74LVC3G17

Triple non-inverting Schmitt trigger with 5 V tolerant input

     Product data sheet

1. General description

The 74LVC3G17 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. This feature allows the use of this device as translator 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.

The 74LVC3G17 provides three non-inverting buffers with Schmitt-trigger action. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

2. 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
- ESD protection:
  - HBM EIA/JESD22-A114-B exceeds 2000 V
  - MM EIA/JESD22-A115-A exceeds 200 V.
- ±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.

PHILIPS

4. Quick reference data

Table 1: **Quick reference data**
GND = 0 V; T_{amb} = 25 °C.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
t_{PHL}, t_{PLH}	propagation delay input nA to output nY	V_{CC} = 1.8 V; C_L = 30 pF; R_L = 1 kΩ	-	5.6	-	ns
		V_{CC} = 2.5 V; C_L = 30 pF; R_L = 500 Ω	-	3.7	-	ns
		V_{CC} = 2.7 V; C_L = 50 pF; R_L = 500 Ω	-	3.8	-	ns
		V_{CC} = 3.3 V; C_L = 50 pF; R_L = 500 Ω	-	3.6	-	ns
		V_{CC} = 5.0 V; C_L = 50 pF; R_L = 500 Ω	-	2.7	-	ns
C_I	input capacitance		-	3.5	-	pF
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 V [1] [2]	-	16.3	-	pF

[1] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

N = number of inputs switching;

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

[2] The condition is V_I = GND to V_{CC}.

5. Ordering information

Table 2: **Ordering information**

Type number	Package				Version
	Temperature range	Name	Description		
74LVC3G17DP	−40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm		SOT505-2
74LVC3G17DC	−40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm		SOT765-1
74LVC3G17GT	−40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm		SOT833-1

6. Marking

Table 3: **Marking codes**

Type number	Marking code
74LVC3G17DP	V17
74LVC3G17DC	V17
74LVC3G17GT	V17

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7. Functional diagram

Fig 1. Logic symbol

Fig 2. IEC logic symbol

**Fig 3. Logic diagram**
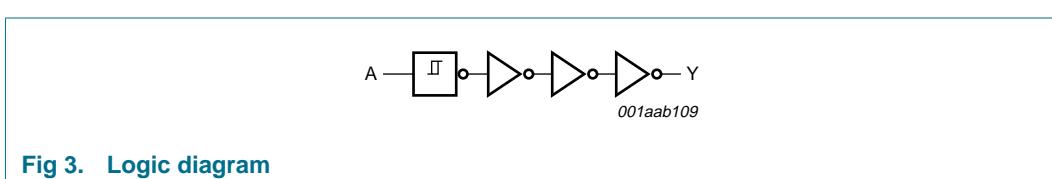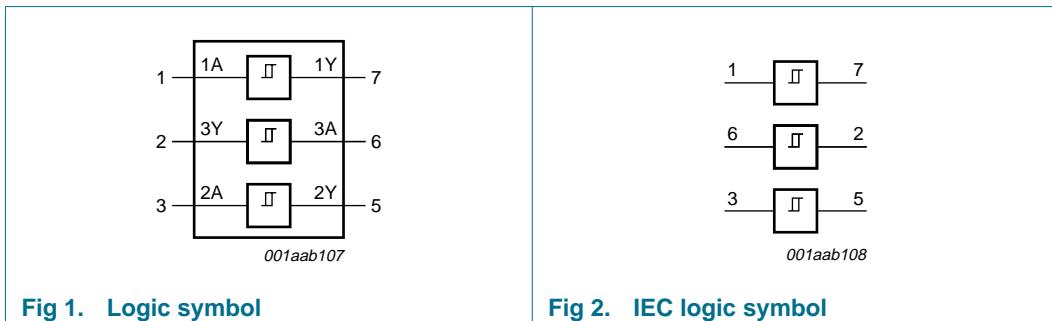
## 8. Pinning information

