

# DATA SHEET

## **74LVC2G17**

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

Product specification  
Supersedes data of 2003 Aug 13

2004 Sep 08

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

## 74LVC2G17

### FEATURES

- 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)
  - JESD8B/JESD36 (2.7 V to 3.6 V).
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds 2000 V
  - MM EIA/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.

### APPLICATIONS

- Wave and pulse shapers for highly noisy environments.

### DESCRIPTION

The 74LVC2G17 is a high-performance, low-power, low-voltage, Si-gate CMOS device and superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3 V or 5 V devices. These 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 back flow current through the device when it is powered down.

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

### QUICK REFERENCE DATA

GND = 0 V;  $T_{amb} = 25$  °C.

SYMBOL	PARAMETER	CONDITIONS	TYPICAL	UNIT
$t_{PHL}/t_{PLH}$	propagation delay inputs nA to output nY	$V_{CC} = 1.8$ V; $C_L = 30$ pF; $R_L = 1$ k $\Omega$	5.6	ns
		$V_{CC} = 2.5$ V; $C_L = 30$ pF; $R_L = 500$ $\Omega$	3.7	ns
		$V_{CC} = 2.7$ V; $C_L = 50$ pF; $R_L = 500$ $\Omega$	3.8	ns
		$V_{CC} = 3.3$ V; $C_L = 50$ pF; $R_L = 500$ $\Omega$	3.6	ns
		$V_{CC} = 5.0$ V; $C_L = 50$ pF; $R_L = 500$ $\Omega$	2.7	ns
$C_I$	input capacitance		3.5	pF
$C_{PD}$	power dissipation capacitance per buffer	$V_{CC} = 3.3$ V; notes 1 and 2	16.3	pF

### Notes

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

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

$C_L$  = output load capacitance in pF;

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

$N$  = total load switching outputs;

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

2. The condition is  $V_I = \text{GND to } V_{CC}$ .

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

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## FUNCTION TABLE

See note 1.

INPUT		OUTPUT	
nA	nY	nA	nY
L	L	L	L
H	H	H	H

### Note

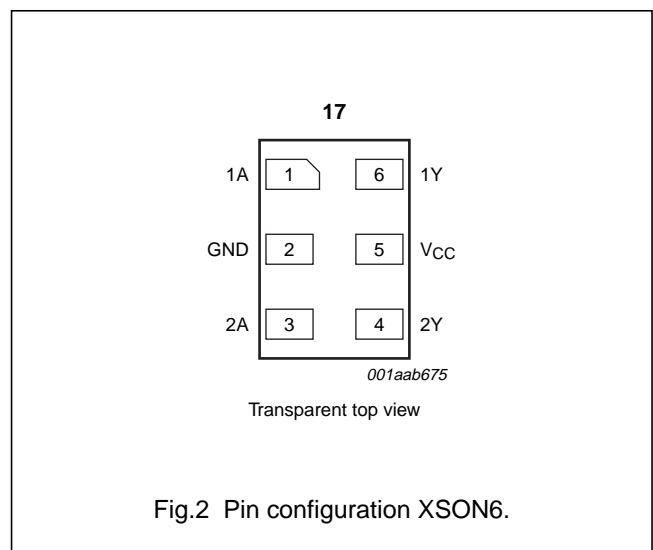
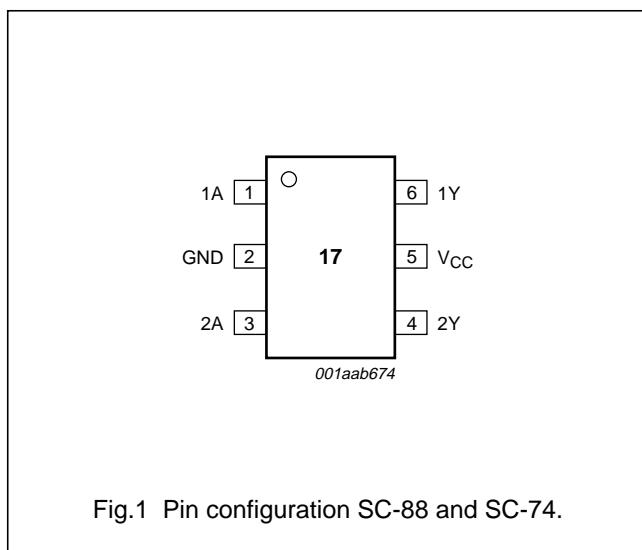
1. H = HIGH voltage level;  
L = LOW voltage level.

