# 74LVC2G17

# **Dual non-inverting Schmitt trigger with 5 V tolerant input**

Rev. 7 — 1 December 2011

**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<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.

### 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<sub>CC</sub> = 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



### Dual non-inverting Schmitt trigger with 5 V tolerant input

# 4. Ordering information

Table 1. Ordering information

Type number	Package							
	Temperature range	Name	Description	Version				
74LVC2G17GW	−40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363				
74LVC2G17GV	−40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457				
74LVC2G17GM	–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				
74LVC2G17GF	–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				
74LVC2G17GN	–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				
74LVC2G17GS	–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				

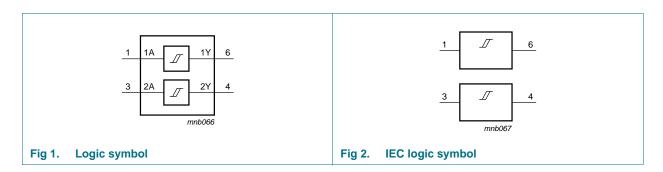
## 5. Marking

Table 2. Marking codes

Type number	Marking code[1]
74LVC2G17GW	VV
74LVC2G17GV	VV
74LVC2G17GM	VV
74LVC2G17GF	VV
74LVC2G17GN	VV
74LVC2G17GS	VV

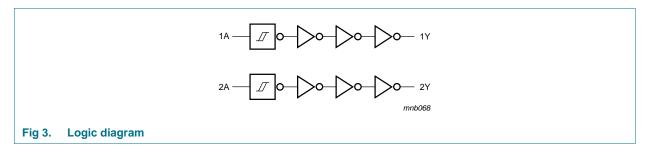
<sup>[1]</sup> The pin 1 indicator is located on the lower left corner of the device, below the marking code.

## 6. Functional diagram



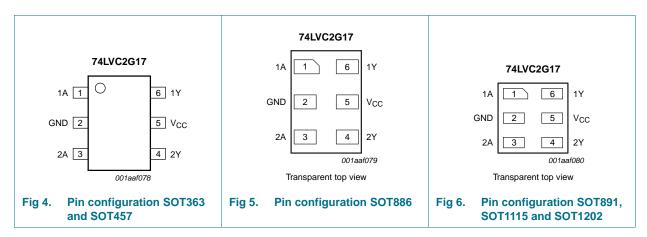
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#### Dual non-inverting Schmitt trigger with 5 V tolerant input



### **Pinning information**

### 7.1 Pinning



#### 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
$V_{CC}$	5	supply voltage
1Y	6	data input

## **Functional description**

Table 4. Function table[1]

**Product data sheet** 

Input	Output
nA	nY
L	L
Н	Н

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

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### Dual non-inverting Schmitt trigger with 5 V tolerant input

## 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
$V_{CC}$	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	$V_I < 0 V$	-	-50	mA
$V_{I}$	input voltage		<u>[1]</u> –0.5	+6.5	V
l <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-	-50	mA
Vo	output voltage	Active mode	<u>[1][2]</u> –0.5	$V_{CC} + 0.5$	V
		Power-down mode	<u>[1][2]</u> –0.5	+6.5	V
lo	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
$I_{GND}$	ground current		-	-100	mA
T <sub>stg</sub>	storage temperature		<b>–65</b>	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +125  ^{\circ}\text{C}$	[3] _	300	mW

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

# 10. Recommended operating conditions

Table 6. Recommended operating conditions

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		0	-	$V_{CC}$	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	Тур	Max	Unit
T <sub>amb</sub> = -	-40 °C to +85 °C <u>[1]</u>					
$V_{OL}$	LOW-level output voltage	$V_I = V_{T+}$ or $V_{T-}$				
		$I_O$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		$I_O = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	V
		$I_{O}$ = 8 mA; $V_{CC}$ = 2.3 V	-	-	0.3	V
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	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