8.1 Pinning

Fig 4. Pin configuration TSSOP8 and VSSOP8

Fig 5. Pin configuration XSON8
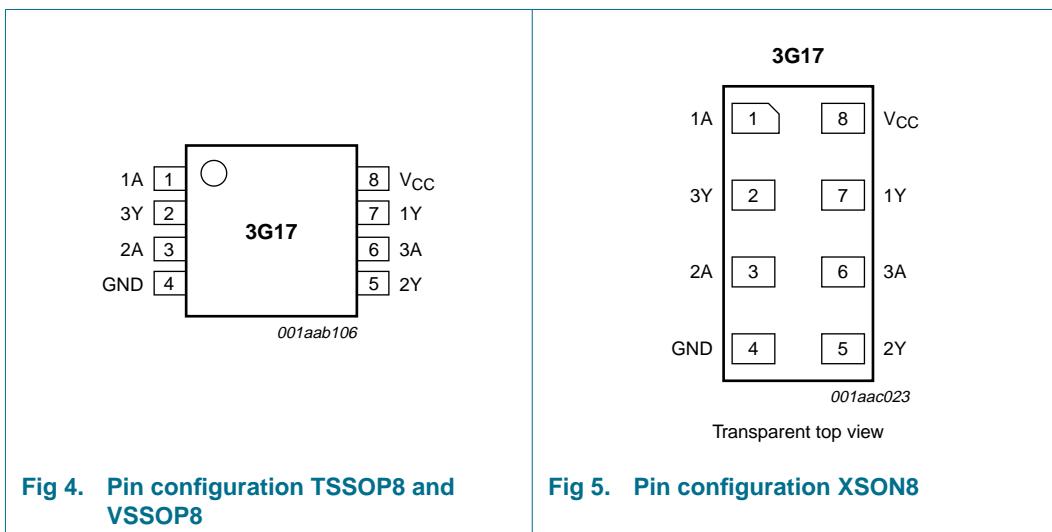
8.2 Pin description

Table 4:   Pin description

Symbol	Pin	Description
1A	1	data input
3Y	2	data output
2A	3	data input
GND	4	ground (0 V)
2Y	5	data output
3A	6	data input
1Y	7	data output
V_{CC}	8	supply voltage

9. Functional description

9.1 Function table

Table 5:   Function table [1]

Input nA	Output nY
L	L
H	H

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

10. Limiting values

Table 6:   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
V_I	input voltage		[1]	−0.5	+6.5	V
V_O	output voltage	active mode	[1]	−0.5	V_{CC} + 0.5	V
		Power-down mode	[1] [2]	−0.5	+6.5	V
I_{IK}	input diode current	V_I < 0 V		-	−50	mA
I_{OK}	output diode current	V_O > V_{CC} or V_O < 0 V		-	±50	mA
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_{tot}	power dissipation	T_{amb} = −40 °C to +125 °C		-	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.

11. Recommended operating conditions

Table 7: **Recommended operating conditions**

Symbol	Parameter	Conditions	Min	Typ	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}	ambient temperature		−40	-	+125	°C

12. Static characteristics

Table 8: **Static characteristics**

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$T_{amb} = -40$ °C to +85 °C [1]						
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100$ µA; $V_{CC} = 1.65$ V to 5.5 V	-	-	0.1	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	-	0.45	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	-	0.3	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	-	0.4	V
		$I_O = 24$ mA; $V_{CC} = 3.0$ V	-	-	0.55	V
		$I_O = 32$ mA; $V_{CC} = 4.5$ V	-	-	0.55	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100$ µA; $V_{CC} = 1.65$ V to 5.5 V	$V_{CC} - 0.1$	-	-	V
		$I_O = -4$ mA; $V_{CC} = 1.65$ V	1.2	-	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	-	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	-	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	-	-	V
		$I_O = -32$ mA; $V_{CC} = 4.5$ V	3.8	-	-	V
I_{LI}	input leakage current	$V_I = 5.5$ V or GND; $V_{CC} = 5.5$ V	-	±0.1	±5	µA
I_{off}	power-off leakage current	V_I or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	±0.1	±10	µA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	0.1	10	µA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	5	500	µA
C_I	input capacitance		-	3.5	-	pF

