

# 74LVC2G17

Dual non-inverting Schmitt trigger with 5 V tolerant input

Rev. 8 — 2 May 2013

Product data sheet

## 1. General description

The 74LVC2G17 provides two non-inverting buffers with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the 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
- 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)
  - ◆ JESD-8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - ◆ HBM JESD22-A114F exceeds 2000 V
  - ◆ MM JESD22-A115-A exceeds 200 V
- $\pm 24$  mA output drive ( $V_{CC} = 3.0$  V)
- CMOS low-power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C

## 3. Applications

- Wave and pulse shapers for highly noisy environments



## 4. Ordering information

**Table 1. Ordering information**

Type number	Package	Temperature range	Name	Description	Version
74LVC2G17GW	SC-88	-40 °C to +125 °C		plastic surface-mounted package; 6 leads	SOT363
74LVC2G17GV	TSOP6	-40 °C to +125 °C		plastic surface-mounted package (TSOP6); 6 leads	SOT457
74LVC2G17GM	XSON6	-40 °C to +125 °C		plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC2G17GF	XSON6	-40 °C to +125 °C		plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891
74LVC2G17GN	XSON6	-40 °C to +125 °C		extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC2G17GS	XSON6	-40 °C to +125 °C		extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202

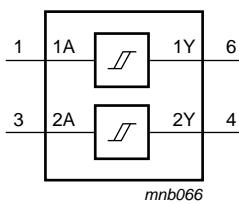
## 5. Marking

**Table 2. Marking codes**

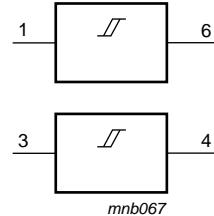
Type number	Marking code <sup>[1]</sup>
74LVC2G17GW	VV
74LVC2G17GV	VV
74LVC2G17GM	VV
74LVC2G17GF	VV
74LVC2G17GN	VV
74LVC2G17GS	VV

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

## 6. Functional diagram



**Fig 1. Logic symbol**



**Fig 2. IEC logic symbol**

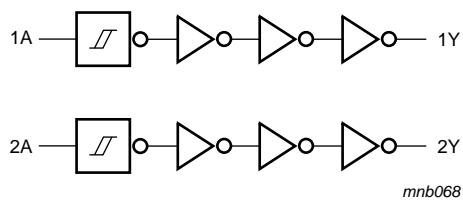


Fig 3. Logic diagram

## 7. Pinning information

### 7.1 Pinning

<p>Fig 4. Pin configuration SOT363 and SOT457</p>	<p>Fig 5. Pin configuration SOT886</p>	<p>Fig 6. Pin configuration SOT891, SOT1115 and SOT1202</p>
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### 7.2 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

## 8. Functional description

Table 4. Function table<sup>[1]</sup>

Input	Output
nA	nY
L	L
H	H

[1] H = HIGH voltage level; L = LOW voltage level.

## 9. 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
V <sub>I</sub>	input voltage		[1]	-0.5	+6.5
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-	-50	mA
V <sub>O</sub>	output voltage	Active mode	[1][2]	-0.5	V <sub>CC</sub> + 0.5
		Power-down mode	[1][2]	-0.5	+6.5
I <sub>O</sub>	output current	V <sub>O</sub> = 0 V to V <sub>CC</sub>	-	±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 <sub>amb</sub> = -40 °C to +125 °C	[3]	-	300 mW

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

[2] When V<sub>CC</sub> = 0 V (Power-down mode), the output voltage can be 5.5 V in normal operation.

[3] 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 XSON6 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

## 10. Recommended operating conditions

**Table 6. Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V
V <sub>I</sub>	input voltage		0	-	5.5	V
V <sub>O</sub>	output voltage		0	-	V <sub>CC</sub>	V
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C

## 11. Static characteristics

**Table 7. Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C[1]</b>						
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>				
		I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.3	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.55	V

**Table 7. Static characteristics ...continued**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>				
		I <sub>O</sub> = -100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	-	-	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 5.5 V	-	±0.1	±5	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	±0.1	±10	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	0.1	10	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.3 V to 5.5 V	-	5	500	µA
C <sub>I</sub>	input capacitance		-	3.5	-	pF
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>				
		I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 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
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>				
		I <sub>O</sub> = -100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	0.95	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.7	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	1.9	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.0	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.4	-	-	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 5.5 V	-	±0.1	±20	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	-	±20	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 5.5 V	-	-	40	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.3 V to 5.5 V	-	-	5	mA

[1] All typical values are measured at V<sub>CC</sub> = 3.3 V and T<sub>amb</sub> = 25 °C.