## ORDERING INFORMATION

TYPE NUMBER	PACKAGE					
	TEMPERATURE RANGE	PINS	PACKAGE	MATERIAL	CODE	MARKING
74LVC2G17GW	-40 °C to +125 °C	6	SC-88	plastic	SOT363	VV
74LVC2G17GV	-40 °C to +125 °C	6	SC-74	plastic	SOT457	V17
74LVC2G17GM	-40 °C to +125 °C	6	XSON6	plastic	SOT886	VV

## PINNING

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



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

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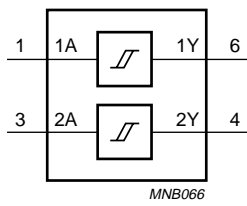


Fig.3 Logic symbol.

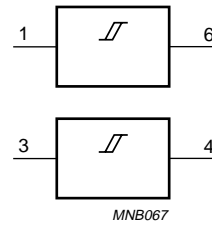


Fig.4 IEC logic symbol.

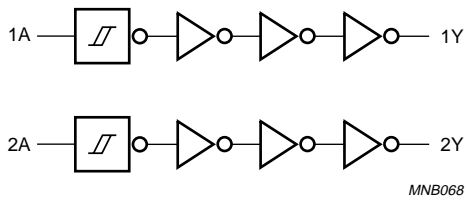


Fig.5 Logic diagram.

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

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### RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CC}$	supply voltage		1.65	5.5	V
$V_I$	input voltage		0	5.5	V
$V_O$	output voltage		0	$V_{CC}$	V
$T_{amb}$	operating ambient temperature		-40	+125	°C

### 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
$I_{IK}$	input diode current	$V_I < 0$ V	-	-50	mA
$V_I$	input voltage	note 1	-0.5	+6.5	V
$I_{OK}$	output diode current	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
$V_O$	output voltage	active mode; notes 1 and 2	-0.5	$V_{CC} + 0.5$	V
		Power-down mode; notes 1 and 2	-0.5	+6.5	V
$I_O$	output source or sink current	$V_O = 0$ V to $V_{CC}$	-	±50	mA
$I_{CC}, I_{GND}$	$V_{CC}$ or GND current		-	±100	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_D$	power dissipation	$T_{amb} = -40$ °C to +125 °C	-	300	mW

### Notes

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.

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

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### DC CHARACTERISTICS

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

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	–	–	0.1	V
		I <sub>O</sub> = 100 μA	1.65	–	–	0.45	V
		I <sub>O</sub> = 4 mA	2.3	–	–	0.3	V
		I <sub>O</sub> = 8 mA	2.7	–	–	0.4	V
		I <sub>O</sub> = 12 mA	3.0	–	–	0.55	V
		I <sub>O</sub> = 24 mA	4.5	–	–	0.55	V
		I <sub>O</sub> = 32 mA					
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	V <sub>CC</sub> – 0.1	–	–	V
		I <sub>O</sub> = -100 μA	1.65	1.2	–	–	V
		I <sub>O</sub> = -4 mA	2.3	1.9	–	–	V
		I <sub>O</sub> = -8 mA	2.7	2.2	–	–	V
		I <sub>O</sub> = -12 mA	3.0	2.3	–	–	V
		I <sub>O</sub> = -24 mA	4.5	3.8	–	–	V
		I <sub>O</sub> = -32 mA					
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND	5.5	–	±0.1	±5	μA
I <sub>off</sub>	power OFF leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0	–	±0.1	±10	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	5.5	–	0.1	10	μA
ΔI <sub>CC</sub>	additional quiescent supply current per pin	V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0 A	2.3 to 5.5	–	5	500	μA

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SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		OTHER	V <sub>CC</sub> (V)				
<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>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	–	–	0.1	V
		I <sub>O</sub> = 100 μA	1.65	–	–	0.70	V
		I <sub>O</sub> = 4 mA	2.3	–	–	0.45	V
		I <sub>O</sub> = 8 mA	2.7	–	–	0.60	V
		I <sub>O</sub> = 12 mA	3.0	–	–	0.80	V
		I <sub>O</sub> = 24 mA	4.5	–	–	0.80	V
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	1.65 to 5.5	V <sub>CC</sub> – 0.1	–	–	V
		I <sub>O</sub> = -100 μA	1.65	0.95	–	–	V
		I <sub>O</sub> = -4 mA	2.3	1.7	–	–	V
		I <sub>O</sub> = -8 mA	2.7	1.9	–	–	V
		I <sub>O</sub> = -12 mA	3.0	2.0	–	–	V
		I <sub>O</sub> = -24 mA	4.5	3.4	–	–	V
I <sub>LI</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND	5.5	–	±0.1	±20	μA
I <sub>off</sub>	power OFF leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V	0	–	–	±20	μA
I <sub>CC</sub>	quiescent supply current	V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0 A	5.5	–	–	40	μA
ΔI <sub>CC</sub>	additional quiescent supply current per pin	V <sub>I</sub> = V <sub>CC</sub> – 0.6 V; I <sub>O</sub> = 0 A	2.3 to 5.5	–	–	5000	μA

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

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**TRANSFER CHARACTERISTICS**

Voltages are referenced to GND (ground = 0 V).

