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<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



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#### **Ordering information** 4.

Table 1. Orderin	ng 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				

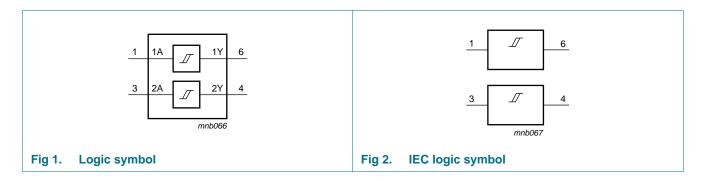
#### Marking 5.

#### Table 2. Marking codes

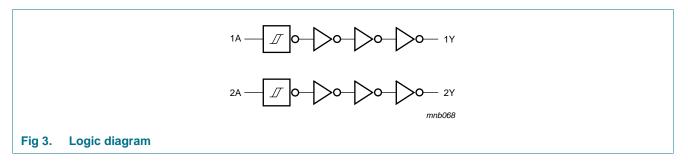
Type number	Marking code <sup>[1]</sup>
74LVC2G17GW	VV
74LVC2G17GV	VV
74LVC2G17GM	VV
74LVC2G17GF	VV
74LVC2G17GN	VV
74LVC2G17GS	VV

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

#### **Functional diagram** 6.

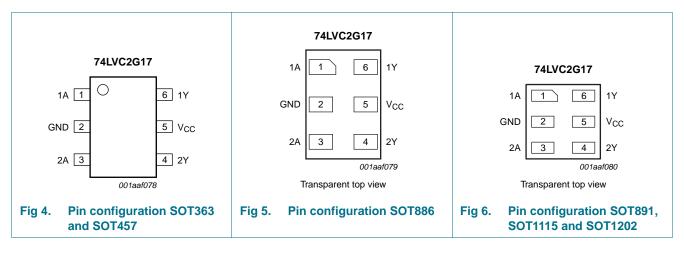


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## 7. Pinning information

### 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 <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
Н	Н

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

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#### **Limiting values** 9.

#### 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>1</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][2]</u> –0.5	$V_{CC} + 0.5$	V
		Power-down mode	<u>[1][2]</u> –0.5	+6.5	V
lo	output current	$V_{O} = 0 V$ to $V_{CC}$	-	±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 °C to +125 °C	<u>[3]</u>	300	mW

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

[2] When  $V_{CC} = 0 V$  (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 Ptot derates linearly with 4.0 mW/K. For XSON6 packages: above 118 °C the value of Ptot derates linearly with 7.8 mW/K.

### 10. 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		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).

Symbo	ol Parameter	Conditions	Min	Тур	Мах	Unit
T <sub>amb</sub> =	–40 °C to +85 °C[1]					
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
		$I_0 = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	V
		$I_0 = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.3	V
		$I_0 = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	V
		$I_0 = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	V
		$I_0 = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.55	V

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### Table 7. Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
V <sub>он</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	$V_{CC}-0.1$	-	    ±0.1 ±5 ±0.1 ±10 0.1 10 5 500 3.5 -	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	V
		$I_0 = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	-	-	V
		$I_0 = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	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
I <sub>I</sub>	input leakage current	$V_{I}$ = 5.5 V or GND; $V_{CC}$ = 5.5 V	-	±0.1	±5	μA
I <sub>OFF</sub>	power-off leakage current	$V_{1} \text{ or } V_{O} = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	±0.1	±10	μA
I <sub>CC</sub>	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	0.1	10	μA
Δl <sub>CC</sub>	additional supply current		-	5	500	μA
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 $\mu\text{A};V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		$I_0 = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.70	V
		$I_{O} = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.45	V
		$I_0 = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.60	V
		$I_0 = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.80	V
		$I_0 = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.80	V
V <sub>он</sub>	HIGH-level output voltage	$V_I = V_{T+}$ or $V_{T-}$				
		$I_{O}$ = $-100~\mu\text{A};~V_{CC}$ = 1.65 V to 5.5 V	$V_{CC}-0.1$	-	-	V
		$I_0 = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	0.95	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.7	-	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	1.9	-	-	V
		$I_{O} = -24$ mA; $V_{CC} = 3.0$ V	2.0	-	-	V
		$I_O = -32$ mA; $V_{CC} = 4.5$ V	3.4	-	-	V
l	input leakage current	$V_{I}$ = 5.5 V or GND; $V_{CC}$ = 5.5 V	-	±0.1	±20	μA
I <sub>OFF</sub>	power-off leakage current	$V_{I}$ or $V_{O}$ = 5.5 V; $V_{CC}$ = 0 V	-	-	±20	μA
сс	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	40	μA
Δl <sub>CC</sub>	additional supply current		-	-	5	mA

