# Inverters with open-drain outputs Rev. 8 — 12 December 2016

**Product data sheet** 

#### **General description** 1.

The 74LVC2G06 provides two inverting buffers.

The output of this device is an open drain and can be connected to other open-drain outputs to implement active-LOW wired-OR or active-HIGH wired-AND functions.

Input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment.

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

This device is fully specified for partial power-down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

#### Features and benefits 2.

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant input/output 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 JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- -24 mA output drive ( $V_{CC} = 3.0 \text{ V}$ )
- 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			
74LVC2G06GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363			
74LVC2G06GV	-40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457			
74LVC2G06GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 1.45 $\times$ 0.5 mm	SOT886			
74LVC2G06GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 1 $\times$ 0.5 mm	SOT891			
74LVC2G06GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $0.9 \times 1.0 \times 0.35$ mm	SOT1115			
74LVC2G06GS	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $1.0 \times 1.0 \times 0.35$ mm	SOT1202			
74LVC2G06GX	–40 °C to +125 °C	X2SON6	plastic thermal extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 0.8 $\times$ 0.35 mm	SOT1255			

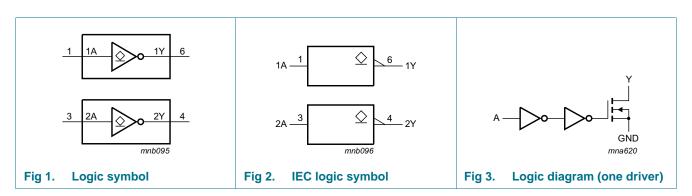
### 4. Marking

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC2G06GW	V6
74LVC2G06GV	V06
74LVC2G06GM	V6
74LVC2G06GF	V6
74LVC2G06GN	V6
74LVC2G06GS	V6
74LVC2G06GX	V6

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

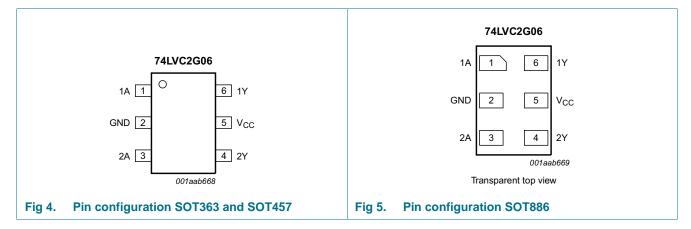
### 5. Functional diagram



Inverters with open-drain outputs

### 6. Pinning information

#### 6.1 Pinning





### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1A	1	data input
GND	2	ground (0 V)
2A	3	data input
2Y	4	data output
V <sub>CC</sub>	5	supply voltage
1Y	6	data output

Inverters with open-drain outputs

## 7. Functional description

Table 4. Function table[1]

Input nA	Output nY
L	Z
Н	L

<sup>[1]</sup> H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF-state.

### 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 <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		<u>[1]</u>	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V		-50	-	mA
Vo	output voltage	Active mode	<u>[1]</u>	-0.5	+6.5	V
		Power-down mode	[1][2]	-0.5	+6.5	V
Io	output current	V <sub>O</sub> = 0 V to 6.5 V		-	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	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	<u>[3]</u>	-	250	mW

<sup>[1]</sup> The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 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
Vo	output voltage	Active mode	0	-	5.5	V
		Power-down mode; V <sub>CC</sub> = 0 V	0	-	5.5	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C
Δt/ΔV	input transition rise and	V <sub>CC</sub> = 1.65 V to 2.7 V	-	-	20	ns/V
	fall rate	V <sub>CC</sub> = 2.7 V to 5.5 V	-	-	10	ns/V

<sup>[2]</sup> When  $V_{CC} = 0 \text{ V}$  (Power-down mode), the output voltage can be 5.5 V in normal operation.