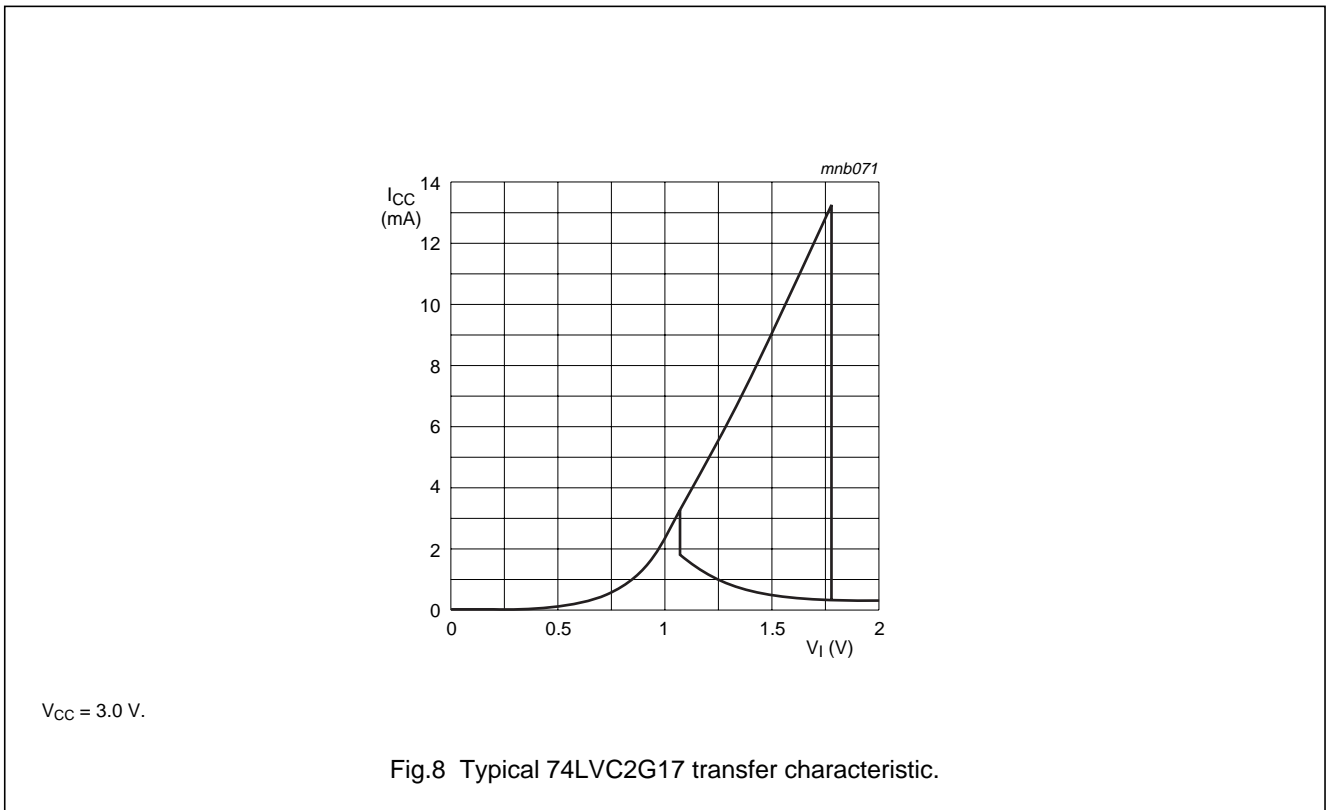
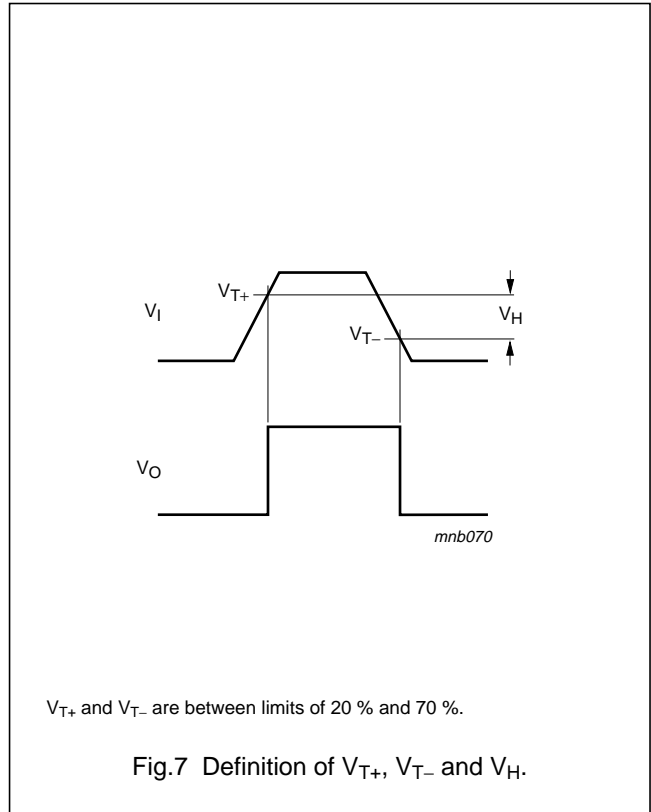
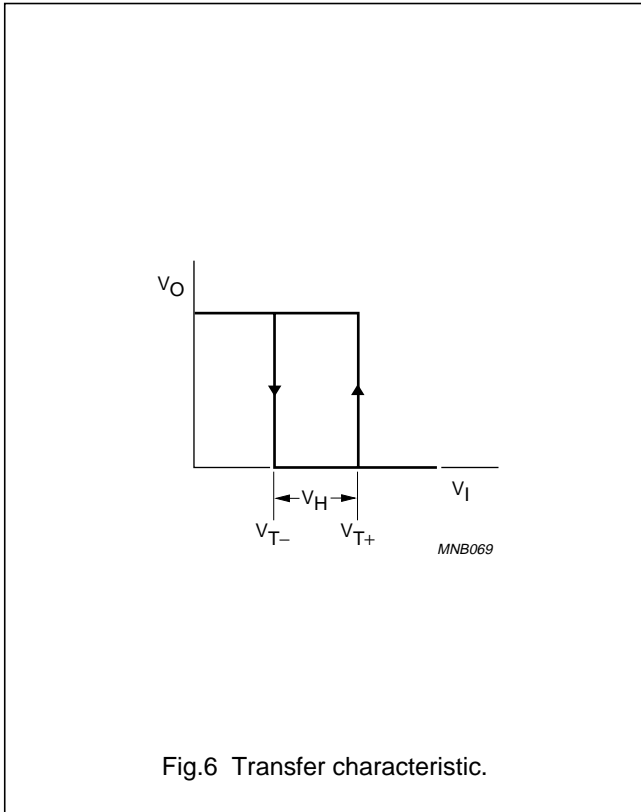
SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		WAVEFORMS	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
V <sub>T+</sub>	positive-going threshold	see Figs 6 and 7	1.8	0.70	1.10	1.50	V
			2.3	1.00	1.40	1.80	V
			3.0	1.30	1.76	2.20	V
			4.5	1.90	2.47	3.10	V
			5.5	2.20	2.91	3.60	V
V <sub>T-</sub>	negative-going threshold	see Figs 6 and 7	1.8	0.25	0.61	0.90	V
			2.3	0.40	0.80	1.15	V
			3.0	0.60	1.04	1.50	V
			4.5	1.00	1.55	2.00	V
			5.5	1.20	1.86	2.30	V
V <sub>H</sub>	hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )	see Figs 6, 7 and 8	1.8	0.15	0.49	1.00	V
			2.3	0.25	0.60	1.10	V
			3.0	0.40	0.73	1.20	V
			4.5	0.60	0.92	1.50	V
			5.5	0.70	1.02	1.70	V
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>							
V <sub>T+</sub>	positive-going threshold	see Figs 6 and 7	1.8	0.70	–	1.70	V
			2.3	1.00	–	2.00	V
			3.0	1.30	–	2.40	V
			4.5	1.90	–	3.30	V
			5.5	2.20	–	3.80	V
V <sub>T-</sub>	negative-going threshold	see Figs 6 and 7	1.8	0.25	–	1.10	V
			2.3	0.40	–	1.35	V
			3.0	0.60	–	1.70	V
			4.5	1.00	–	2.20	V
			5.5	1.20	–	2.50	V
V <sub>H</sub>	hysteresis (V <sub>T+</sub> - V <sub>T-</sub> )	see Figs 6, 7 and 8	1.8	0.15	–	1.20	V
			2.3	0.25	–	1.30	V
			3.0	0.40	–	1.40	V
			4.5	0.60	–	1.70	V
			5.5	0.70	–	1.90	V