[1] All typical values are measured at V\_{CC} = 3.3 V and T\_{amb} = 25 °C.

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## **12. Dynamic characteristics**

#### Table 8. Dynamic characteristics

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

Symbol	Parameter	Conditions	Conditions		–40 °C to +85 °C			–40 °C to +125 °C		
				Min	Typ <mark>[1]</mark>	Max	Min	Max		
t <sub>pd</sub>	propagation delay	nA to nY; see Figure 7	[2]							
		$V_{CC}$ = 1.65 V to 1.95 V		1.5	5.6	10.5	1.5	13.1	ns	
		$V_{CC}$ = 2.3 V to 2.7 V		1.0	3.7	6.5	1.0	8.5	ns	
		$V_{CC} = 2.7 V$		1.0	3.8	6.5	1.0	8.5	ns	
		$V_{CC}$ = 3.0 V to 3.6 V		1.0	3.6	5.7	1.0	7.1	ns	
		$V_{CC}$ = 4.5 V to 5.5 V		1.0	2.7	4.3	1.0	5.4	ns	
$C_{PD}$	power dissipation capacitance	per buffer; $V_{CC}$ = 3.3 V; $V_{I}$ = GND to $V_{CC}$	<u>[3]</u>	-	16.3	-	-	-	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  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W).

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

f<sub>i</sub> = input frequency in MHz;

 $f_o = output frequency in MHz;$ 

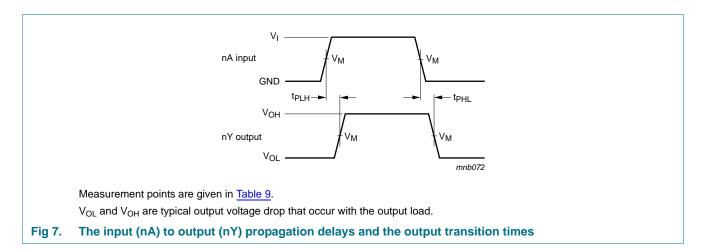
 $C_L$  = output load capacitance in pF;

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

N = number of inputs switching;

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

## 13. Waveforms



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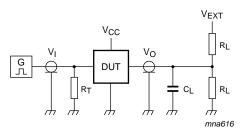
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Supply voltage	Input	Output
V <sub>cc</sub>	V <sub>M</sub>	V <sub>M</sub>
1.65 V to 1.95 V	$0.5  imes V_{CC}$	$0.5  imes V_{CC}$
2.3 V to 2.7 V	$0.5  imes V_{CC}$	$0.5 \times V_{CC}$
2.7 V	1.5 V	1.5 V
3.0 V to 3.6 V	1.5 V	1.5 V
4.5 V to 5.5 V	$0.5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

#### Table 9.Measurement points



Measurement points are given in Table 10.

Definitions for test circuit:

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

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to output impedance  $Z_0$  of the pulse generator.