<sup>[3]</sup> For SC-88 and SC-74 packages: above 87.5  $^{\circ}$ C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K. For XSON6 and X2SON6 packages: above 118  $^{\circ}$ C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

### Inverters with open-drain outputs

### 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
$T_{amb} = -40$	0 °C to +85 °C						
$V_{IH}$	HIGH-level input	V <sub>CC</sub> = 1.65 V to 1.95 V		0.65 × V <sub>CC</sub>	-	-	V
	voltage	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		$0.7 \times V_{CC}$	-	-	V
$V_{IL}$	LOW-level input	V <sub>CC</sub> = 1.65 V to 1.95 V		-	-	$0.35 \times V_{CC}$	V
	voltage	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		-	-	$0.3 \times V_{CC}$	V
V <sub>OL</sub>	LOW-level output	$V_I = V_{IH}$ or $V_{IL}$					
	voltage	$I_O = 100 \mu A; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$		-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V		-	-	0.45	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$		-	-	0.3	V
		$I_{O}$ = 12 mA; $V_{CC}$ = 2.7 V		-	-	0.4	V
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$		-	-	0.55	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$		-	-	0.55	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	[2]	-	±0.1	±1	μΑ
I <sub>OZ</sub>	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$		-	±0.1	±2	μА
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$		-	±0.1	±2	μΑ
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.65 V to 5.5 V		-	0.1	4	μΑ
Δl <sub>CC</sub>	additional supply current	per pin; $V_1 = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V}$	[2]	-	5	500	μΑ
Cı	input capacitance			-	2.5	-	pF

### Inverters with open-drain outputs

 Table 7.
 Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
$T_{amb} = -40$	°C to +125 °C					
V <sub>IH</sub>	HIGH-level input	V <sub>CC</sub> = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
	voltage	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	$0.7 \times V_{CC}$	-	-	V
V <sub>IL</sub> LOW-level input	LOW-level input	V <sub>CC</sub> = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
	voltage	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	-	-	$0.3 \times V_{CC}$	V
V <sub>OL</sub>	LOW-level output	$V_I = V_{IH}$ or $V_{IL}$				
	voltage	$I_O = 100 \ \mu A; \ V_{CC} = 1.65 \ V \ to \ 5.5 \ V$	-	-	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.70	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	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 <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.80	V
l <sub>l</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	±1	μΑ
l <sub>OZ</sub>	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$	-	-	±2	μΑ
l <sub>OFF</sub>	power-off leakage current			-	±2	μΑ
lcc	supply current	V <sub>I</sub> = 5.5 V or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	4	μА
Δl <sub>CC</sub>	additional supply current	per pin; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$ ; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	-	500	μΑ

<sup>[1]</sup> All typical values are measured at  $T_{amb}$  = 25 °C.

<sup>[2]</sup> These typical values are measured at  $V_{CC}$  = 3.3 V.

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### 11. Dynamic characteristics

Table 8. Dynamic characteristics

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

Symbol	Parameter	Conditions	-40	-40 °C to +85 °C		-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA to nY; see Figure 8						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	3.2	6.5	1.0	8.2	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	2.0	3.9	0.5	4.9	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.6	4.2	1.0	5.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	2.3	3.4	0.5	4.3	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	1.6	2.9	0.5	3.7	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$	-	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  $t_{PZL}$ .
- [3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu W$ ).

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

 $f_i$  = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

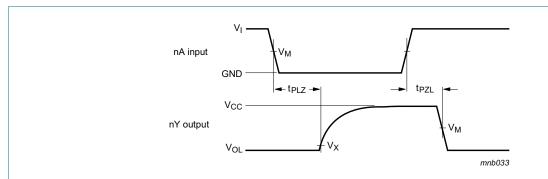
C<sub>L</sub> = output load capacitance in pF;

 $V_{CC}$  = supply voltage in V;

N = number of inputs switching;

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

#### 12. Waveforms



Measurement points are given in Table 9.

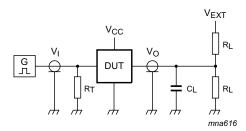
 $\ensuremath{V_{\text{OL}}}$  is the typical output voltage drop that occur with the output load.

Fig 8. The input (nA) to output (nY) propagation delays

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Table 9. Measurement points

Supply voltage	Input	Output		
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>X</sub>	
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V <sub>OL</sub> + 0.15 V	
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V <sub>OL</sub> + 0.15 V	
2.7 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	
3.0 V to 3.6 V	1.5 V	1.5 V	V <sub>OL</sub> + 0.3 V	
4.5 V to 5.5 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V <sub>OL</sub> + 0.3 V	



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  $Z_0$  of the pulse generator.