## 12. Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$t_{pd}$	propagation delay nA to nY; see <a href="#">Figure 7</a>	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$ $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ $V_{CC} = 2.7 \text{ V}$ $V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$ $V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	[2]					
			1.5	5.6	10.5	1.5	13.1	ns
			1.0	3.7	6.5	1.0	8.5	ns
			1.0	3.8	6.5	1.0	8.5	ns
			1.0	3.6	5.7	1.0	7.1	ns
$C_{PD}$	power dissipation capacitance	per buffer; $V_{CC} = 3.3 \text{ V}$ ; $V_I = \text{GND to } V_{CC}$	[3]	-	16.3	-	-	pF

[1] Typical values are measured at  $T_{amb} = 25 \text{ }^{\circ}\text{C}$  and  $V_{CC} = 1.8 \text{ V}, 2.5 \text{ V}, 2.7 \text{ V}, 3.3 \text{ V}$  and  $5.0 \text{ V}$  respectively.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

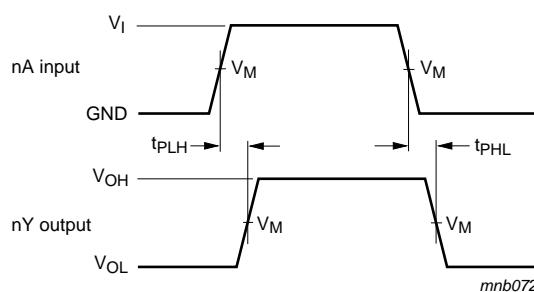
$C_L$  = output load capacitance in pF;

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

N = number of inputs switching;

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

## 13. Waveforms



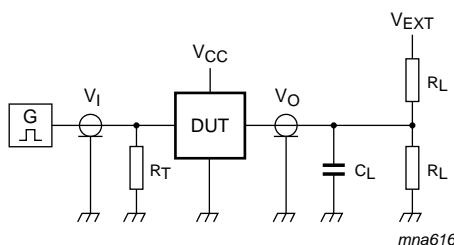
Measurement points are given in [Table 9](#).

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

**Fig 7. The input (nA) to output (nY) propagation delays and the output transition times**

**Table 9. Measurement points**

Supply voltage	Input	Output
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>
1.65 V to 1.95 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
2.3 V to 2.7 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
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 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>



Measurement points are given in [Table 10](#).

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

C<sub>L</sub> = Load capacitance including jig and probe capacitance.

R<sub>T</sub> = Termination resistance should be equal to output impedance Z<sub>o</sub> of the pulse generator.

V<sub>EXT</sub> = External voltage for measuring switching times.

**Fig 8. Test circuit for measuring switching times****Table 10. Test data**

Supply voltage	Load			V <sub>EXT</sub>	
V <sub>CC</sub>	V <sub>I</sub>	t <sub>r</sub> , t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open

## 14. Transfer characteristics

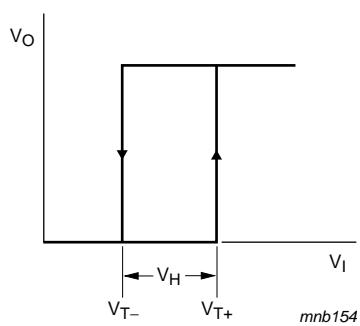
**Table 11. Transfer characteristics**

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

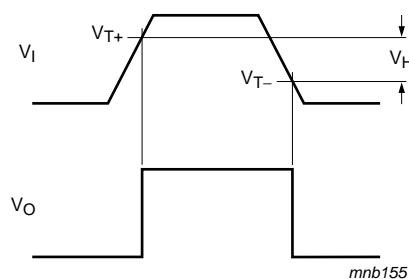
Symbol	Parameter	Conditions	−40 °C to +85 °C			−40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$V_{T+}$	positive-going threshold voltage see <a href="#">Figure 9</a> and <a href="#">Figure 10</a>	$V_{CC} = 1.8 \text{ V}$	0.70	1.10	1.50	0.70	1.70	V
		$V_{CC} = 2.3 \text{ V}$	1.00	1.40	1.80	1.00	2.00	V
		$V_{CC} = 3.0 \text{ V}$	1.30	1.76	2.20	1.30	2.40	V
		$V_{CC} = 4.5 \text{ V}$	1.90	2.47	3.10	1.90	3.30	V
		$V_{CC} = 5.5 \text{ V}$	2.20	2.91	3.60	2.20	3.80	V
$V_{T-}$	negative-going threshold voltage see <a href="#">Figure 9</a> and <a href="#">Figure 10</a>	$V_{CC} = 1.8 \text{ V}$	0.25	0.61	0.90	0.25	1.10	V
		$V_{CC} = 2.3 \text{ V}$	0.40	0.80	1.15	0.40	1.35	V
		$V_{CC} = 3.0 \text{ V}$	0.60	1.04	1.50	0.60	1.70	V
		$V_{CC} = 4.5 \text{ V}$	1.00	1.55	2.00	1.00	2.20	V
		$V_{CC} = 5.5 \text{ V}$	1.20	1.86	2.30	1.20	2.50	V
$V_H$	hysteresis voltage ( $V_{T+} - V_{T-}$ ); see <a href="#">Figure 9</a> , <a href="#">Figure 10</a> and <a href="#">Figure 11</a>	$V_{CC} = 1.8 \text{ V}$	0.15	0.49	1.00	0.15	1.20	V
		$V_{CC} = 2.3 \text{ V}$	0.25	0.60	1.10	0.25	1.30	V
		$V_{CC} = 3.0 \text{ V}$	0.40	0.73	1.20	0.40	1.40	V
		$V_{CC} = 4.5 \text{ V}$	0.60	0.92	1.50	0.60	1.70	V
		$V_{CC} = 5.5 \text{ V}$	0.70	1.02	1.70	0.70	1.90	V