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

Fig 8. 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	RL	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	$\leq$ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	$\leq$ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	$\leq$ 2.5 ns	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	$\leq$ 2.5 ns	50 pF	500 Ω	open
4.5 V to 5.5 V	V <sub>CC</sub>	$\leq$ 2.5 ns	50 pF	500 Ω	open

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

## 14. Transfer characteristics

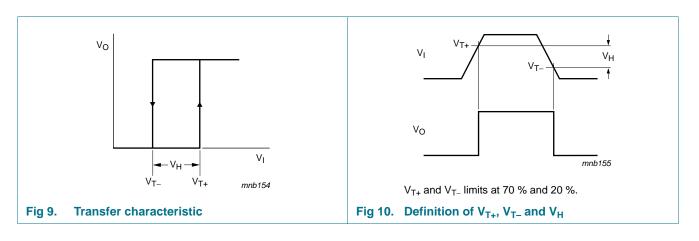
### Table 11. Transfer characteristics

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

Symbol	Parameter	Conditions	-40	0 °C to +85	°C	–40 °C to	Unit	
			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
		$V_{CC} = 2.3 V$	1.00	1.40	1.80	1.00	2.00	V
		$V_{CC} = 3.0 V$	1.30	1.76	2.20	1.30	2.40	V
		$V_{CC} = 4.5 V$	1.90	2.47	3.10	1.90	3.30	V
		$V_{CC} = 5.5 V$	2.20	2.91	3.60	2.20	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
		$V_{CC} = 2.3 V$	0.40	0.80	1.15	0.40	1.35	V
		$V_{CC} = 3.0 V$	0.60	1.04	1.50	0.60	1.70	V
		$V_{CC} = 4.5 V$	1.00	1.55	2.00	1.00	2.20	V
		$V_{CC} = 5.5 V$	1.20	1.86	2.30	1.20	2.50	V
V <sub>H</sub>	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
		$V_{CC} = 2.3 V$	0.25	0.60	1.10	0.25	1.30	V
		$V_{CC} = 3.0 V$	0.40	0.73	1.20	0.40	1.40	V
		$V_{CC} = 4.5 V$	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

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

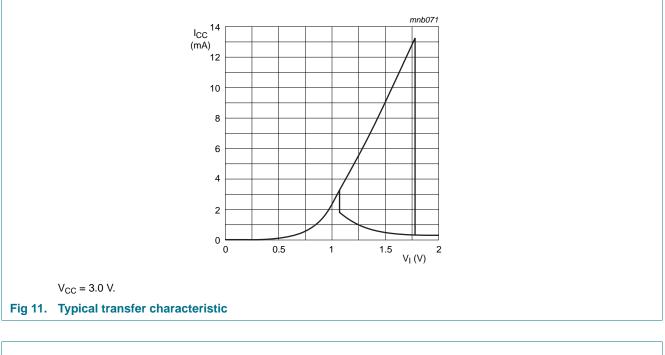
## 15. Waveforms transfer characteristics

