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# Buffers with open-drain outputs Rev. 9 — 12 December 2016

**Product data sheet** 

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

The 74LVC2G07 provides two non-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.

Inputs 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			
74LVC2G07GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363			
74LVC2G07GV	–40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457			
74LVC2G07GM	-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			
74LVC2G07GF	–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			
74LVC2G07GN	–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			
74LVC2G07GS	-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			
74LVC2G07GX	-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			

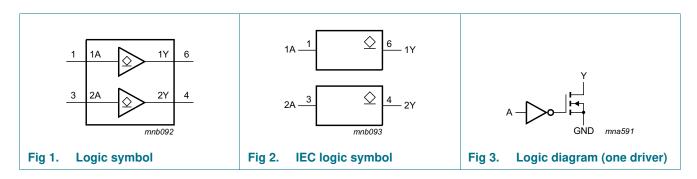
## 4. Marking

#### Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC2G07GW	V7
74LVC2G07GV	V07
74LVC2G07GM	V7
74LVC2G07GF	V7
74LVC2G07GN	V7
74LVC2G07GS	V7
74LVC2G07GX	V7

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

## 5. Functional diagram



#### **Buffers 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

## 7. Functional description

Table 4. Function table[1]

Input nA	Output nY
L	L
Н	Z

<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		[1]	-0.5	+6.5	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V		-50	-	mA
V <sub>O</sub>	output voltage	Active mode	[1]	-0.5	+6.5	V
		Power-down mode	[1][2]	-0.5	+6.5	V
Io	output current	$V_O = 0 V \text{ to } 6.5 V$		-	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
V <sub>O</sub>	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
$\Delta t/\Delta V$ 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

74LVC2G07

<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 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K. For X2SON6 and XSON6 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 10. Static characteristics

Table 7. Static characteristics

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

Symbol	Parameter	Conditions		Min	Тур	Max	Unit
$T_{amb} = -40$	0 °C to +85 °C[1]		'				
$V_{IH}$	HIGH-level input	V <sub>CC</sub> = 1.65 V to 1.95 V	C	$0.65 \times V_{CC}$	-	-	V
	voltage	V <sub>CC</sub> = 2.3 V to 2.7 V		1.7	-	-	٧
		V <sub>CC</sub> = 2.7 V to 3.6 V		2.0	-	-	٧
		V <sub>CC</sub> = 4.5 V to 5.5 V	(	$0.7 \times V_{CC}$	-	-	٧
$V_{IL}$	V <sub>IL</sub> LOW-level input	V <sub>CC</sub> = 1.65 V to 1.95 V		-	-	$0.35 \times V_{CC}$	٧
	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
$V_{OL}$	LOW-level output	$V_I = V_{IH}$ or $V_{IL}$					
	voltage	$I_O = 100 \mu A$ ; $V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$		-	-	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V		-	-	0.45	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$		-	-	0.30	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V		-	-	0.40	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V		-	-	0.55	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$		-	-	0.55	V
lı	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
l <sub>OZ</sub>	OFF-state output current	$V_I = V_{IH}$ or $V_{IL}$ ; $V_O = V_{CC}$ or GND; $V_{CC} = 5.5 \text{ V}$		-	±0.1	±2	μΑ
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; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$ ; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	[2]	-	5	500	μА
Cı	input capacitance			-	2.5	-	pF

#### **Buffers 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	Тур	Max	Unit
T <sub>amb</sub> = -40	0 °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	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 $V_{IL}$				
voli	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
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.80	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.80	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	-	±1	μА
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	μА
OFF	power-off leakage current	$V_{I}$ or $V_{O} = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	-	±2	μА
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; $V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V}$	-	-	500	μА

<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.

## 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 °C to +85 °C -40 °C		–40 °C to	°C to +125 °C		
			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	3.5	6.7	1.0	8.4	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	2.4	4.3	0.5	5.5	ns
		V <sub>CC</sub> = 2.7 V	1.0	2.3	4.2	1.0	5.3	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	2.6	3.7	0.5	4.7	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	1.5	2.9	0.5	3.7	ns
$C_{PD}$	power dissipation capacitance	$V_I = GND \text{ to } V_{CC}; V_{CC} = 3.3 \text{ V}$	-	6.5	-	-	-	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;

fo = output frequency in MHz;

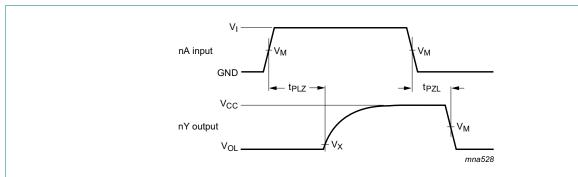
C<sub>L</sub> = output load capacitance in pF;

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

N = number of inputs switching;

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

#### 12. Waveforms



Measurement points are given in Table 9.