[1] All typical values are measured at  $T_{\text{amb}} = 25 \text{ }^{\circ}\text{C}$ .

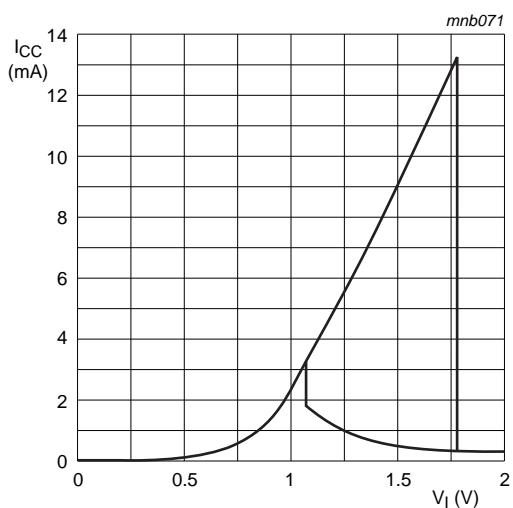
## 15. Waveforms transfer characteristics



**Fig 9. Transfer characteristic**

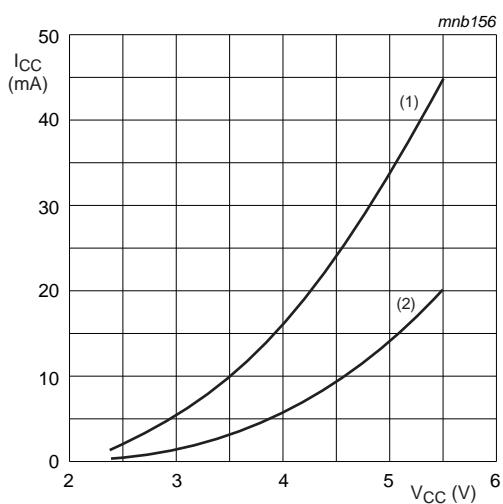


**Fig 10. Definition of  $V_{T+}$ ,  $V_{T-}$  and  $V_H$**



$V_{CC} = 3.0$  V.

Fig 11. Typical transfer characteristic



(1) Positive-going edge

(2) Negative-going edge

Linear change of  $V_I$  between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.