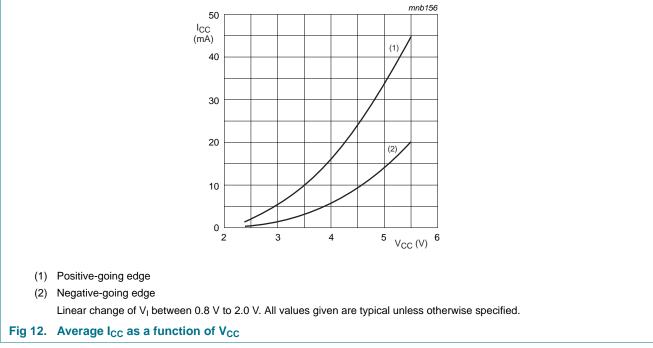


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### 16. Package outline

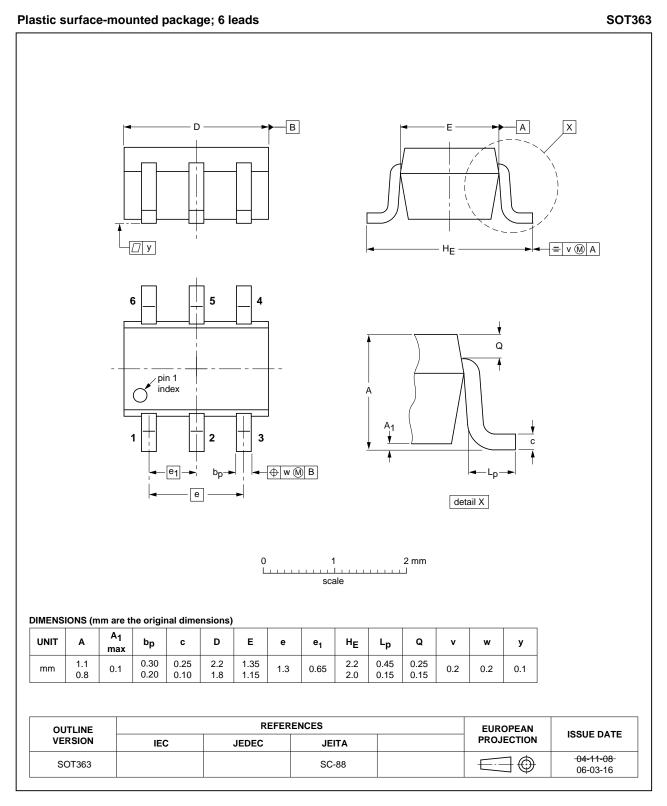


Fig 13. Package outline SOT363 (SC-88)

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Dual non-inverting Schmitt trigger with 5 V tolerant input

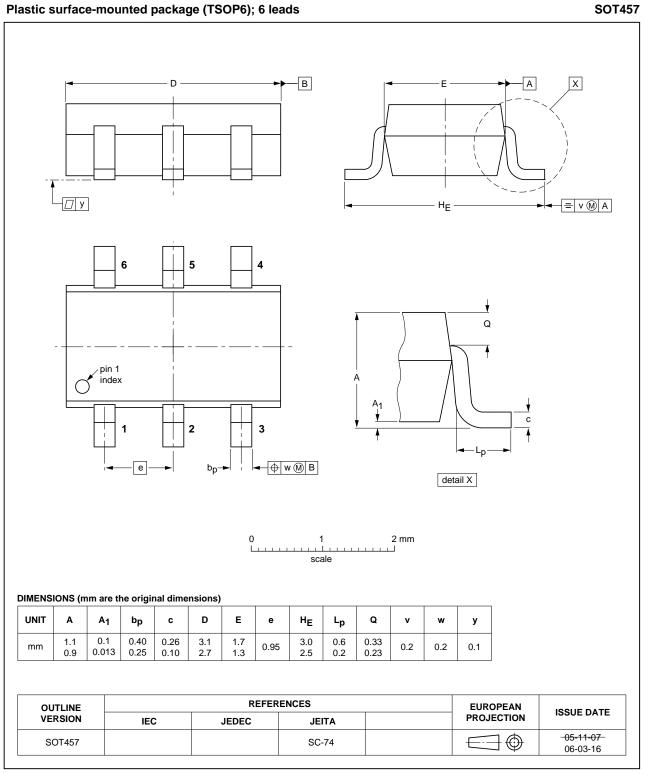
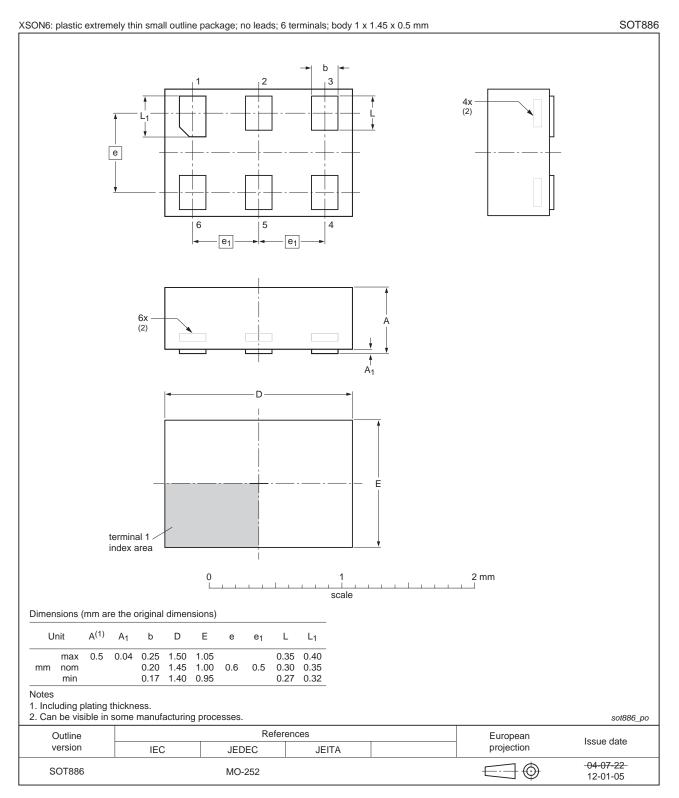