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

Fig 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 <sub>r</sub> , t <sub>f</sub>	CL	$R_L$	t <sub>PZL</sub> , t <sub>PLZ</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	$2 \times V_{CC}$
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	500 Ω	2 × V <sub>CC</sub>
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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	2 × V <sub>CC</sub>

### 13. Package outline

#### **SOT363** Plastic surface-mounted package; 6 leads Α X = v (M) A ΗE ⊕ w M B е detail X scale **DIMENSIONS** (mm are the original dimensions) Α1 UNIT D Q Α С Ε ٧ e<sub>1</sub> $H_{\mathsf{E}}$ $L_{\mathbf{p}}$ w у max 0.25 0.30 0.25 0.10 1.35 1.15 2.2 2.0 0.45 1.1 2.2 0.65 0.1 0.8 0.20 1.8 0.15 0.15 REFERENCES EUROPEAN OUTLINE ISSUE DATE VERSION JEDEC **PROJECTION** IEC JEITA 04-11-08 SOT363 SC-88 $\bigcirc$

Fig 10. Package outline SOT363 (SC-88)

06-03-16

#### Plastic surface-mounted package (TSOP6); 6 leads

**SOT457** 

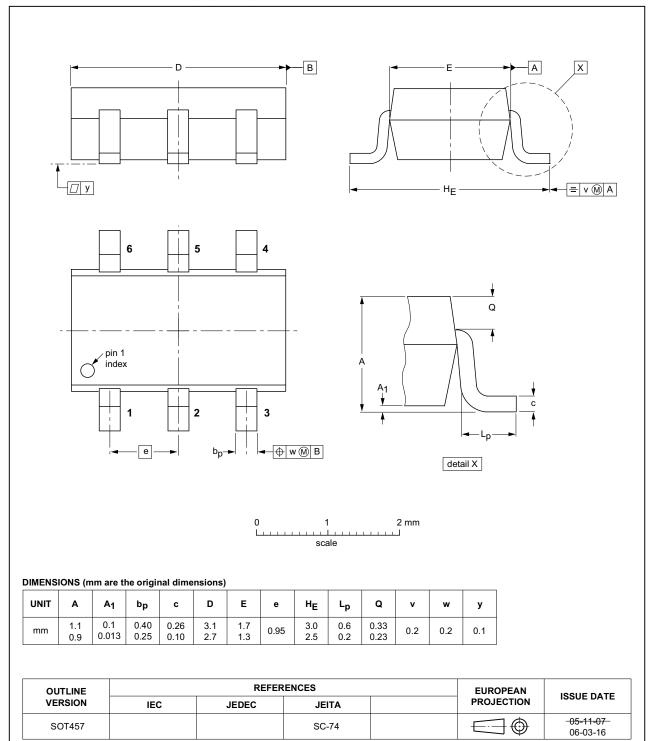


Fig 11. Package outline SOT457 (TSOP6)

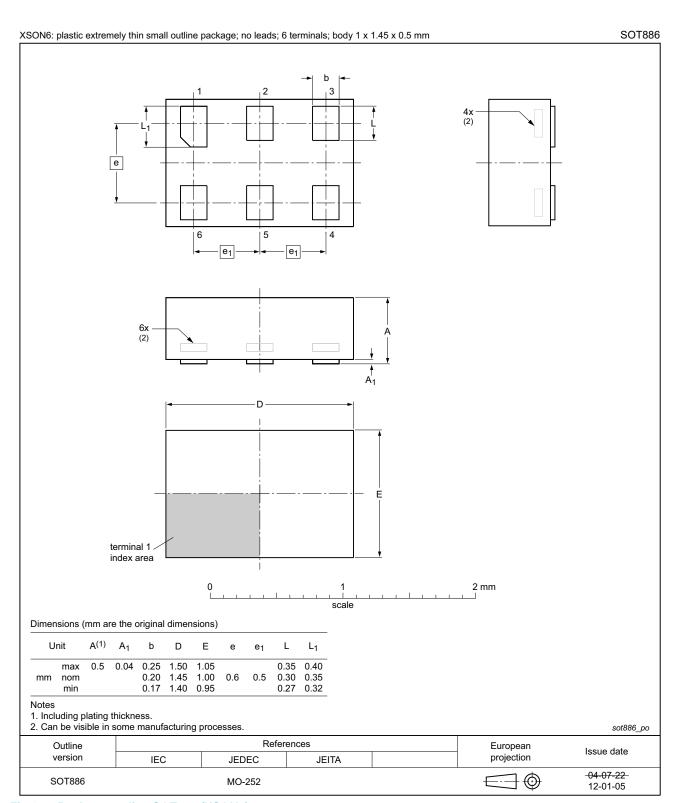


Fig 12. Package outline SOT886 (XSON6)