**Note**1. All typical values are measured at T<sub>amb</sub> = 25 °C.



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

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## AC CHARACTERISTICS

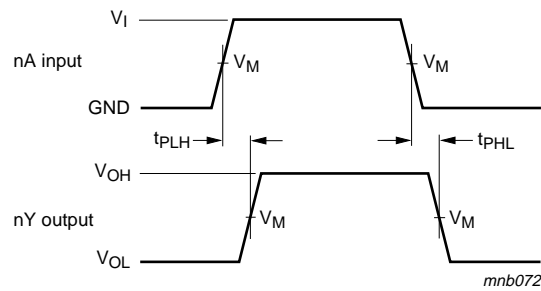
GND = 0 V.

SYMBOL	PARAMETER	TEST CONDITIONS		MIN.	TYP. <sup>(1)</sup>	MAX.	UNIT
		WAVEFORMS	V <sub>CC</sub> (V)				
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>							
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay nA to nY	see Figs 9 and 10	1.65 to 1.95	1.5	5.6	10.5	ns
			2.3 to 2.7	1.0	3.7	6.5	ns
			2.7	1.0	3.8	6.5	ns
			3.0 to 3.6	1.0	3.6	5.7	ns
			4.5 to 5.5	1.0	2.7	4.3	ns
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>							
t <sub>PHL</sub> /t <sub>PLH</sub>	propagation delay nA to nY	see Figs 9 and 10	1.65 to 1.95	1.5	–	13.1	ns
			2.3 to 2.7	1.0	–	8.5	ns
			2.7	1.0	–	8.5	ns
			3.0 to 3.6	1.0	–	7.1	ns
			4.5 to 5.5	1.0	–	5.4	ns

### Note

1. All typical values are measured at T<sub>amb</sub> = 25 °C.

## AC WAVEFORMS



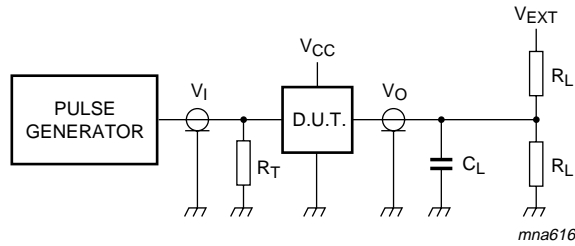
V <sub>CC</sub>	V <sub>M</sub>	INPUT	
		V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>
1.65 V to 1.95 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.3 V to 2.7 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.0 ns
2.7 V	1.5 V	2.7 V	≤ 2.5 ns
3.0 V to 3.6 V	1.5 V	2.7 V	≤ 2.5 ns
4.5 V to 5.5 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 2.5 ns

V<sub>OL</sub> and V<sub>OH</sub> are typical output voltage drop that occur with the output load.

Fig.9 The input (nA) to output (nY) propagation delays and the output transition times.

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V <sub>CC</sub>	V <sub>I</sub>	C <sub>L</sub>	R <sub>L</sub>	V <sub>EXT</sub>		
				t <sub>PLH</sub> /t <sub>PHL</sub>	t <sub>PZH</sub> /t <sub>PHZ</sub>	t <sub>PZL</sub> /t <sub>PLZ</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	30 pF	1 kΩ	open	GND	2 × V <sub>CC</sub>
2.3 V to 2.7 V	V <sub>CC</sub>	30 pF	500 Ω	open	GND	2 × V <sub>CC</sub>
2.7 V	2.7 V	50 pF	500 Ω	open	GND	6 V
3.0 V to 3.6 V	2.7 V	50 pF	500 Ω	open	GND	6 V
4.5 V to 5.5 V	V <sub>CC</sub>	50 pF	500 Ω	open	GND	2 × V <sub>CC</sub>

Definitions for test circuit:

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

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

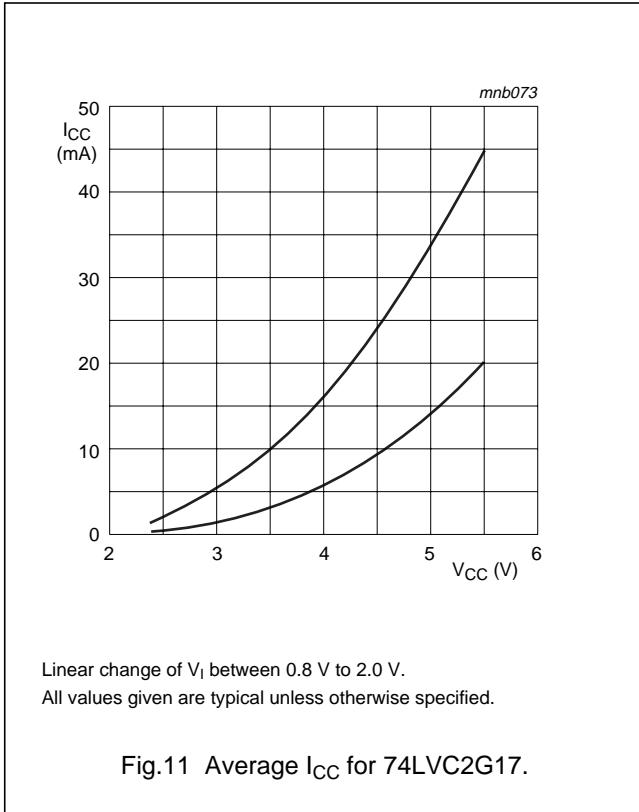
R<sub>T</sub> = Termination resistance should be equal to the output impedance Z<sub>o</sub> of the pulse generator.