Fig 14. Package outline SOT457 (SC-74)

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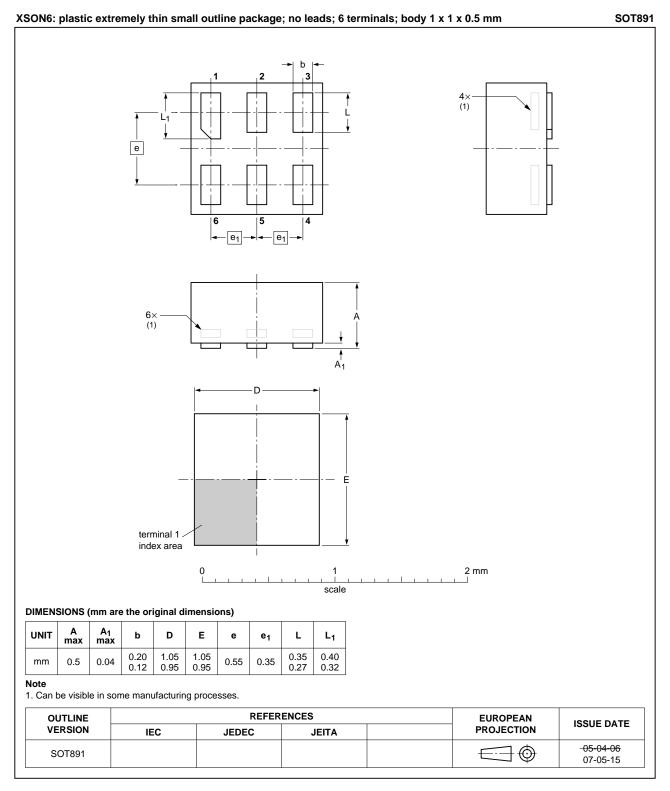
#### Dual non-inverting Schmitt trigger with 5 V tolerant input



