Triple inverter with open-drain output

Rev. 15 - 20 April 2021

1. General description

The 74LVC3G06 is a triple inverter with open-drain outputs. 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
- 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 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
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C

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3. Ordering information

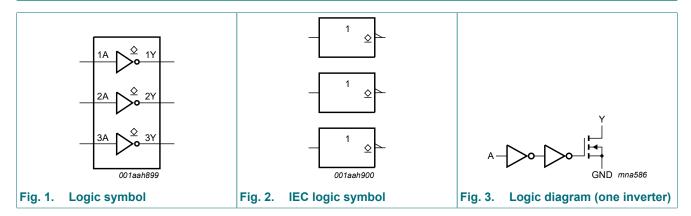
Type number	Package			
	Temperature range	Name	Description	Version
74LVC3G06DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74LVC3G06DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74LVC3G06GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1
74LVC3G06GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm	SOT1116
74LVC3G06GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm	SOT1203

4. Marking

Table 2. Marking codes				
Type number	Marking code [1]			
74LVC3G06DP	V06			
74LVC3G06DC	V06			
74LVC3G06GT	V06			
74LVC3G06GN	V6			
74LVC3G06GS	V6			

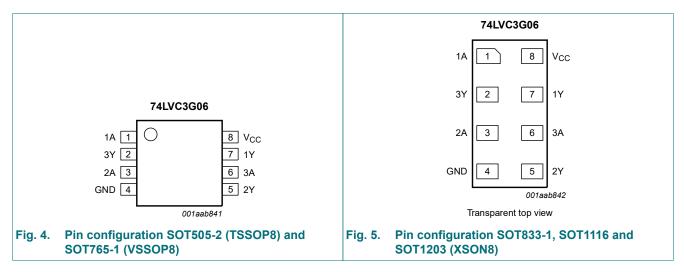
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information





6.2. Pin description

Table 3. Pin description				
Symbol	Pin	Description		
1A, 2A, 3A	1, 3, 6	data input		
1Y, 2Y, 3Y	7, 5, 2	data output		
GND	4	ground (0 V)		
V _{cc}	8	supply voltage		

7. Functional description

Table 4. Function table

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

Input nA	Output nY
L	Z
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	Мах	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 < 0 V		-50	-	mA
Vo	output voltage	Active mode	[1]	-0.5	+6.5	V
		Power-down mode; V_{CC} = 0 V	[1]	-0.5	+6.5	V
lo	output current	V _O = 0 V to 6.5 V		-	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 minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT505-2 (TSSOP8) package: P_{tot} derates linearly with 4.6 mW/K above 96 °C. For SOT765-1 (VSSOP8) package: P_{tot} derates linearly with 4.9 mW/K above 99 °C. For SOT833-1 (XSON8) package: P_{tot} derates linearly with 3.1 mW/K above 68 °C.

For SOT1116 (XSON8) package: P_{tot} derates linearly with 4.2 mW/K above 90 °C.

For SOT1203 (XSON8) package: P_{tot} derates linearly with 3.6 mW/K above 81 $^\circ\text{C}.$

9. Recommended operating conditions

Table 6. Operating conditions

Symbol	Parameter	Conditions	Min	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	Min	Тур [1]	Max	Unit
T _{amb} = -	40 °C to +85 °C			I	1	_
VIH	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65V _{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	0.7V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{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	-	-	0.3V _{CC}	V
V _{OL}	LOW-level output	$V_{I} = V_{IH} \text{ or } V_{IL}$				
	voltage	I_{O} = 100 µA; V_{CC} = 1.65 V to 5.5 V	-	-	0.10	V
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.30	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.40	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	$V_1 = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$ [2]	-	±0.1	±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	μA
I _{OFF}	power-off leakage current	$V_{1} \text{ or } V_{0} = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	±0.1	±2	μA
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	μA
ΔI _{CC}	additional supply current	per pin; $V_1 = V_{CC} - 0.6 \text{ V}$; $I_0 = 0 \text{ A}$; [2] $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	5	500	μA
CI	input capacitance		-	2.5	-	pF
T _{amb} = -	40 °C to +125 °C	· · · · · · · · · · · · · · · · · · ·				_
VIH	HIGH-level input voltage	V _{CC} = 1.65 V to 1.95 V	0.65V _{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	0.7V _{CC}	-	-	V
V _{IL}	LOW-level input voltage	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{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	-	_	0.3V _{CC}	V