Table 8:   Static characteristics *…continued*

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

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +125 °C						
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_O = 100 μA; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I_O = 4 mA; V_{CC} = 1.65 V	-	-	0.70	V
		I_O = 8 mA; V_{CC} = 2.3 V	-	-	0.45	V
		I_O = 12 mA; V_{CC} = 2.7 V	-	-	0.60	V
		I_O = 24 mA; V_{CC} = 3.0 V	-	-	0.80	V
		I_O = 32 mA; V_{CC} = 4.5 V	-	-	0.80	V
V_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		I_O = −100 μA; V_{CC} = 1.65 V to 5.5 V	V_{CC} − 0.1	-	-	V
		I_O = −4 mA; V_{CC} = 1.65 V	0.95	-	-	V
		I_O = −8 mA; V_{CC} = 2.3 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
I_{LI}	input leakage current	V_I = 5.5 V or GND; V_{CC} = 5.5 V	-	-	±20	μA
I_{off}	power-off leakage current	V_I or V_O = 5.5 V; V_{CC} = 0 V	-	-	±20	μA
I_{CC}	quiescent supply current	$V_I = V_{CC}$ or GND; I_O = 0 A; V_{CC} = 5.5 V	-	-	40	μA
ΔI_{CC}	additional quiescent supply current per pin	$V_I = V_{CC}$ − 0.6 V; I_O = 0 A; V_{CC} = 2.3 V to 5.5 V	-	-	5000	μA

[1]   All typical values are measured at T_{amb} = 25 °C.

13. Dynamic characteristics

Table 9:   Dynamic characteristics

GND = 0 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]						
t_{PHL}, t_{PLH}	propagation delay input nA to output nY	see Figure 6 and 7				
		V_{CC} = 1.65 V to 1.95 V	1.5	5.6	10.5	ns
		V_{CC} = 2.3 V to 2.7 V	1.0	3.7	6.5	ns
		V_{CC} = 2.7 V	1.0	3.8	6.5	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	3.6	5.7	ns
		V_{CC} = 4.5 V to 5.5 V	1.0	2.7	4.3	ns
C_{PD}	power dissipation capacitance per buffer	V_{CC} = 3.3 V [2] [3]	-	16.3	-	pF

Table 9: **Dynamic characteristics** …continued

GND = 0 V.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +125 °C						
t_{PHL}, t_{PLH}	propagation delay input nA to output nY	see Figure 6 and 7				
		V_{CC} = 1.65 V to 1.95 V	1.5	-	13.1	ns
		V_{CC} = 2.3 V to 2.7 V	1.0	-	8.5	ns
		V_{CC} = 2.7 V	1.0	-	8.5	ns
		V_{CC} = 3.0 V to 3.6 V	1.0	-	7.1	ns
		V_{CC} = 4.5 V to 5.5 V	1.0	-	5.4	ns

[1] All typical values are measured at nominal V_{CC} and T_{amb} = 25 °C.

[2] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

N = number of inputs switching;

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

[3] The condition is V_I = GND to V_{CC}.

14. Waveforms

Measurement points are given in Table 10.

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

Fig 6. **The input (nA) to output (nY) propagation delays**
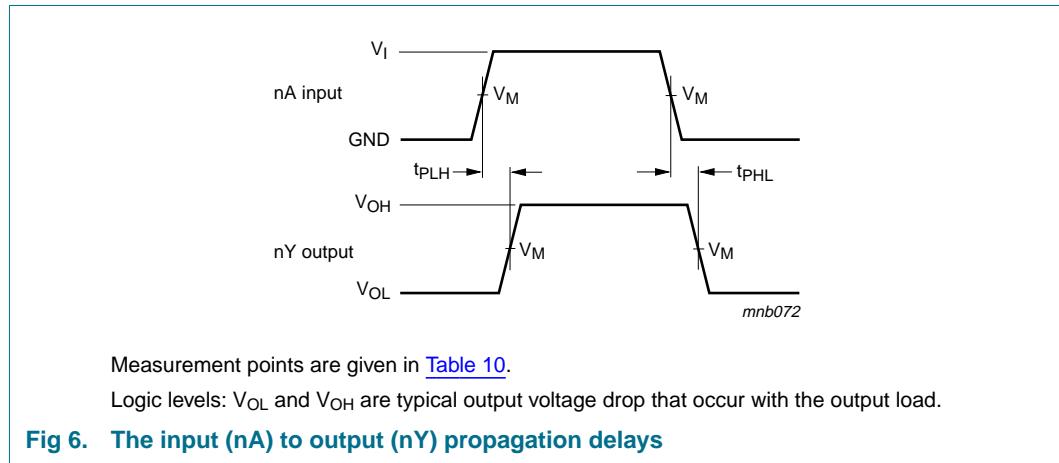
Table 10: **Measurement points**

Supply voltage	Input	Output
V_{CC}	V_M	V_M
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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$

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Test data is given in Table 11.