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

### Dual non-inverting Schmitt trigger with 5 V tolerant input

**Table 7. Static characteristics** ...continued
At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{T+}$ or $V_{T-}$				
		$I_O = -100 \mu A$ ; $V_{CC} = 1.65 \text{ V}$ to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	-	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	-	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	-		V
l <sub>l</sub>	input leakage current	$V_{I} = 5.5 \text{ V or GND}; V_{CC} = 5.5 \text{ V}$	-	±0.1	±5	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	±10	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	0.1	10	μА
Δl <sub>CC</sub>	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V} \text{ to } 5.5 \text{ V}$	-	5	500	μА
Cı	input capacitance		-	3.5	-	pF
T <sub>amb</sub> = -	40 °C to +125 °C					
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{T+}$ or $V_{T-}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		$I_O = 4 \text{ mA}$ ; $V_{CC} = 1.65 \text{ V}$	-	-	0.70	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.45	V
		$I_{O} = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	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
V <sub>OH</sub>	HIGH-level output voltage	$V_I = V_{T+}$ or $V_{T-}$				
		$I_{O} = -100 \mu A$ ; $V_{CC} = 1.65 V$ to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	0.95	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.7	-	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	1.9	-	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.0	-	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.4	-	-	V
l <sub>l</sub>	input leakage current	$V_I = 5.5 \text{ V or GND}; V_{CC} = 5.5 \text{ V}$	-	±0.1	±20	μΑ
I <sub>OFF</sub>	power-off leakage current	$V_I$ or $V_O = 5.5 \text{ V}$ ; $V_{CC} = 0 \text{ V}$	-	-	±20	μΑ
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5 \text{ V}$	-	-	40	μА
$\Delta I_{CC}$	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V} \text{ to } 5.5 \text{ V}$	-	-	5	mA

<sup>[1]</sup> All typical values are measured at  $V_{CC}$  = 3.3 V and  $T_{amb}$  = 25 °C.

#### Dual non-inverting Schmitt trigger with 5 V tolerant input

## 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[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA to nY; see Figure 7	[2]						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.5	5.6	10.5	1.5	13.1	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.0	3.7	6.5	1.0	8.5	ns
		$V_{CC} = 2.7 \text{ V}$		1.0	3.8	6.5	1.0	8.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$		1.0	3.6	5.7	1.0	7.1	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$		1.0	2.7	4.3	1.0	5.4	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

<sup>[1]</sup> 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.

[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;

 $f_o$  = output frequency in MHz;

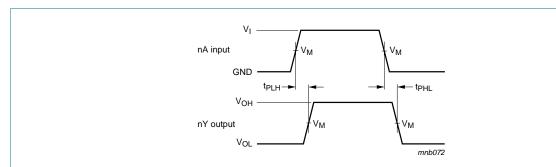
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

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

#### 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

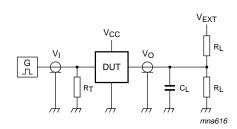
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<sup>[2]</sup>  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

### Dual non-inverting Schmitt trigger with 5 V tolerant input

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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



Measurement points are 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 output impedance  $Z_o$  of the pulse generator.

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

Fig 8. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input I		Load	V <sub>EXT</sub>	
V <sub>CC</sub>	VI	t <sub>r</sub> , t <sub>f</sub>	CL	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	$V_{CC}$	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	$V_{CC}$	≤ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	≤ 2.5 ns	50 pF	$500~\Omega$	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	$V_{CC}$	≤ 2.5 ns	50 pF	500 Ω	open