Fig 12. Average  $I_{CC}$  as a function of  $V_{CC}$

## 16. Package outline

Plastic surface-mounted package; 6 leads

SOT363

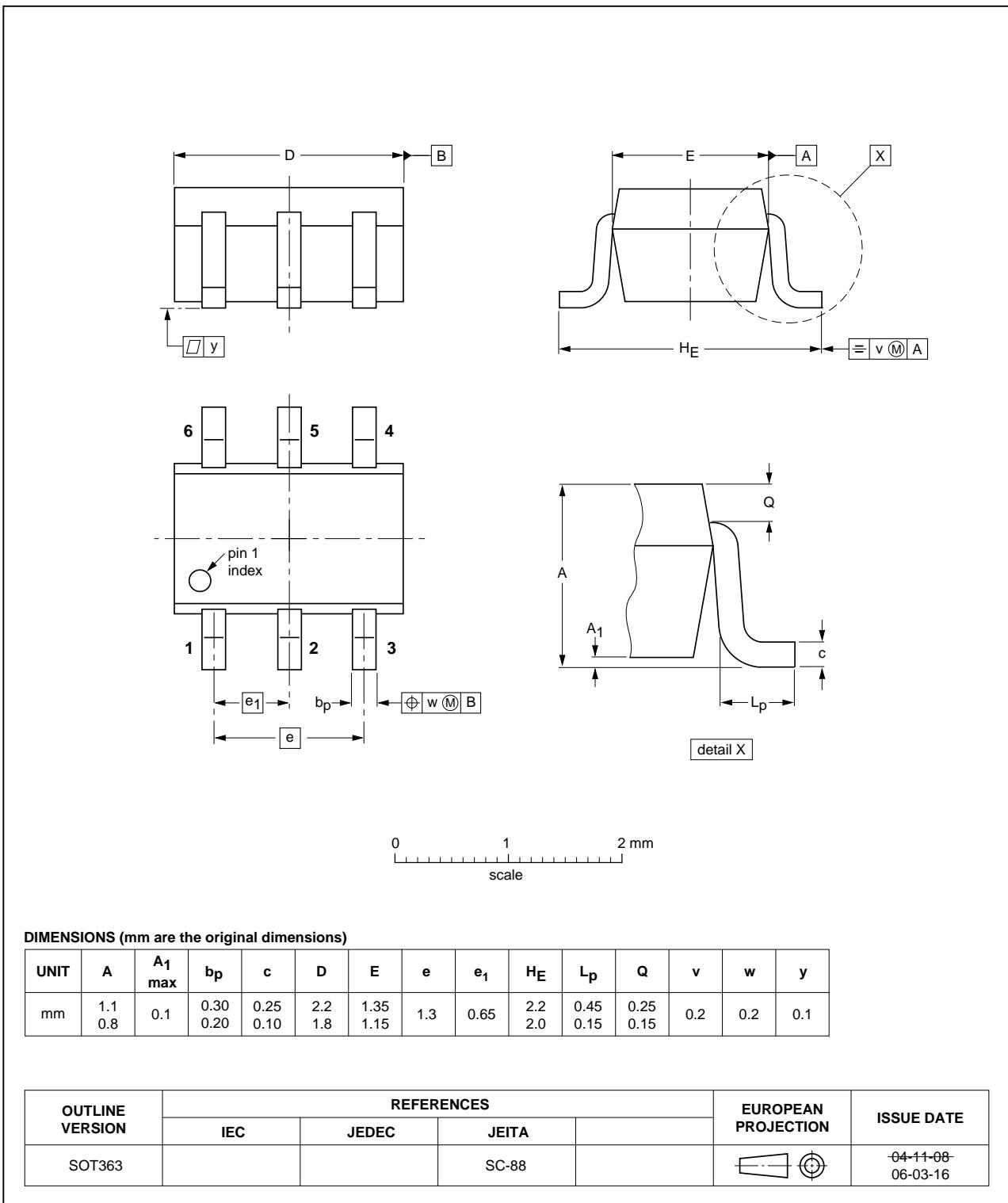


Fig 13. Package outline SOT363 (SC-88)