R_L = Load resistor.

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.

Fig 7. Load circuitry for switching times
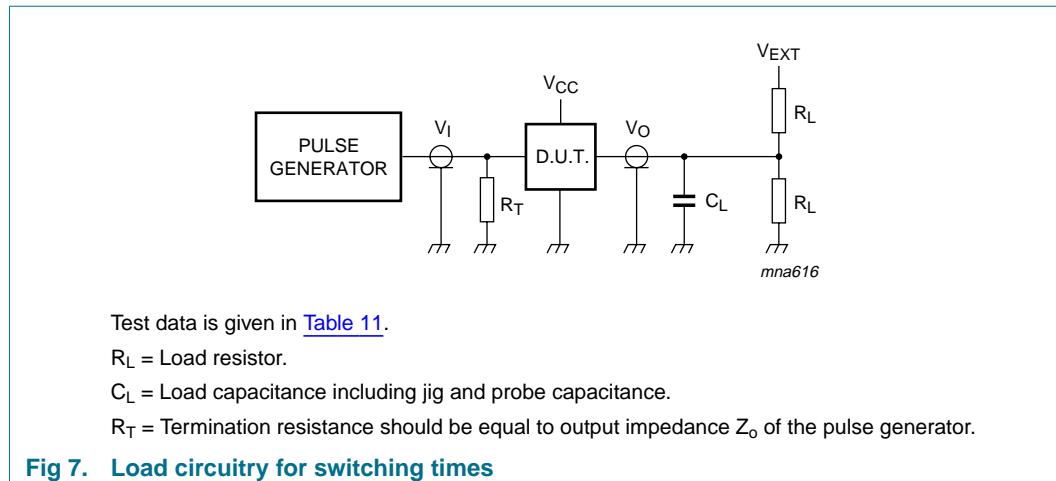
Table 11: Test data

Supply voltage	Input		Load		V_{EXT}		
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}	t_{PZH}, t_{PHZ}	t_{PZL}, t_{PLZ}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 kΩ	open	GND	$2 \times V_{CC}$
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	open	GND	$2 \times V_{CC}$
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	open	GND	6 V
4.5 V to 5.5 V	V_{CC}	≤ 2.5 ns	50 pF	500 Ω	open	GND	$2 \times V_{CC}$

15. Transfer characteristics

Table 12: Transfer characteristics
*Voltages are referenced to GND (ground = 0 V).*

| Symbol	Parameter	Conditions	Min	Typ	Max	Unit
T_{amb} = −40 °C to +85 °C [1]						
V_{T+}	positive-going threshold	see Figure 8 and 9				
		V_{CC} = 1.8 V	0.70	1.10	1.50	V
		V_{CC} = 2.3 V	1.00	1.40	1.80	V
		V_{CC} = 3.0 V	1.30	1.76	2.20	V
		V_{CC} = 4.5 V	1.90	2.47	3.10	V
		V_{CC} = 5.5 V	2.20	2.91	3.60	V
V_{T-}	negative-going threshold	see Figure 8 and 9				
		V_{CC} = 1.8 V	0.25	0.61	0.90	V
		V_{CC} = 2.3 V	0.40	0.80	1.15	V
		V_{CC} = 3.0 V	0.60	1.04	1.50	V
		V_{CC} = 4.5 V	1.00	1.55	2.00	V
		V_{CC} = 5.5 V	1.20	1.86	2.30	V