### Dual non-inverting Schmitt trigger with 5 V tolerant input

### 14. Transfer characteristics

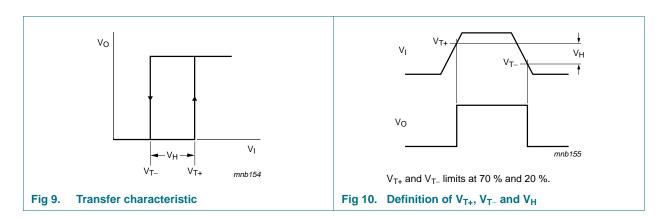
Table 11. Transfer characteristics

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

Symbol Parameter		Conditions	-40	–40 °C to +85 °C			-40 °C to +125 °C	
			Min	Typ[1]	Max	Min	Max	
$V_{T+}$	positive-going	see Figure 9 and Figure 10						
	threshold voltage	V <sub>CC</sub> = 1.8 V	0.70	1.10	1.50	0.70	1.70	V
		V <sub>CC</sub> = 2.3 V	1.00	1.40	1.80	1.00	2.00	V
		V <sub>CC</sub> = 3.0 V	1.30	1.76	2.20	1.30	2.40	V
		V <sub>CC</sub> = 4.5 V	1.90	2.47	3.10	1.90	3.30	V
		V <sub>CC</sub> = 5.5 V	2.20	2.91	3.60	2.20 3.	3.80	V
$V_{T-}$	negative-going threshold voltage	see Figure 9 and Figure 10						
		V <sub>CC</sub> = 1.8 V	0.25	0.61	0.90	0.25	1.10	V
		V <sub>CC</sub> = 2.3 V	0.40	0.80	1.15	0.40	1.35	V
		V <sub>CC</sub> = 3.0 V	0.60	1.04	1.50	0.60	1.70	V
		V <sub>CC</sub> = 4.5 V	1.00	1.55	2.00	1.00	2.20	V
		V <sub>CC</sub> = 5.5 V	1.20	1.86	2.30	1.20	2.50	V
$V_{H}$	hysteresis voltage	(V <sub>T+</sub> – V <sub>T-</sub> ); see <u>Figure 9</u> , <u>Figure 10</u> and <u>Figure 11</u>						
		V <sub>CC</sub> = 1.8 V	0.15	0.49	1.00	0.15	1.20	V
		V <sub>CC</sub> = 2.3 V	0.25	0.60	1.10	0.25	1.30	V
		V <sub>CC</sub> = 3.0 V	0.40	0.73	1.20	0.40	1.40	V
		V <sub>CC</sub> = 4.5 V	0.60	0.92	1.50	0.60	1.70	V
		V <sub>CC</sub> = 5.5 V	0.70	1.02	1.70	0.70	1.90	V

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

## 15. Waveforms transfer characteristics

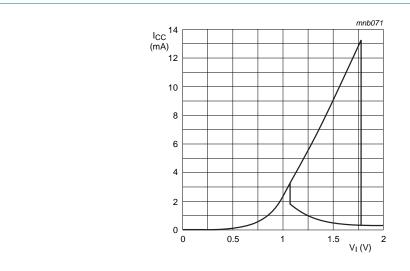


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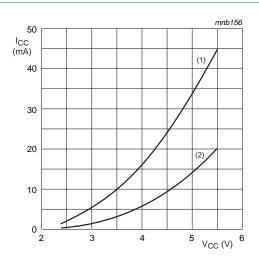
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 $V_{CC} = 3.0 \text{ V}.$ 

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<sub>CC</sub> as a function of V<sub>CC</sub>

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# 16. Package outline

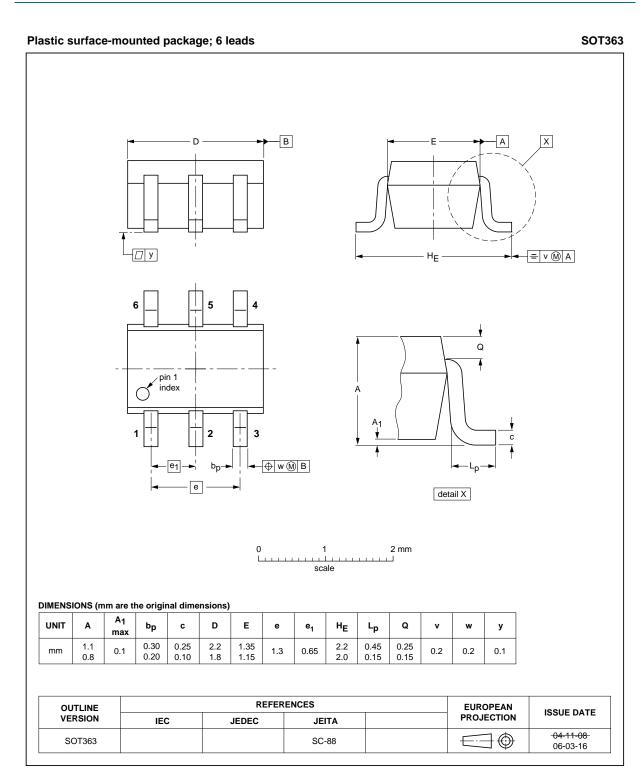


Fig 13. Package outline SOT363 (SC-88)

