74LVC2G17

Dual non-inverting Schmitt trigger with 5 V tolerant input

Rev. 04 — 9 October 2006 Product data sheet

1. General 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. 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.

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.

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
- 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-A114-D exceeds 2000 V
  - MM 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

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	SC-74	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 × 1.45 × 0.5 mm	SOT886
74LVC2G17GF	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891

5. Marking

Table 2. Marking codes

Type number	Marking code
74LVC2G17GW	VV
74LVC2G17GV	VV
74LVC2G17GM	VV
74LVC2G17GF	VV

6. Functional diagram

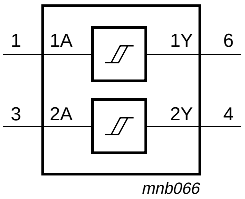


Fig 1. Logic symbol

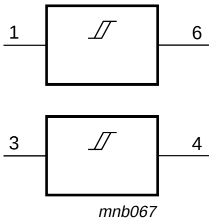


Fig 2. IEC logic symbol

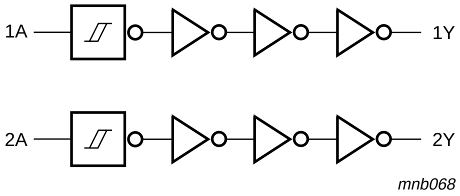


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

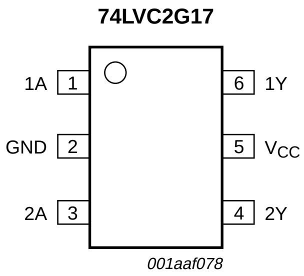
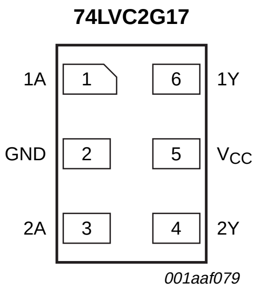
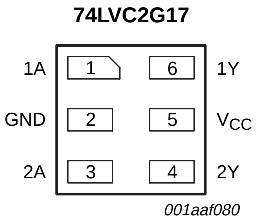


Fig 4. Pin configuration SOT363 and SOT457



Transparent top view

Fig 5. Pin configuration SOT886



Transparent top view

Fig 6. Pin configuration SOT891

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

8. Functional description

Table 4. Function table[1]

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_{CC}	supply voltage			–0.5	+6.5	V
I_{IK}	input clamping current	$V_I < 0$ V		-	–50	mA
V_I	input voltage		[1]	–0.5	+6.5	V
I_{OK}	output clamping current	$V_O < 0$ V		-	–50	mA
V_O	output voltage	Active mode	[1][2]	–0.5	V_{CC} + 0.5	V
		Power-down mode	[1][2]	–0.5	+6.5	V
I_O	output current	V_O = 0 V to V_{CC}		-	±50	mA
I_{CC}	supply current			-	100	mA
I_{GND}	ground current			-	–100	mA
T_{stg}	storage temperature			–65	+150	°C
P_{tot}	total power dissipation	T_{amb} = –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_{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 P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: above 45 °C the value of P_{tot} derates linearly with 2.4 mW/K.

10. Recommended operating conditions

Table 6. 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

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
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

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_{OH}	HIGH-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = -100\ \mu A$; $V_{CC} = 1.65\ V$ 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_I	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}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\ A$; $V_{CC} = 5.5\ V$	-	0.1	10	µA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6\ V$; $I_O = 0\ A$; $V_{CC} = 2.3\ V$ to $5.5\ V$	-	5	500	µA
C_I	input capacitance		-	3.5	-	pF
$T_{amb} = -40\ °C$ to $+125\ °C$						
V_{OL}	LOW-level output voltage	$V_I = V_{IH}$ or V_{IL}				
		$I_O = 100\ \mu A$; $V_{CC} = 1.65\ V$ 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}				
		$I_O = -100\ \mu A$; $V_{CC} = 1.65\ V$ 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_I	input leakage current	$V_I = 5.5\ V$ or GND; $V_{CC} = 5.5\ V$	-	±0.1	±20	µA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5\ V$; $V_{CC} = 0\ V$	-	-	±20	µA
I_{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0\ A$; $V_{CC} = 5.5\ V$	-	-	40	µA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6\ V$; $I_O = 0\ A$; $V_{CC} = 2.3\ V$ to $5.5\ V$	-	-	5	mA