Table 12:   Transfer characteristics *...continued*
Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_H	hysteresis $(V_{T+} - V_{T-})$	see Figure 8, 9 and 10				
		V_{CC} = 1.8 V	0.15	0.49	1.00	V
		V_{CC} = 2.3 V	0.25	0.60	1.10	V
		V_{CC} = 3.0 V	0.40	0.73	1.20	V
		V_{CC} = 4.5 V	0.60	0.92	1.50	V
		V_{CC} = 5.5 V	0.70	1.02	1.70	V
T_{amb} = −40 °C to +125 °C						
V_{T+}	positive-going threshold	see Figure 8 and 9				
		V_{CC} = 1.8 V	0.70	-	1.70	V
		V_{CC} = 2.3 V	1.00	-	2.00	V
		V_{CC} = 3.0 V	1.30	-	2.40	V
		V_{CC} = 4.5 V	1.90	-	3.30	V
		V_{CC} = 5.5 V	2.20	-	3.80	V
V_{T-}	negative-going threshold	see Figure 8 and 9				
		V_{CC} = 1.8 V	0.25	-	1.10	V
		V_{CC} = 2.3 V	0.40	-	1.35	V
		V_{CC} = 3.0 V	0.60	-	1.70	V
		V_{CC} = 4.5 V	1.00	-	2.20	V
		V_{CC} = 5.5 V	1.20	-	2.50	V
V_H	hysteresis $(V_{T+} - V_{T-})$	see Figure 8, 9 and 10				
		V_{CC} = 1.8 V	0.15	-	1.20	V
		V_{CC} = 2.3 V	0.25	-	1.30	V
		V_{CC} = 3.0 V	0.40	-	1.40	V
		V_{CC} = 4.5 V	0.60	-	1.70	V
		V_{CC} = 5.5 V	0.70	-	1.90	V

[1]   All typical values are measured at T_{amb} = 25 °C.

16. Waveforms transfer characteristics

Fig 8.   Transfer characteristic

V_{T+} and V_{T-} limits at 70 % and 20 %.

Fig 9.   Definition of V_{T+}, V_{T-} and V_H
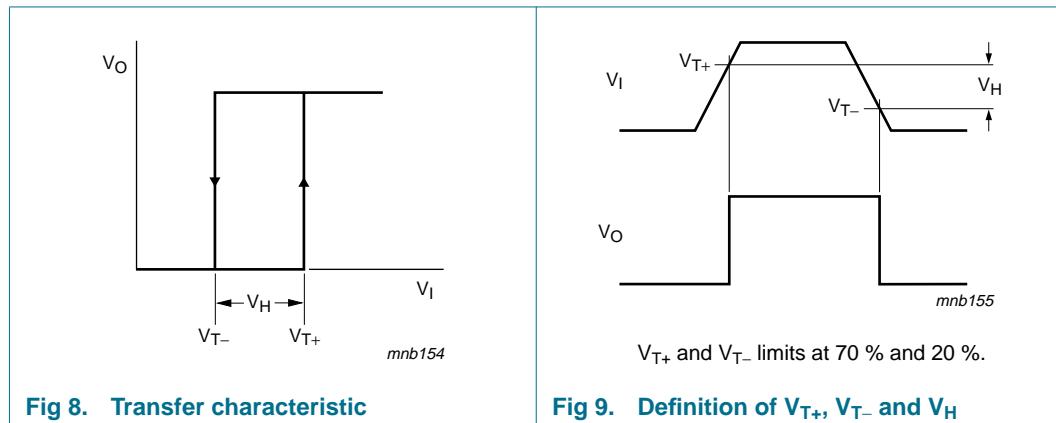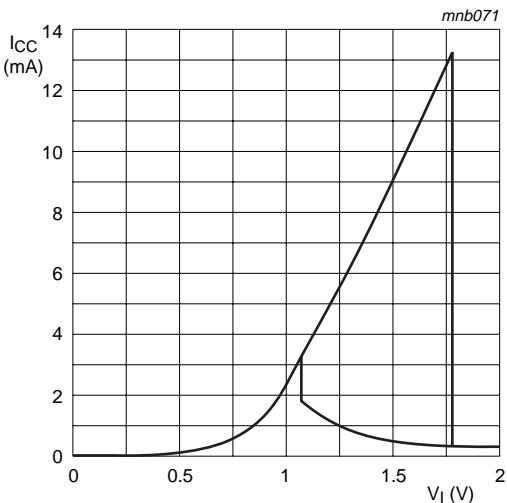
$V_{CC} = 3.0$ V.