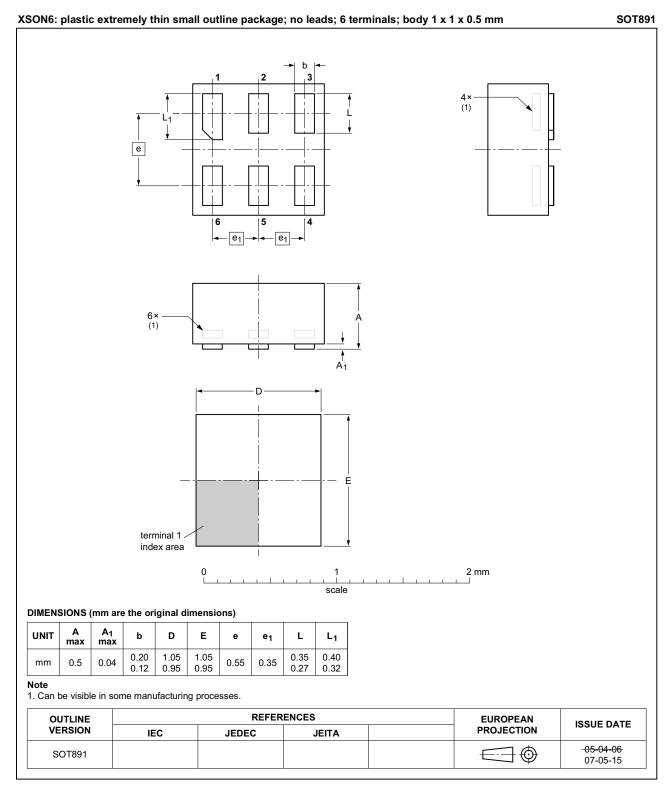


Fig 13. Package outline SOT891 (XSON6)

**Product data sheet** 

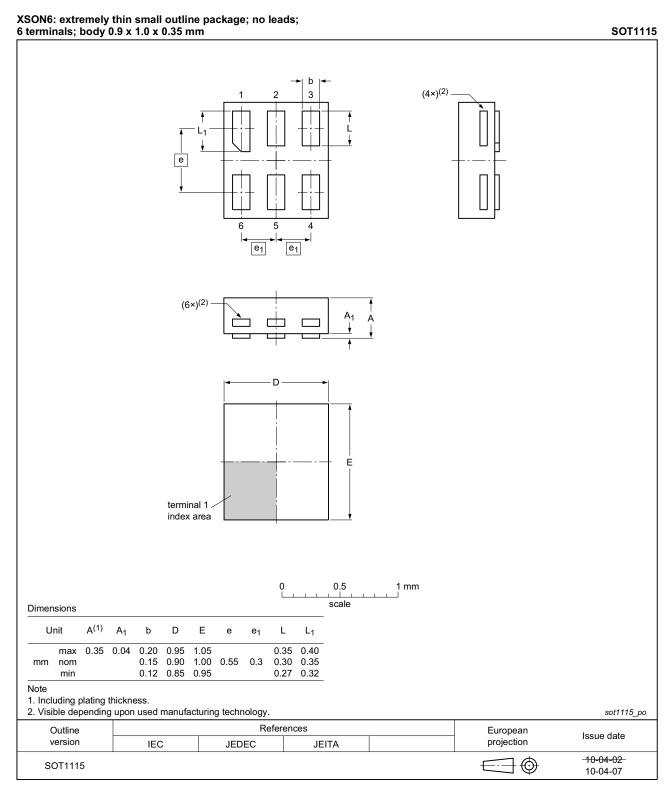


Fig 14. Package outline SOT1115 (XSON6)