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

**SOT457** 

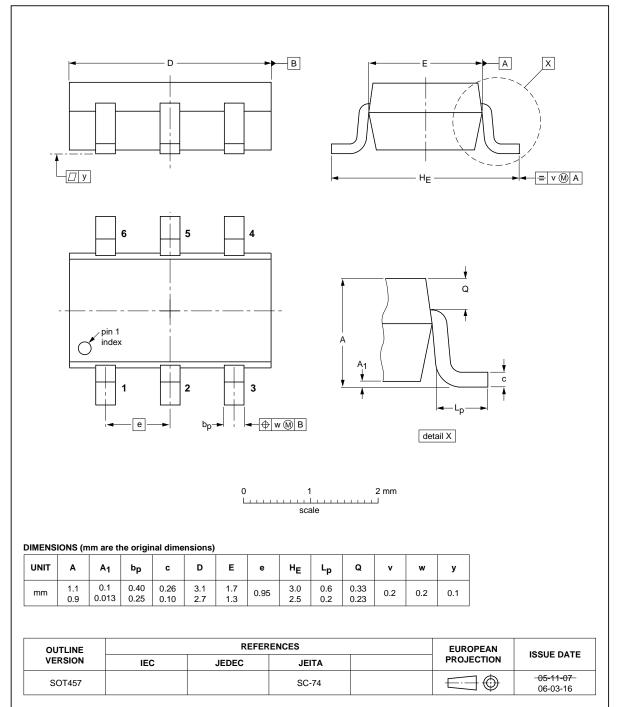


Fig 14. Package outline SOT457 (SC-74)

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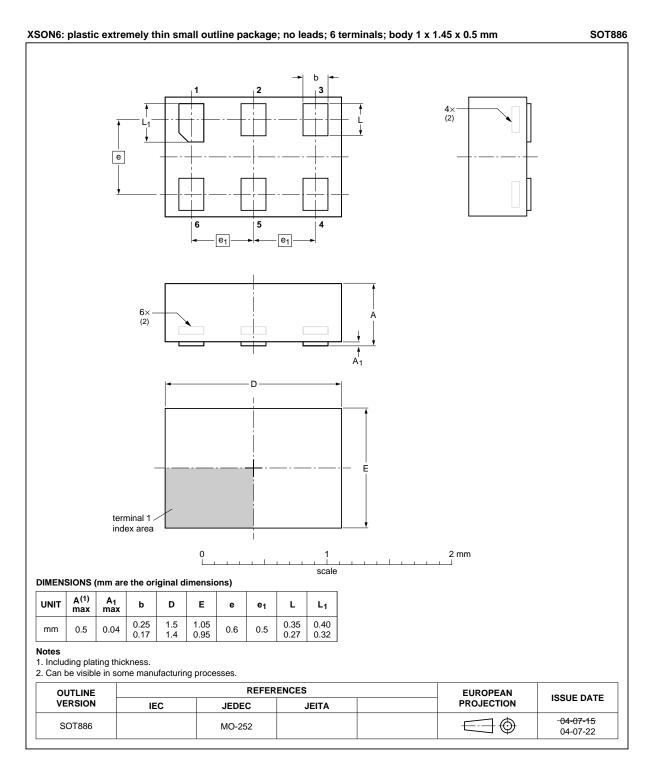


Fig 15. Package outline SOT886 (XSON6)

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Product data sheet

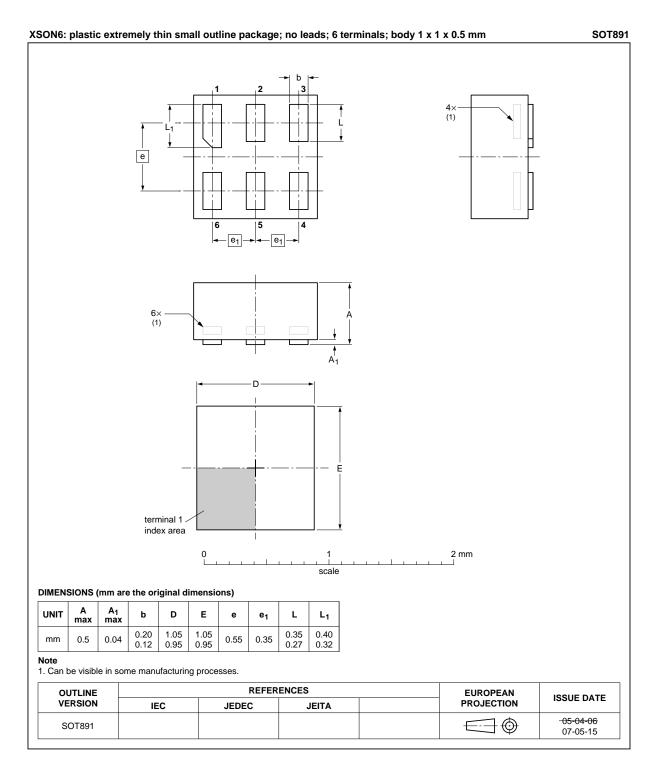


Fig 16. Package outline SOT891 (XSON6)