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

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[1]	Max	Min	Max	
t_{pd}	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}	[3]	-	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_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;

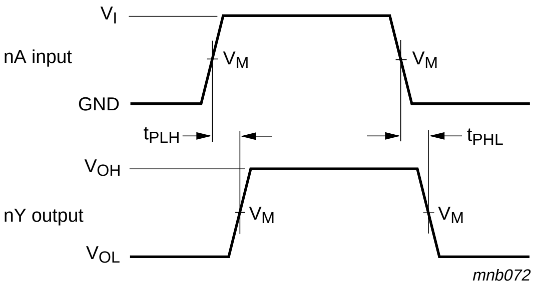
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

13. Waveforms



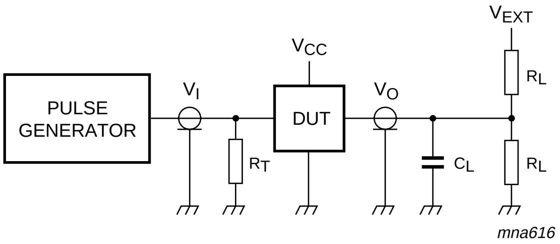
Measurement points are given in Table 9.

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_{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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



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_{EXT} = External voltage for measuring switching times.

Fig 8. Load circuitry for switching times

Table 10. Test data

Supply voltage	Input		Load		V_{EXT}
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PLH}, t_{PHL}
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 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_{CC}	≤ 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[1]	Max	Min	Max	
V_{T+}	positive-going threshold voltage	see Figure 9 and Figure 10						
		V_{CC} = 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_{CC} = 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_H	hysteresis voltage	($V_{T+} - V_{T-}$); see Figure 9, Figure 10 and Figure 11						
		V_{CC} = 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_{CC} = 5.5 V	0.70	1.02	1.70	0.70	1.90	V

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

15. Waveforms transfer characteristics

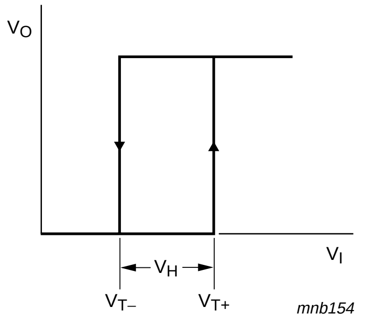
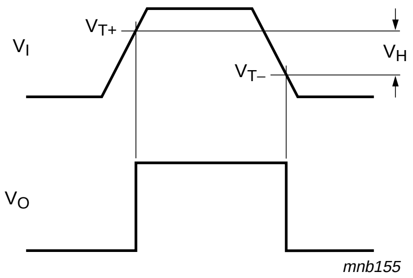
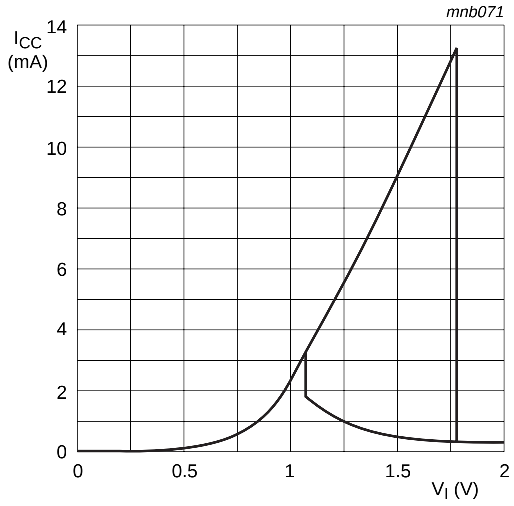