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

SOT457

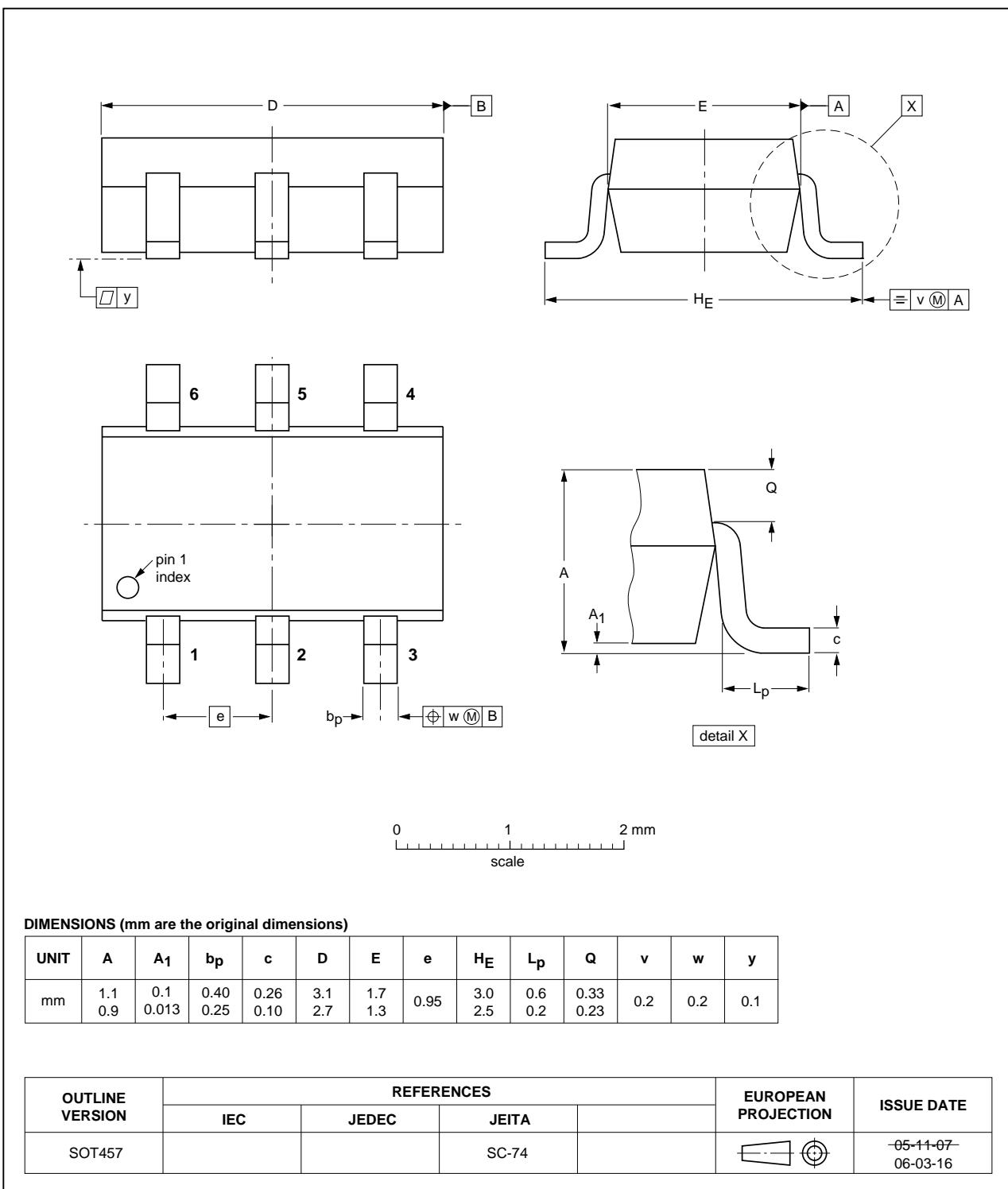


Fig 14. Package outline SOT457 (SC-74)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body  $1 \times 1.45 \times 0.5$  mm