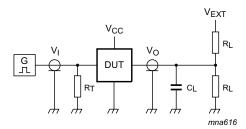
 $V_{\text{OL}}$  is the typical output voltage drop that occur with the output load.

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

#### **Buffers with open-drain outputs**

Table 9. Measurement points

Supply voltage	Input	Output	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>	C <sub>L</sub>	R <sub>L</sub>	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 × V <sub>CC</sub>
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 0.1 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** 

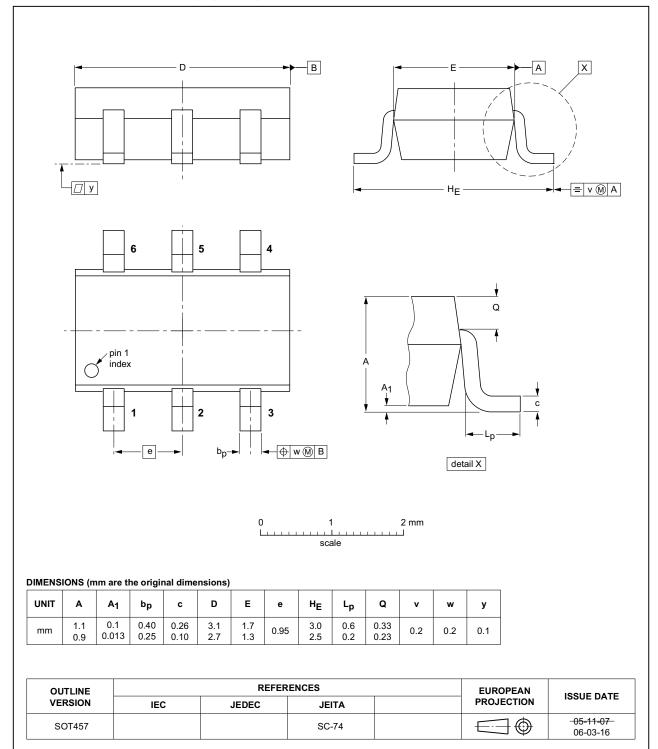


Fig 11. Package outline SOT457 (TSOP6)

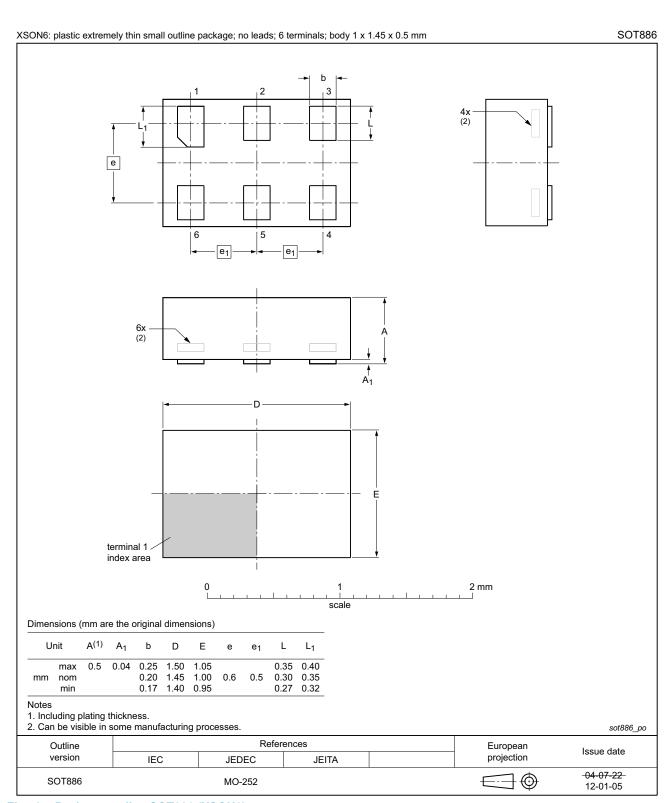


Fig 12. Package outline SOT886 (XSON6)