Fig.10 Load circuitry for switching times.

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

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## APPLICATION INFORMATION



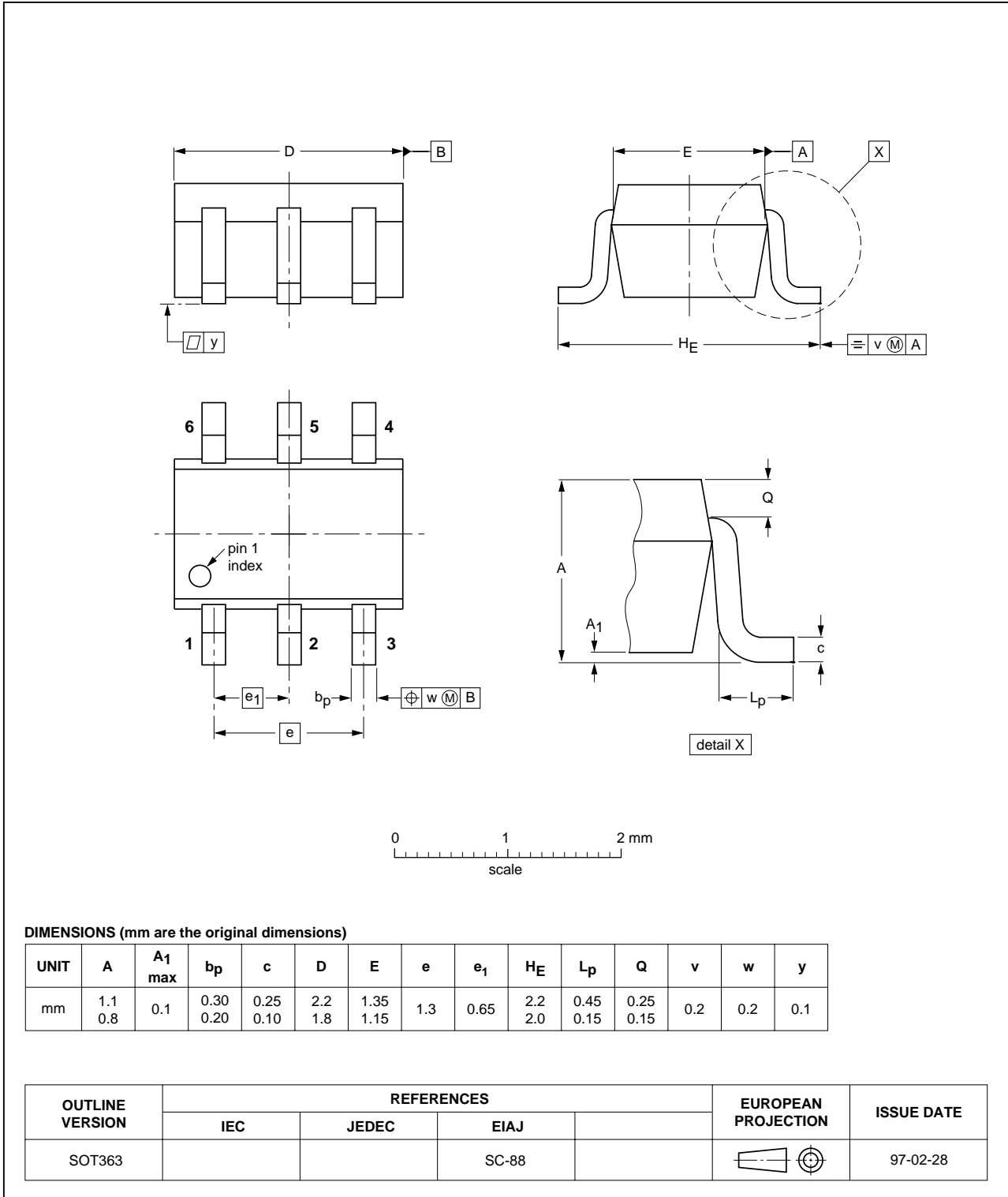
# Dual non-inverting Schmitt-trigger with 5 V tolerant input