SOT886

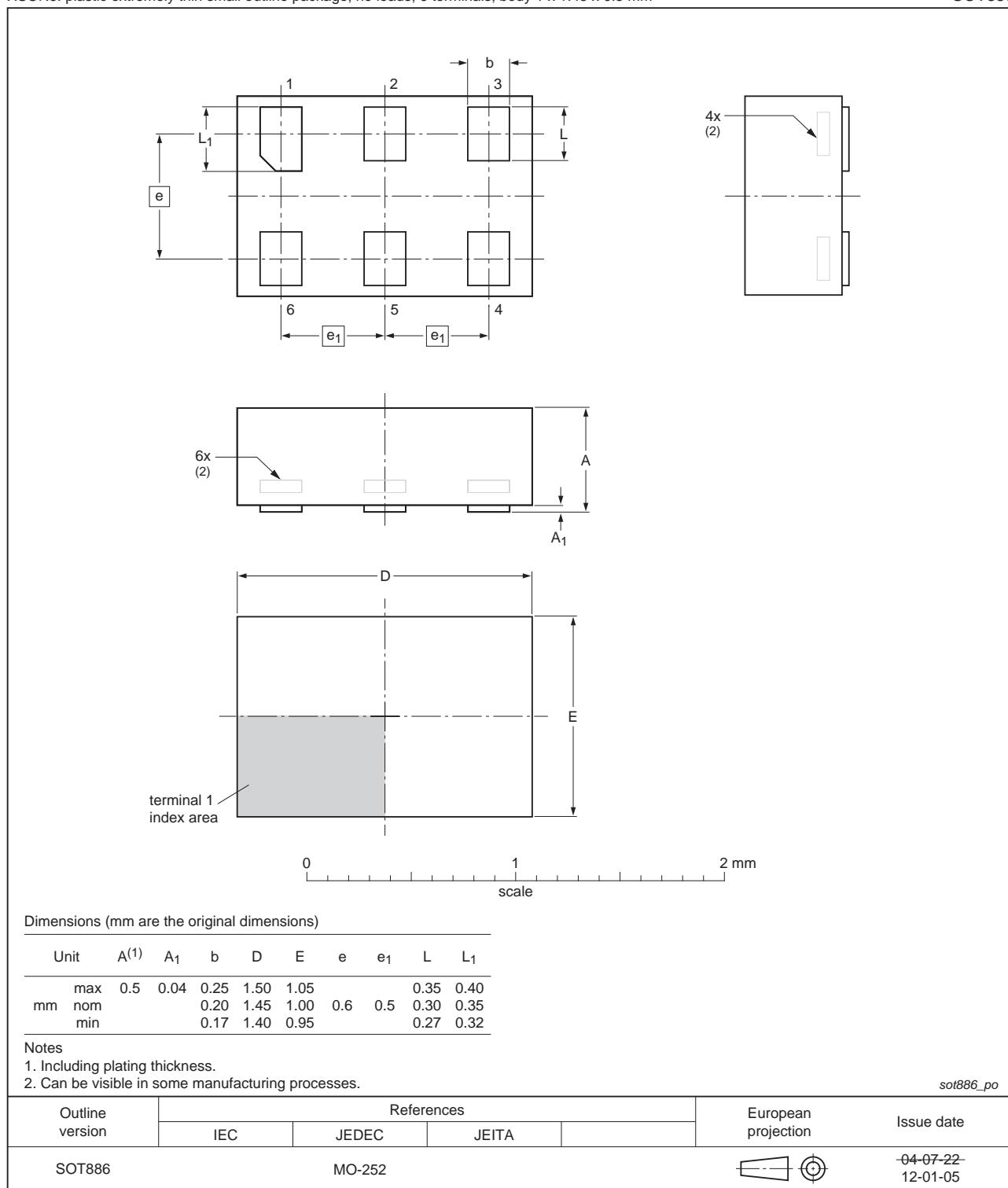
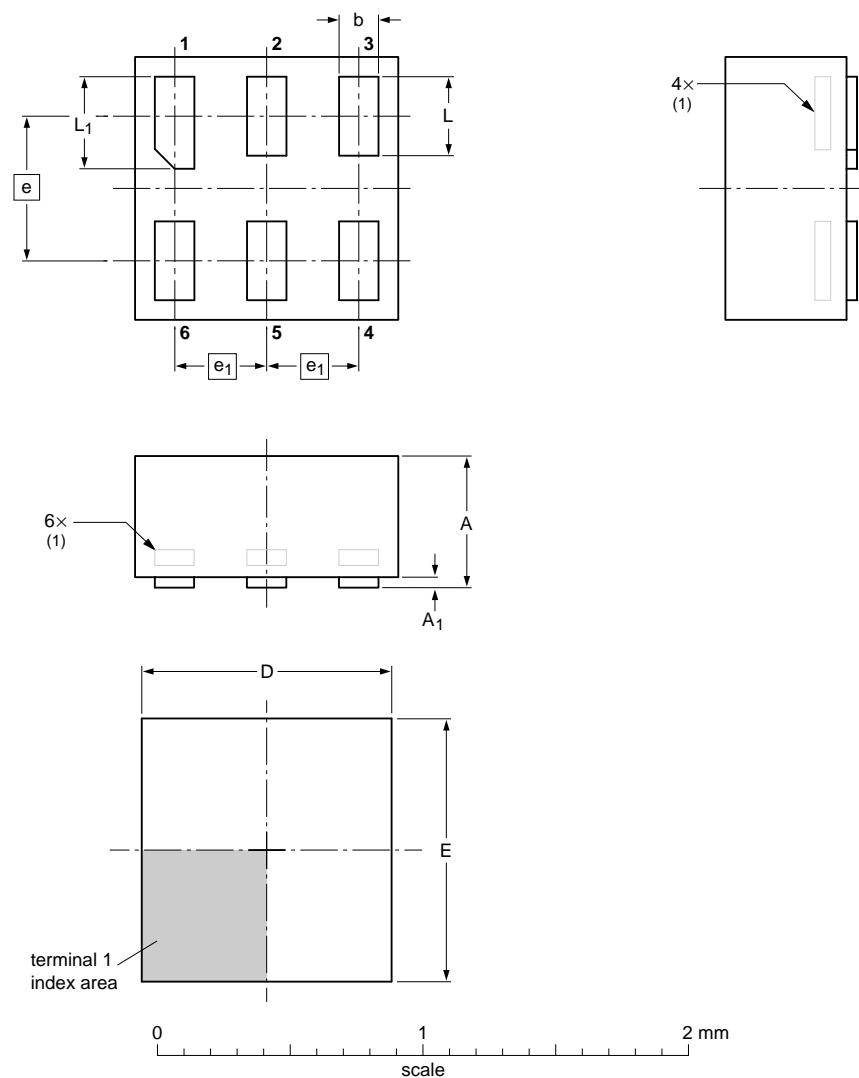