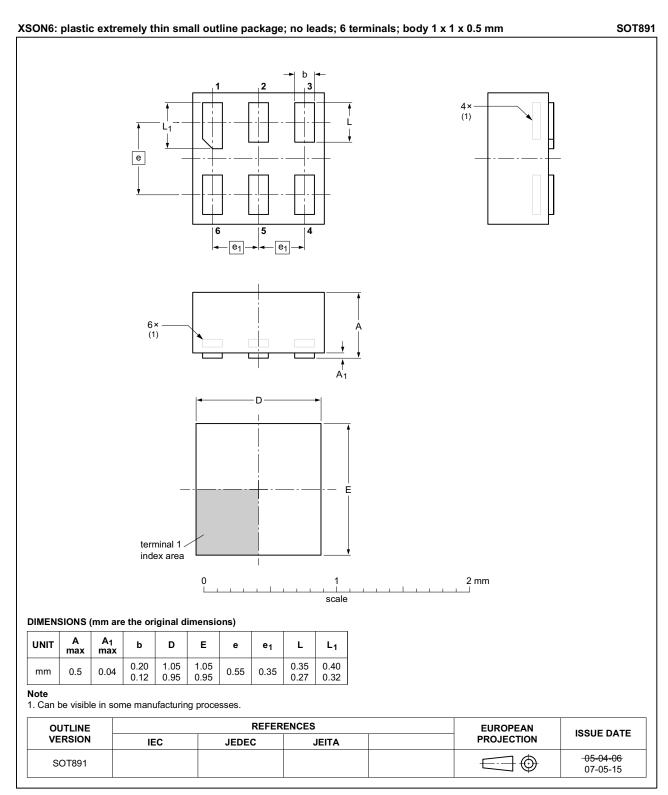


Fig 13. Package outline SOT891 (XSON6)

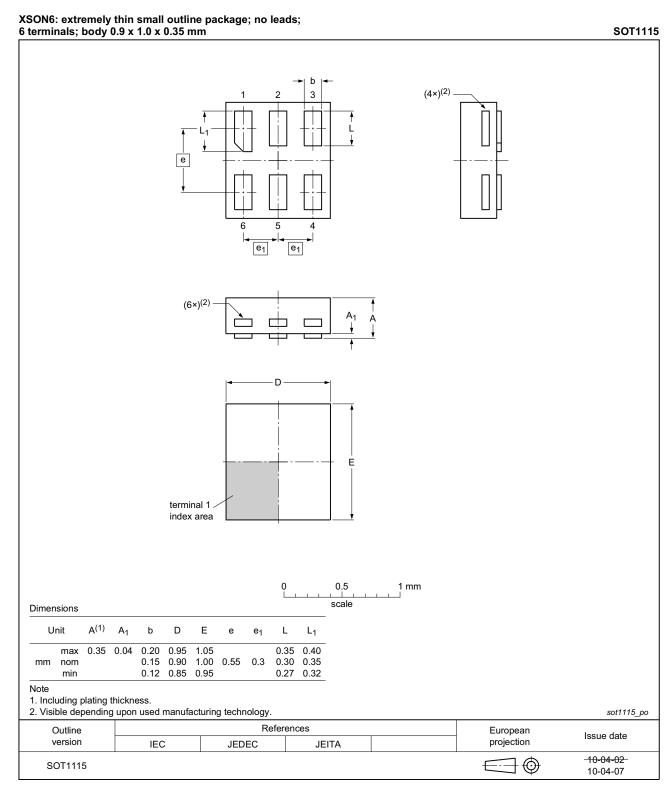


Fig 14. Package outline SOT1115 (XSON6)