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## PACKAGE OUTLINES

Plastic surface mounted package; 6 leads

SOT363

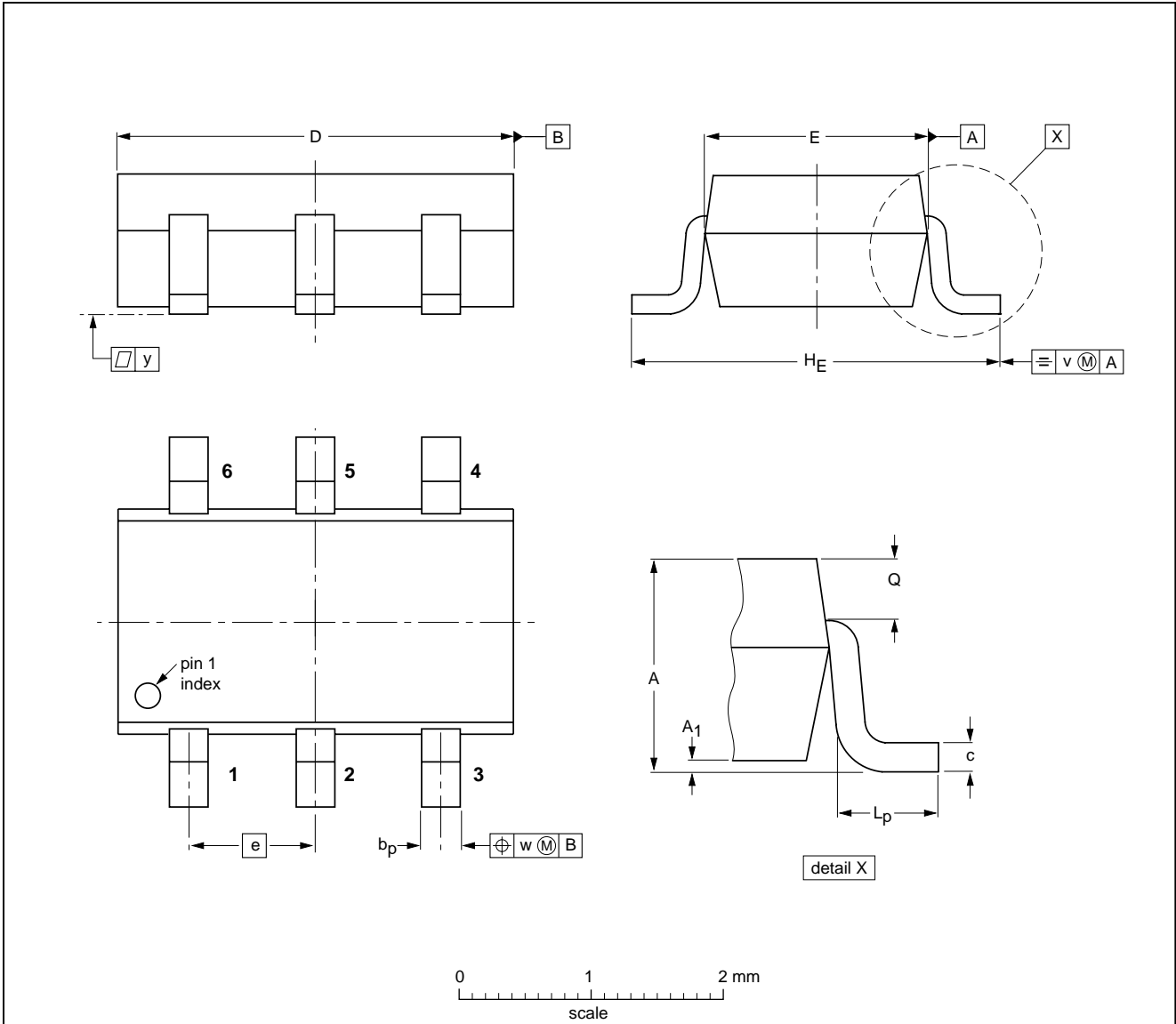


# Dual non-inverting Schmitt-trigger with 5 V tolerant input

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Plastic surface mounted package; 6 leads

SOT457



DIMENSIONS (mm are the original dimensions)

UNIT	A	A <sub>1</sub>	b <sub>p</sub>	c	D	E	e	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