Fig 15. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891



## DIMENSIONS (mm are the original dimensions)

UNIT	A max	A <sub>1</sub> max	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
mm	0.5	0.04	0.20 0.12	1.05 0.95	1.05 0.95	0.55	0.35	0.35 0.27	0.40 0.32

## Note

1. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT891						05-04-06 07-05-15

Fig 16. Package outline SOT891 (XSON6)

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

SOT1115

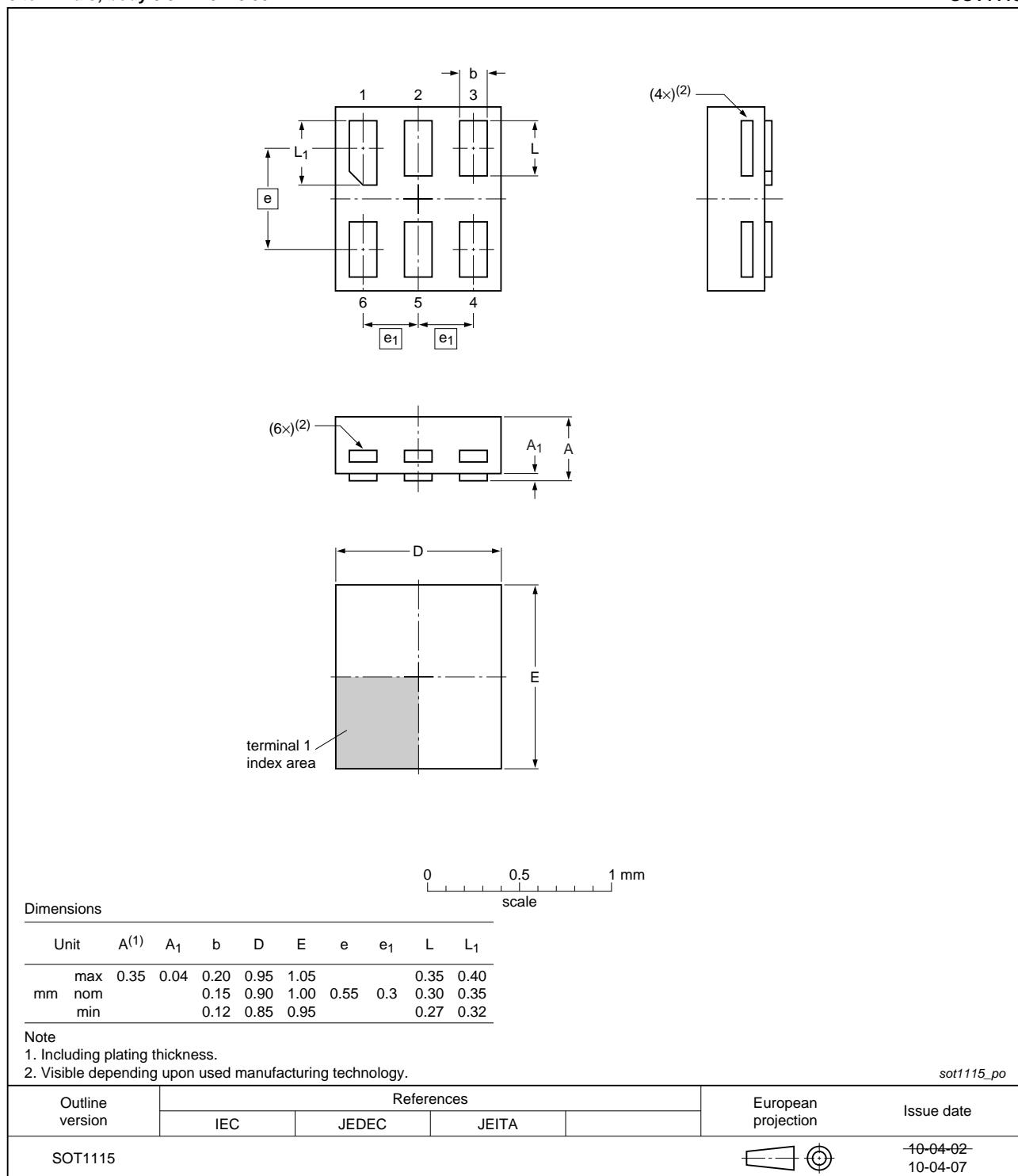


Fig 17. Package outline SOT1115 (XSON6)