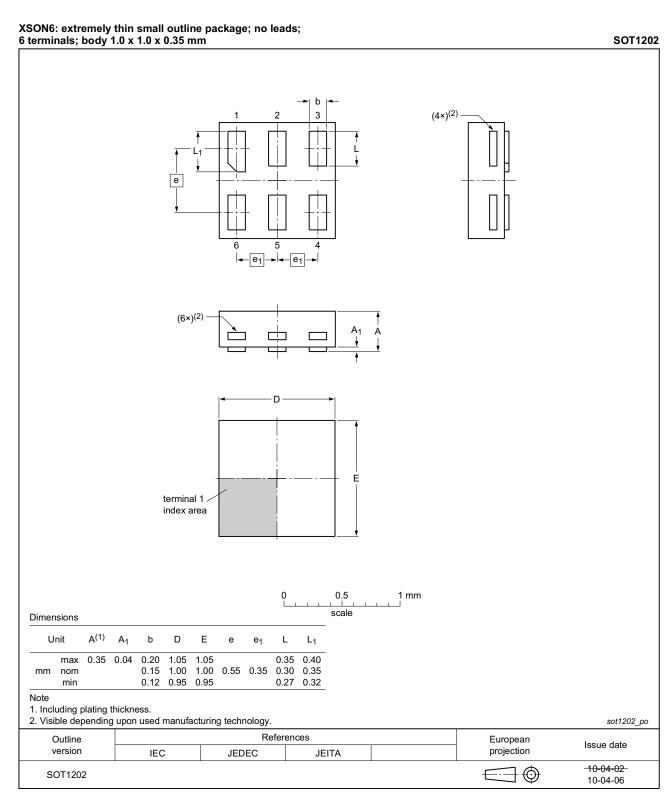


Fig 15. Package outline SOT1202 (XSON6)

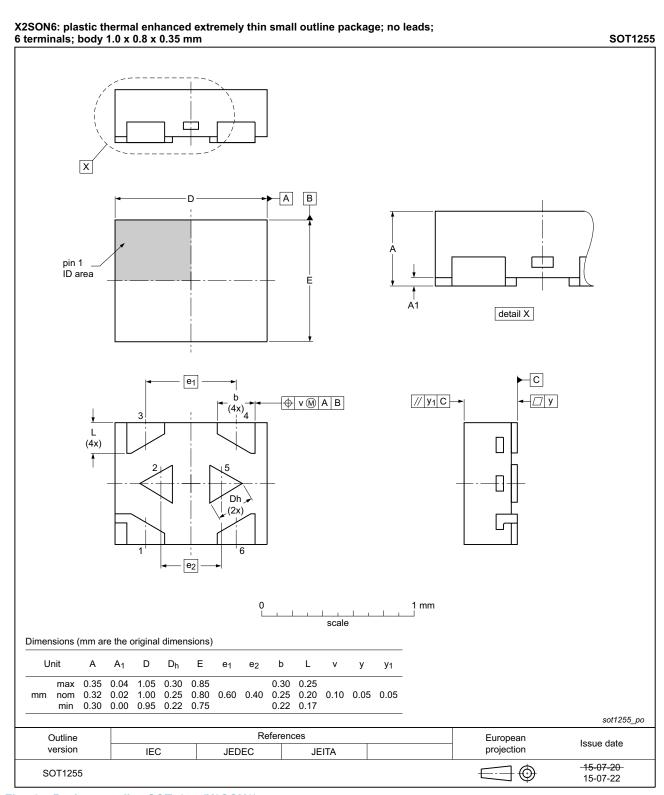


Fig 16. Package outline SOT1255 (X2SON6)

## 14. Abbreviations

#### Table 11. Abbreviations

Acronym	Description	
CMOS	Complementary Metal Oxide Semiconductor	
DUT	evice Under Test	
ESD	ElectroStatic Discharge	
НВМ	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
74LVC2G07 v.9	20161212	Product data sheet	-	74LVC2G07 v.8
Modifications:	• Table 7: The r	maximum limits for leakage cu	rrent and supply cur	rent have changed.
74LVC2G07 v.8	20150923	Product data sheet	-	74LVC2G07 v.7
Modifications:	Added type no	umber 74LVC2G07GX (SOT12	255/X2SON6).	
74LVC2G07 v.7	20120704	Product data sheet	-	74LVC2G07 v.6
Modifications:	Package outli	ne drawing of SOT886 (Figure	12) modified.	
74LVC2G07 v.6	20111130	Product data sheet	-	74LVC2G07 v.5
Modifications:	Legal pages updated.			
74LVC2G07 v.5	20100806	Product data sheet	-	74LVC2G07 v.4
74LVC2G07 v.4	20070521	Product data sheet	-	74LVC2G07 v.3
74LVC2G07 v.3	20040908	Product data sheet	-	74LVC2G07 v.2
74LVC2G07 v.2	20040319	Product data sheet	-	74LVC2G07 v.1
74LVC2G07 v.1	20030825	Product data sheet	-	-

#### **Buffers 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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## **Nexperia**

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