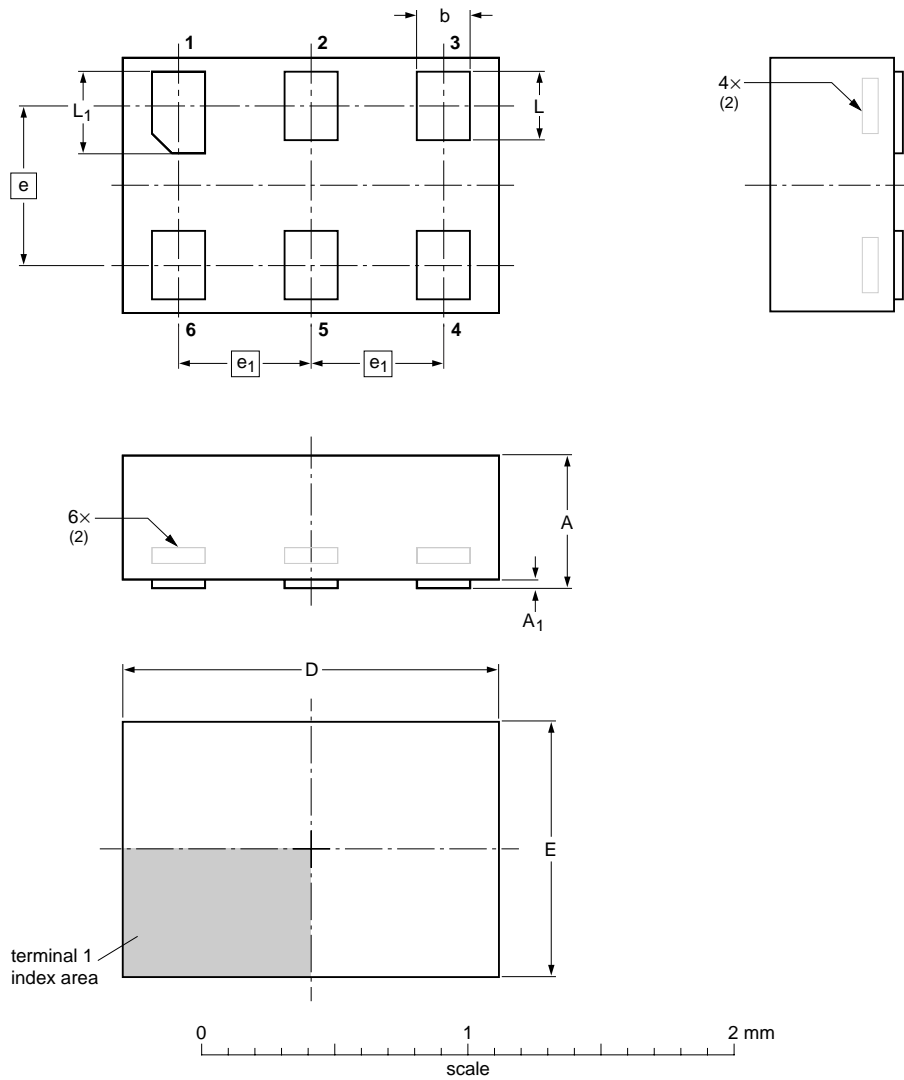
OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT457			SC-74			-97-02-28- 01-05-04

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

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

SOT886



**DIMENSIONS (mm are the original dimensions)**

UNIT	A <sup>(1)</sup> max	A <sub>1</sub> max	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
mm	0.5	0.04	0.25 0.17	1.5 1.4	1.05 0.95	0.6	0.5	0.35 0.27	0.40 0.32

**Notes**

1. Including plating thickness.
2. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT886		MO-252			04-07-15 04-07-22

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

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### DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
I	Objective data	Development	This data sheet contains data from the objective specification for product development. Philips Semiconductors reserves the right to change the specification in any manner without notice.
II	Preliminary data	Qualification	This data sheet contains data from the preliminary specification. Supplementary data will be published at a later date. Philips Semiconductors reserves the right to change the specification without notice, in order to improve the design and supply the best possible product.
III	Product data	Production	This data sheet contains data from the product specification. Philips Semiconductors reserves the right to make changes at any time in order to improve the design, manufacturing and supply. Relevant changes will be communicated via a Customer Product/Process Change Notification (CPCN).

### Notes

1. Please consult the most recently issued data sheet before initiating or completing a design.
2. The product status of the device(s) described in this data sheet may have changed since this data sheet was published. The latest information is available on the Internet at URL <http://www.semiconductors.philips.com>.
3. For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

### DEFINITIONS

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 60134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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## **Contact information**

For additional information please visit <http://www.semiconductors.philips.com>. Fax: +31 40 27 24825

For sales offices addresses send e-mail to: [sales.addresses@www.semiconductors.philips.com](mailto:sales.addresses@www.semiconductors.philips.com).

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