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

SOT1202

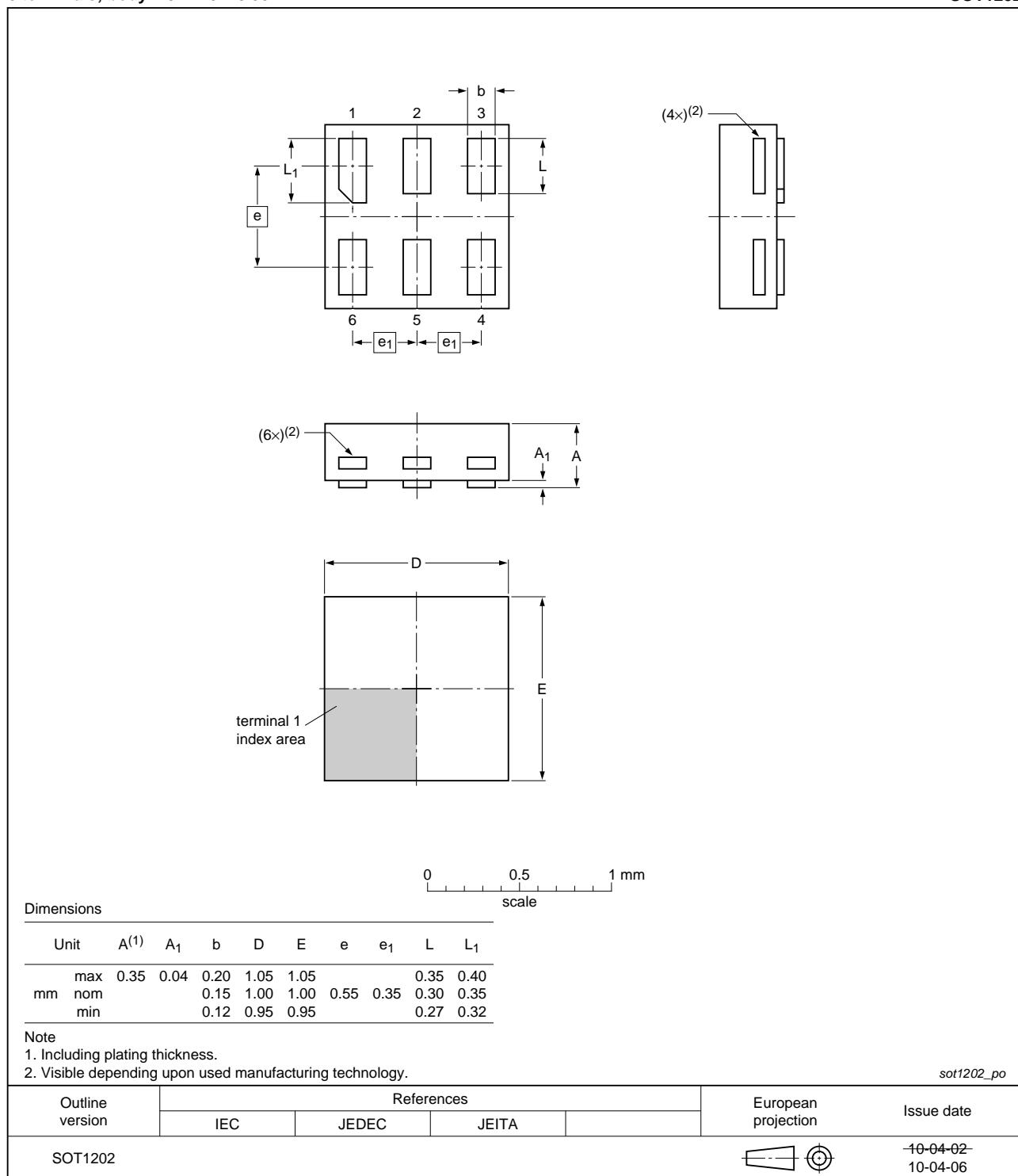


Fig 18. Package outline SOT1202 (XSON6)

## 17. Abbreviations

**Table 12. 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

## 18. Revision history

**Table 13. Revision history**

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G17 v.8	20130502	Product data sheet	-	74LVC2G17 v.7
Modifications:		• <a href="#">Table 3</a> : the description of pin 6 changed from data input to data output.		
74LVC2G17 v.6	20110921	Product data sheet	-	74LVC2G17 v.5
74LVC2G17 v.5	20100806	Product data sheet	-	74LVC2G17 v.4
74LVC2G17 v.4	20061009	Product data sheet	-	74LVC2G17 v.3
74LVC2G17 v.3	20050926	Product data sheet	-	74LVC2G17 v.2
74LVC2G17 v.2	20040908	Product specification	-	74LVC2G17 v.1
74LVC2G17 v.1	20030813	Product specification	-	-

## 19. Legal information

### 19.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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