sheet	-	74LVC1G06 v.12	
Modifications:	 <u>Section 1</u> and <u>Section 2</u> updated. SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. Type number 74LVC1G06GF (SOT891) removed. <u>Table 5</u>: Derating values for P_{tot} total power dissipation updated. 				
74LVC1G06 v.12	20180522	Product data sheet	-	74LVC1G06 v.11	
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. 				
74LVC1G06 v.11	20161128	Product data sheet	-	74LVC1G06 v.10	
Modifications:	 <u>Table 7</u>: The maximum limits for leakage current and supply current have changed. <u>Table 7</u>: OFF-state output current parameter added. 				
74LVC1G06 v.10	20120629	Product data sheet	-	74LVC1G06 v.9	
Modifications:	 Added type number 74LVC1G06GX (SOT1226) Package outline drawing of SOT886 (Fig. 12) modified. 				
74LVC1G06 v.9	20111207	Product data sheet	-	74LVC1G06 v.8	
Modifications:	Legal pages updated.				
74LVC1G06 v.8	20101026	Product data sheet	-	74LVC1G06 v.7	
74LVC1G06 v.7	20070712	Product data sheet	-	74LVC1G06 v.6	
74LVC1G06 v.6	20060912	Product data sheet	-	74LVC1G06 v.5	
74LVC1G06 v.5	20040907	Product specification	-	74LVC1G06 v.4	
74LVC1G06 v.4	20030303	Product specification	-	74LVC1G06 v.3	
74LVC1G06 v.3	20020529	Product specification	-	74LVC1G06 v.2	
74LVC1G06 v.2	20010405	Product specification	-	74LVC1G06 v.1	
74LVC1G06 v.1	20001121	Product specification	-	-	

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.
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Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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