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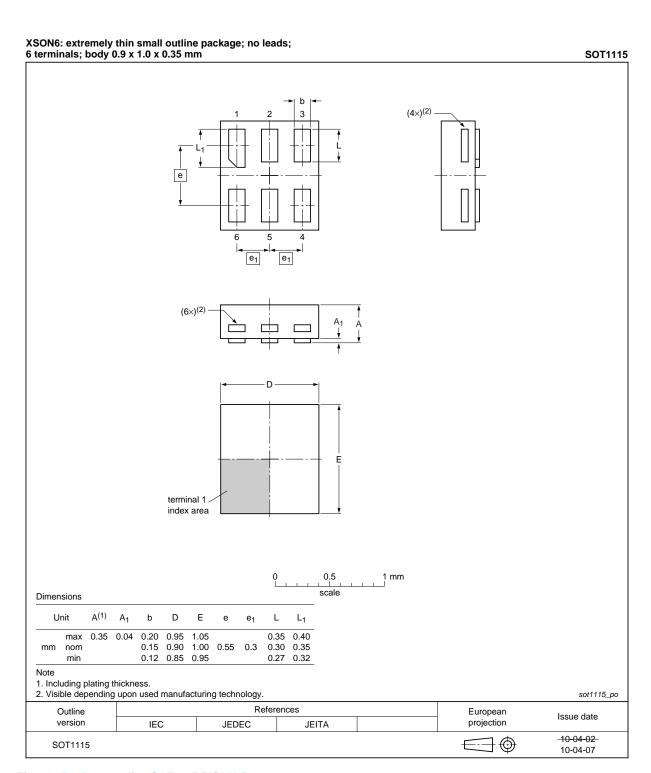


Fig 17. Package outline SOT1115 (XSON6)

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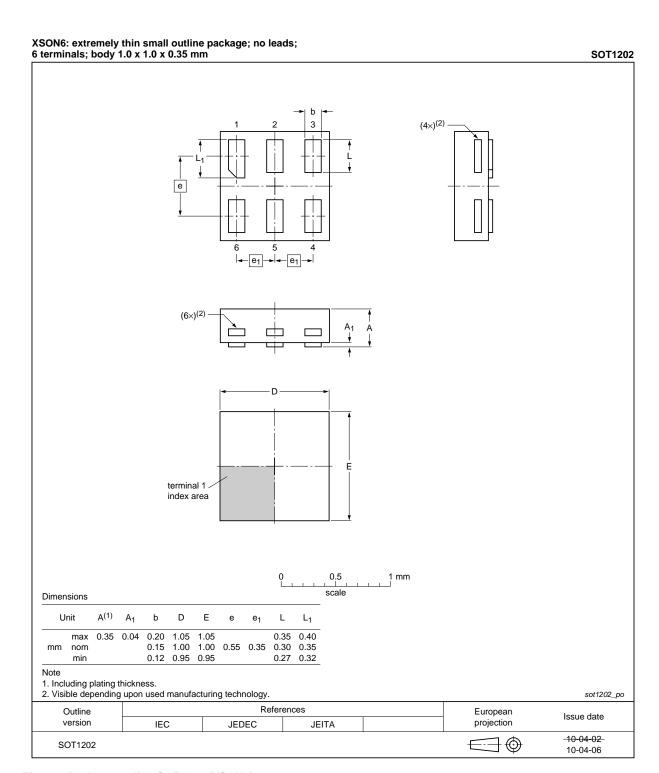


Fig 18. Package outline SOT1202 (XSON6)

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### Dual non-inverting Schmitt trigger with 5 V tolerant input

### 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.7         20111201         Product data sheet         -         74LVC2G17 v.6           Modifications:         • Legal pages updated.           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         -         -					
Modifications:         ● Legal pages updated.           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	Document ID	Release date	Data sheet status	Change notice	Supersedes
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#### Dual non-inverting Schmitt trigger with 5 V tolerant input

### 19. Legal information

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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.
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#### Dual non-inverting Schmitt trigger with 5 V tolerant input

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Dual non-inverting Schmitt trigger with 5 V tolerant input

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