Triple inverter with open-drain output

Symbol	Parameter	Conditions	Min	Тур [1]	Max	Unit
V _{OL}	LOW-level output	$V_{I} = V_{IH} \text{ or } V_{IL}$				
	voltage	I_{O} = 100 µA; V_{CC} = 1.65 V to 5.5 V	-	-	0.10	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	$V_1 = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	-	±1	μA
I _{OZ}	OFF-state output current	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{O} = V_{CC} \text{ or } GND;$ $V_{CC} = 5.5 \text{ V}$	-	-	±2	μA
I _{OFF}	power-off leakage current	$V_{1} \text{ or } V_{0} = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	-	±2	μA
I _{CC}	supply current	V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V	-	-	4	μA
∆l _{CC}	additional supply current	per pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 5.5 V	-	-	500	μA

All typical values are measured at T_{amb} = 25 °C. [1]

These typical values are measured at V_{CC} = 3.3 V. [2]

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 7.

Symbol	Parameter	Conditions	-40	-40 °C to +85 °C -40 °C to +1		+125 °C	5 °C Unit	
			Min	Typ [1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Fig. 6 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	2.6	6.5	1.0	8.2	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	1.6	3.9	0.5	4.9	ns
		V _{CC} = 2.7 V	1.0	2.2	4.2	1.0	5.3	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.0	3.4	0.5	4.3	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.4	2.9	0.5	3.7	ns
C _{PD}	power dissipation capacitance	$V_{I} = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V} $ [3]	-	5.9	-	-	-	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_{PLZ} and t_{PZL} . C_{PD} is used to determine the dynamic power dissipation (P_D in μ W). [3]

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

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;

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

11.1. Waveforms and test circuit

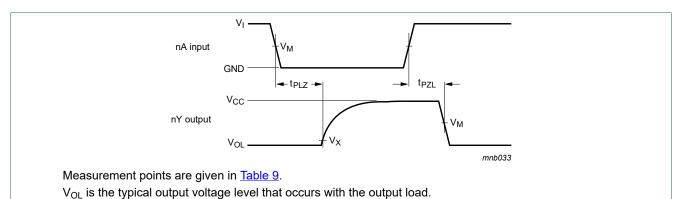
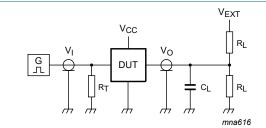


Fig. 6. The input (nA) to output (nY) propagation delays

Table 9. Measurement points

Supply voltage	Input	Output	
V _{cc}	V _M	V _M	V _X
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 × 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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V _{OL} + 0.3 V



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. 7. 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

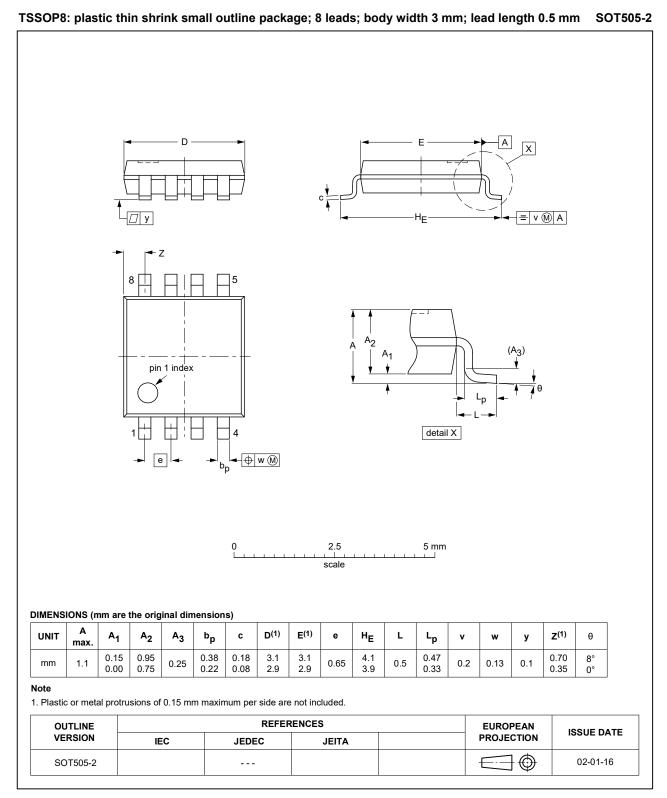
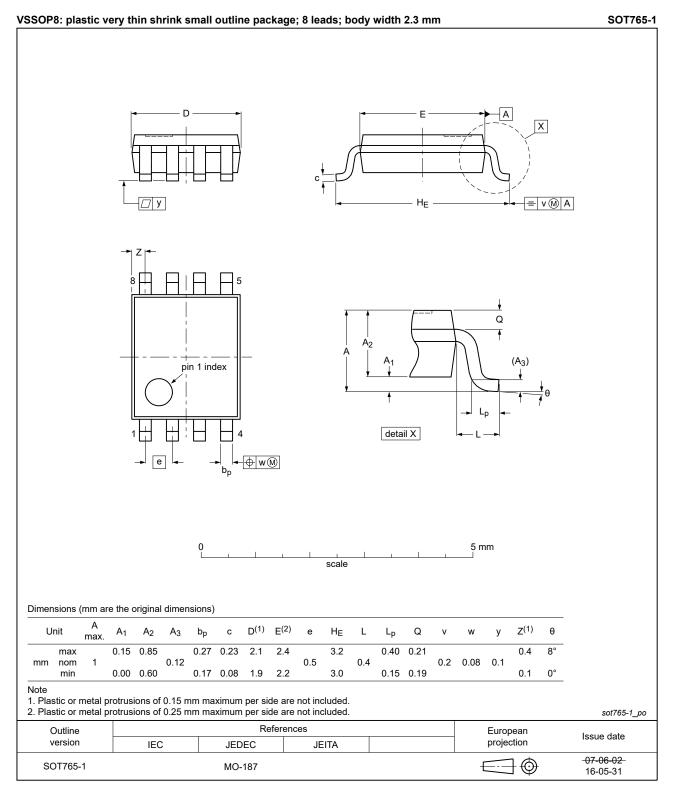