Fig 10. Typical 74LVC3G17 transfer characteristic

17. Application information
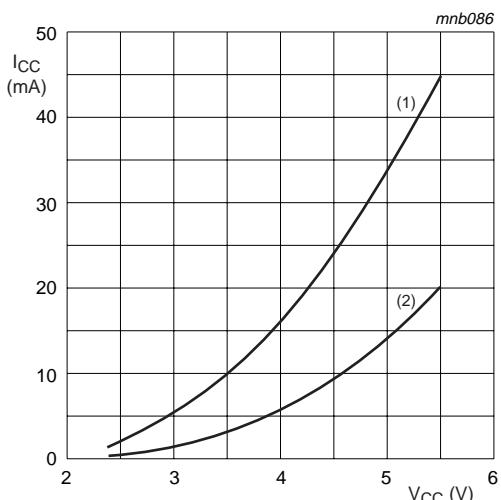
Linear change of V_I between 0.8 V to 2.0 V.

(1) Positive-going edge.

(2) Negative-going edge.

All values given are typical unless otherwise specified.

Fig 11. Average I_{CC} for 74LVC3G17 Schmitt trigger

18. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm   **SOT505-2**

DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D[1]	E[1]	e	HE	L	Lₚ	v	w	y	Z[1]	θ
mm	1.1	0.15 0.00	0.95 0.75	0.25	0.38 0.22	0.18 0.08	3.1 2.9	3.1 2.9	0.65	4.1 3.9	0.5	0.47 0.33	0.2	0.13	0.1	0.70 0.35	8° 0°

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT505-2		- - -				02-01-16
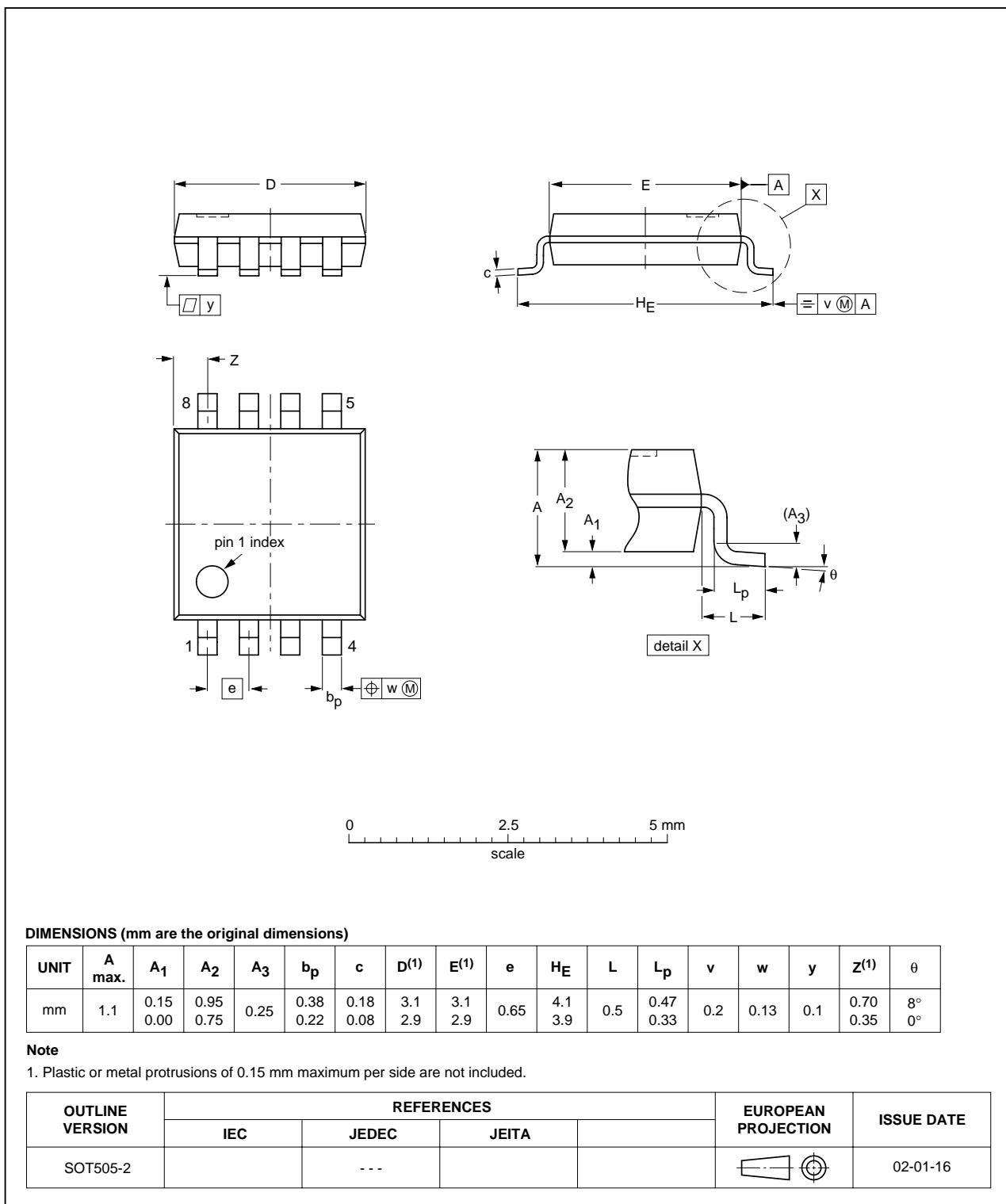
Fig 12. Package outline SOT505-2 (TSSOP8)

**VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm**   **SOT765-1**
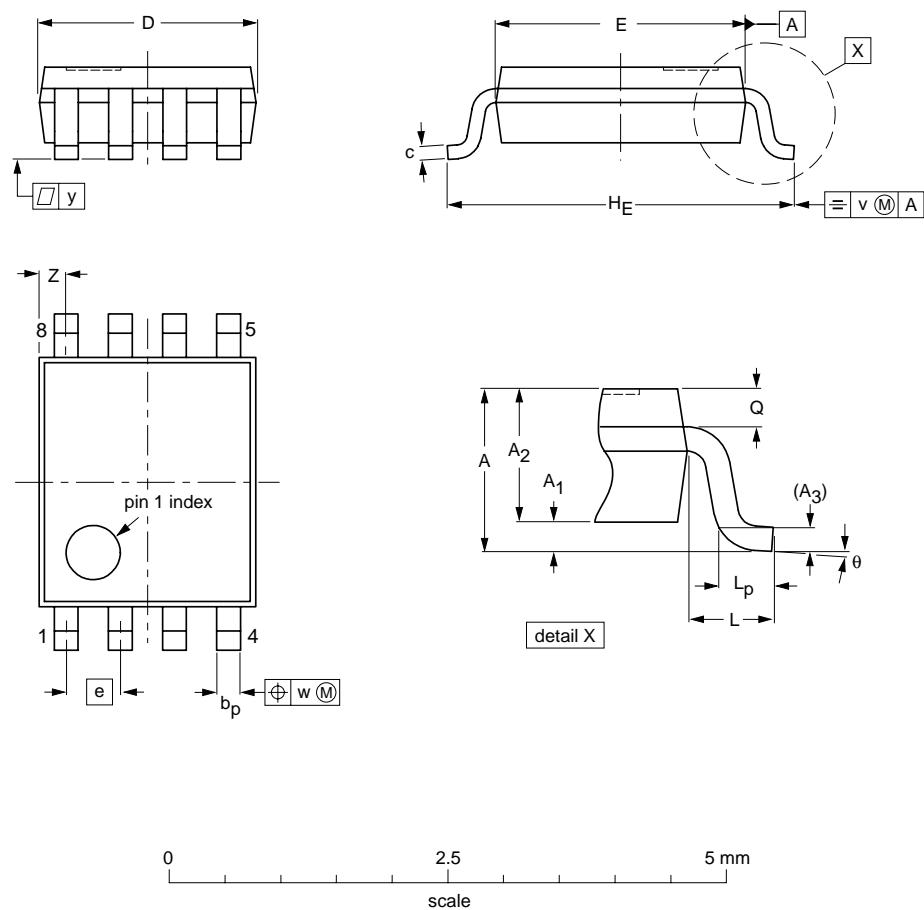
DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D⁽¹⁾	E⁽²⁾	e	Hₑ	L	Lₚ	Q	v	w	y	Z⁽¹⁾	θ
mm	1	0.15 0.00	0.85 0.60	0.12	0.27 0.17	0.23 0.08	2.1 1.9	2.4 2.2	0.5	3.2 3.0	0.4	0.40 0.15	0.21 0.19	0.2	0.13	0.1	0.4 0.1	8° 0°

Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT765-1		MO-187				02-06-07

Fig 13. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm   SOT833-1
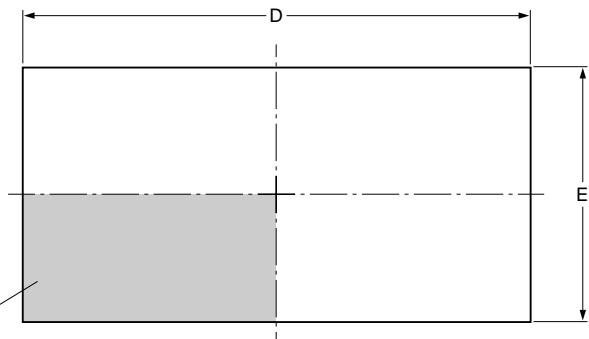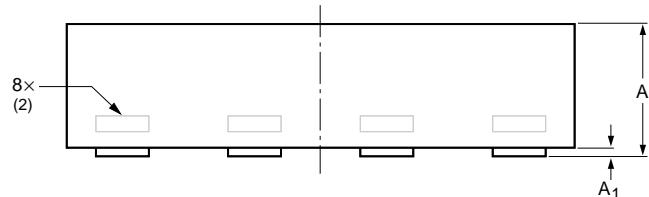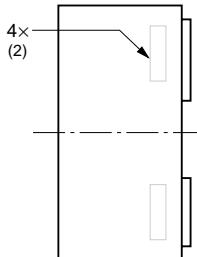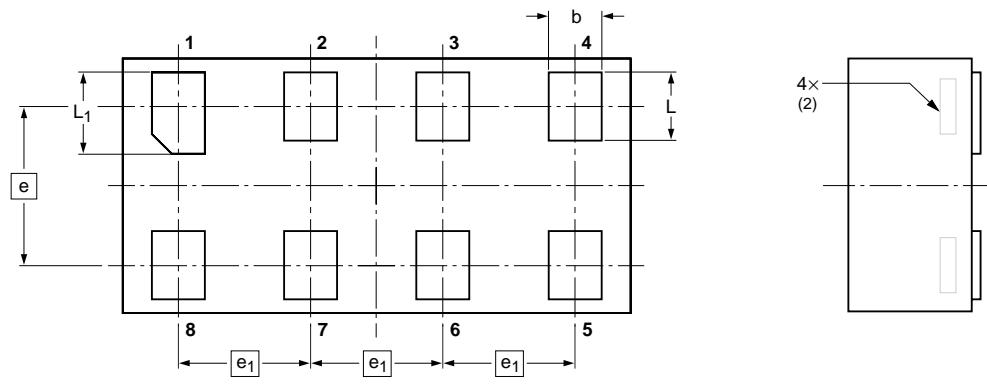
DIMENSIONS (mm are the original dimensions)

UNIT	A$^{(1)}$ max	A$_1$ max	b	D	E	e	e$_1$	L	L$_1$
mm	0.5	0.04	0.25 0.17	2.0 1.9	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			
SOT833-1	- - -	MO-252	- - -			04-07-22 04-11-09

Fig 14. Package outline SOT833-1 (XSON8)

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19. Revision history

Table 13:   Revision history

Document ID	Release date	Data sheet status	Change notice	Doc. number	Supersedes
74LVC3G17_3	20050131	Product data sheet	-	9397 750 14544	74LVC3G17_2
Modifications:	● Changed: type number 74LVC3G17GT				
74LVC3G17_2	20041103	Product data sheet	-	9397 750 13793	74LVC3G17_1
74LVC3G17_1	20040624	Product data sheet	-	9397 750 13332	-

20. Data sheet status

Level	Data sheet status [1]	Product status [2] [3]	Definition
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[3] For data sheets describing multiple type numbers, the highest-level product status determines the data sheet status.

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Product data sheet

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