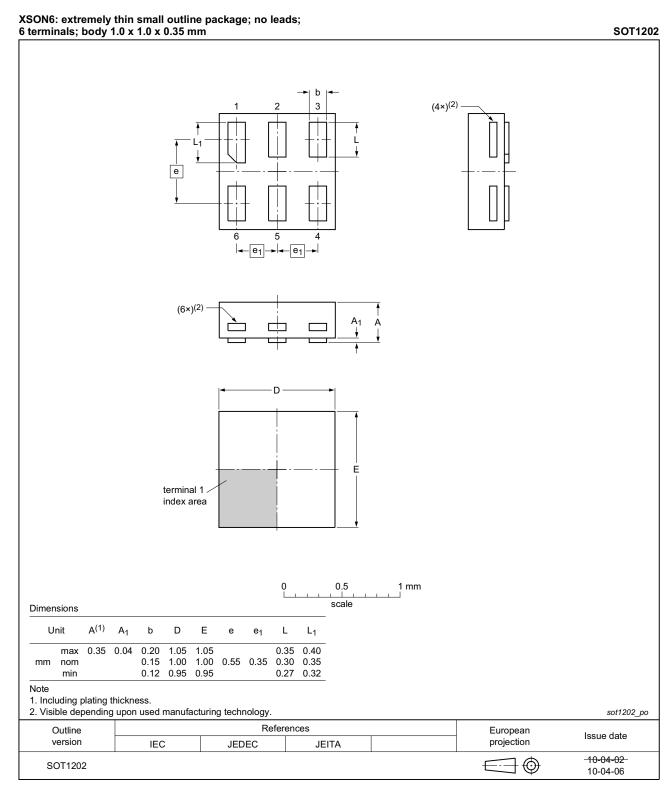


Fig 15. Package outline SOT1202 (XSON6)

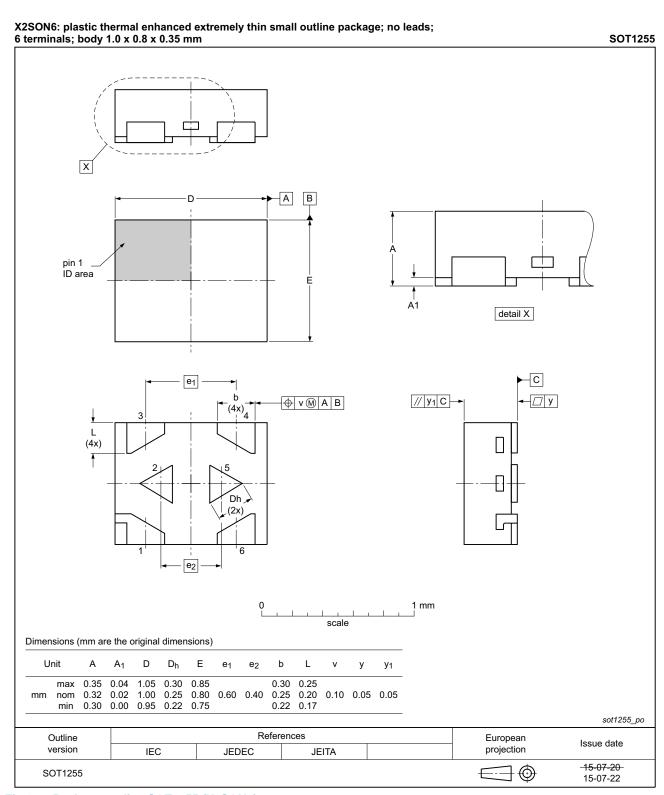


Fig 16. Package outline SOT1255 (X2SON6)

74LVC2G06

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### Inverters with open-drain outputs

### 14. 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

## 15. Revision history

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes	
74LVC2G06 v.8	20161212	Product data sheet	-	74LVC2G06 v.7	
Modifications:	• <u>Table 7</u> : The	<u>Table 7</u> : The maximum limits for leakage current and supply current have changed.			
74LVC2G06 v.7	20150917	Product data sheet	-	74LVC2G06 v.6	
Modifications:	<ul> <li>Added type</li> </ul>	Added type number 74LVC2G06GX (SOT1255/X2SON6).			
74LVC2G06 v.6	20120704	Product data sheet	-	74LVC2G06 v.5	
Modifications:	Package outline drawing of SOT886 (Figure 12) modified.				
74LVC2G06 v.5	20111130	Product data sheet	-	74LVC2G06 v.4	
Modifications:	Legal pages updated.				
74LVC2G06 v.4	20101028	Product data sheet	-	74LVC2G06 v.3	
74LVC2G06 v.3	20070521	Product data sheet	-	74LVC2G06 v.2	
74LVC2G06 v.2	20040910	Product specification	-	74LVC2G06 v.1	
74LVC2G06 v.1	20030825	Product specification	-	-	

#### Inverters with open-drain outputs

### 16. Legal information

#### 16.1 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.

- [1] 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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#### Inverters with open-drain outputs

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### **Nexperia**

Inverters with open-drain outputs

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