Fig. 8. Package outline SOT505-2 (TSSOP8)

Triple inverter with open-drain output





Triple inverter with open-drain output

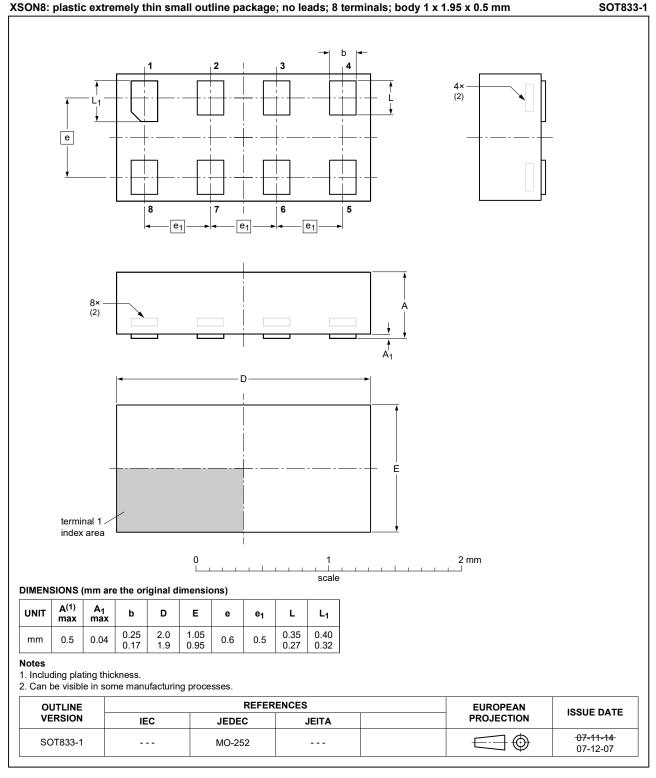


Fig. 10. Package outline SOT833-1 (XSON8)

Triple inverter with open-drain output

XSON8: extremely thin small outline package; no leads; 8 terminals; body 1.2 x 1.0 x 0.35 mm

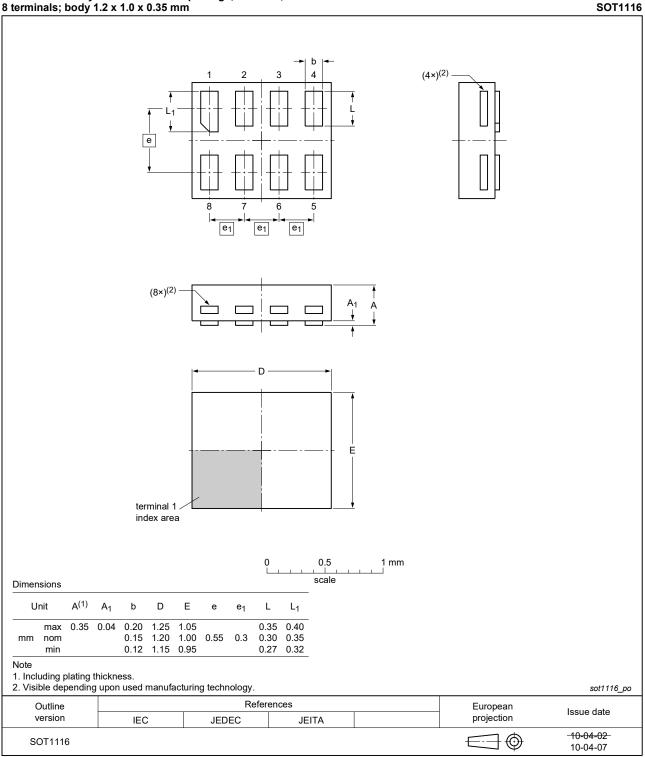


Fig. 11. Package outline SOT1116 (XSON8)