### Fig 15. Package outline SOT886 (XSON6)

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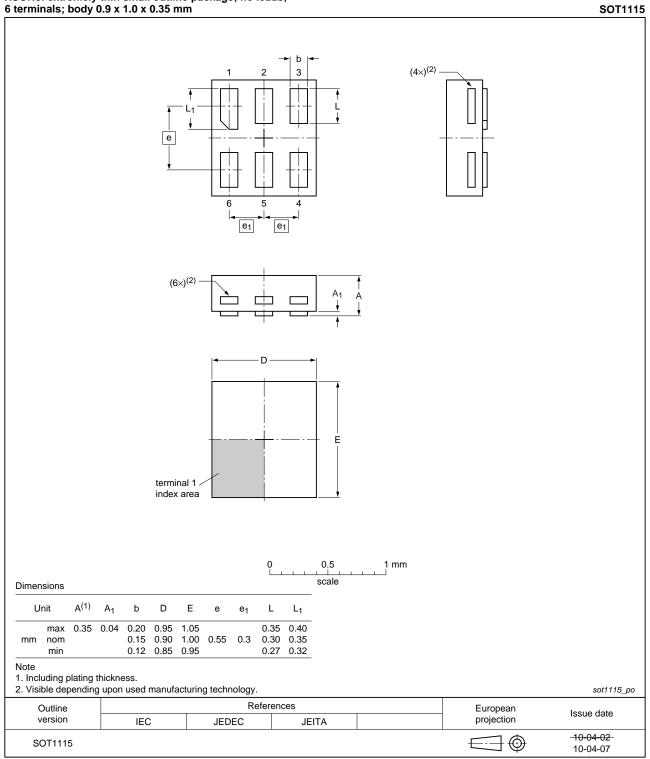
#### Dual non-inverting Schmitt trigger with 5 V tolerant input



#### Fig 16. Package outline SOT891 (XSON6)

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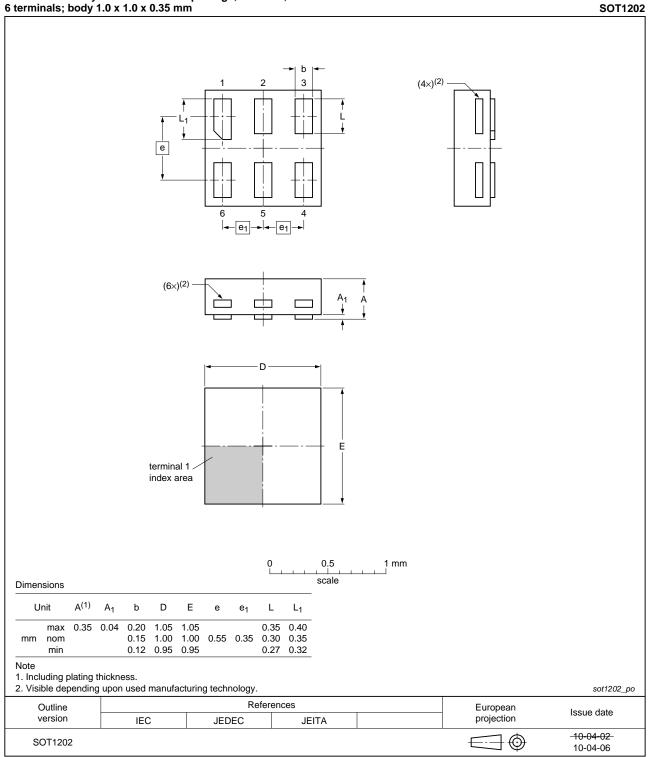


#### XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm

Fig 17. Package outline SOT1115 (XSON6)

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Dual non-inverting Schmitt trigger with 5 V tolerant input



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

Fig 18. Package outline SOT1202 (XSON6)

Dual non-inverting Schmitt trigger with 5 V tolerant input

## **17. Abbreviations**

AcronymDescriptionCMOSComplementary Metal-Oxide SemiconductorDUTDevice Under TestESDElectroStatic DischargeHBMHuman Body ModelMMMachine ModelTTLTransistor-Transistor Logic	Table 12. Abbreviations				
DUTDevice Under TestESDElectroStatic DischargeHBMHuman Body ModelMMMachine Model	Acronym	Description			
ESD     ElectroStatic Discharge       HBM     Human Body Model       MM     Machine Model	CMOS	Complementary Metal-Oxide Semiconductor			
HBM     Human Body Model       MM     Machine Model	DUT	Device Under Test			
MM Machine Model	ESD	ElectroStatic Discharge			
	HBM	Human Body Model			
TTL Transistor-Transistor Logic	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:	• <u>Table 3</u> : the	description of pin 6 change	d from data input to data	a 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[1][2]	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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <a href="http://www.nxp.com">http://www.nxp.com</a>.

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

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