Triple inverter with open-drain output

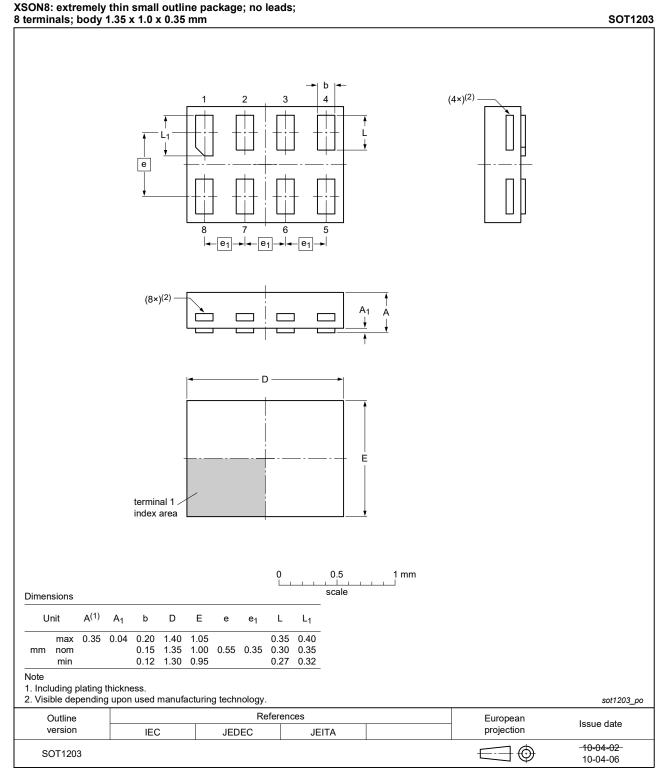


Fig. 12. Package outline SOT1203 (XSON8)

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

Document ID	Release date	Data sheet status	Change notice	Supersedes		
74LVC3G06 v.15	20210420	Product data sheet	-	74LVC3G06 v.14		
Modifications:	<u>Section 1</u> and <u>Section 2</u> updated.					
	 Type number 74LVC3G06GF (SOT1089 / XSON8) removed. 					
74LVC3G06 v.14	20190731	Product data sheet	-	74LVC3G06 v.13		
Modifications:	Type number 74LVC3G06GM (SOT902-2) removed.					
	• <u>Table 5</u> : Derating values for P _{tot} total power dissipation updated.					
74LVC3G06 v.13	20190206	Product data sheet	-	74LVC3G06 v.12		
Modifications:	The format of this data sheet has been redesigned to comply with the identity					
	guidelines of Nexperia. I egal texts have been adapted to the new company name where appropriate					
	 Legal texts have been adapted to the new company name where appropriate. Type number 74LVC3G06GD (SOT996-2) removed. 					
74LVC3G06 v.12	20161215	Product data sheet		74LVC3G06 v.11		
Modifications:	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.					
		1	Rage current and su			
74LVC3G06 v.11	20130328	Product data sheet	-	74LVC3G06 v.10		
Modifications:		mber 74LVC3G06GD X	SON8U has change			
74LVC3G06 v.10	20120627	Product data sheet	-	74LVC3G06 v.9		
Modifications:	 For type number 74LVC3G06GM the SOT code has changed to SOT902-2. 					
74LVC3G06 v.9	20111123	Product data sheet	-	74LVC3G06 v.8		
Modifications:	Legal pages updated.					
74LVC3G06 v.8	20100809	Product data sheet	-	74LVC3G06 v.7		
74LVC3G06 v.7	20090312	Product data sheet	-	74LVC3G06 v.6		
74LVC3G06 v.6	20080403	Product data sheet	-	74LVC3G06 v.5		
74LVC3G06 v.5	20070521	Product data sheet	-	74LVC3G06 v.4		
74LVC3G06 v.4	20060302	Product data sheet	-	74LVC3G06 v.3		
74LVC3G06 v.3	20050201	Product data sheet	-	74LVC3G06 v.2		
74LVC3G06 v.2	20041021	Product data sheet	-	74LVC3G06 v.1		
74LVC3G06 v.1	20040607	Product data sheet	-	-		

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.

 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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