Fig 9. Transfer characteristic



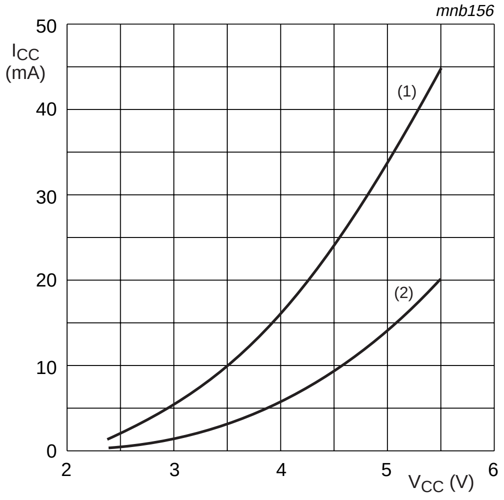
V_{T+} and V_{T-} limits at 70 % and 20 %.

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

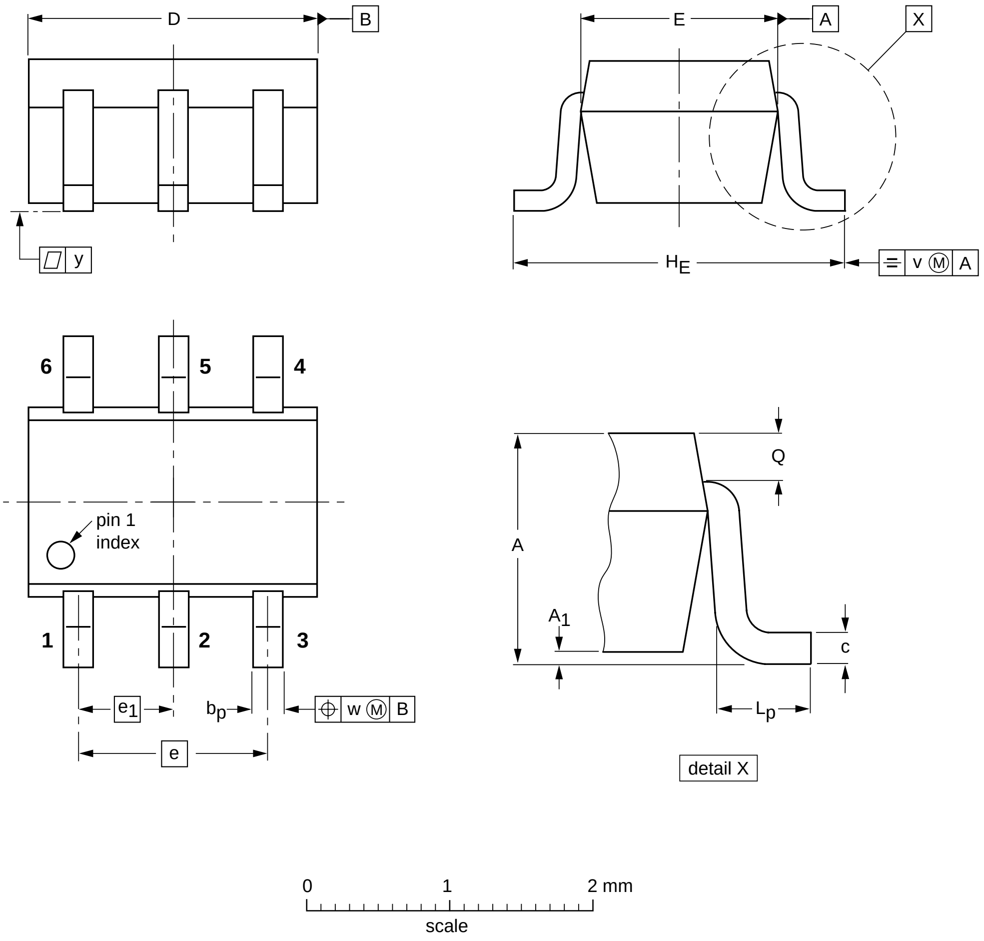
(2) Negative-going edge

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**



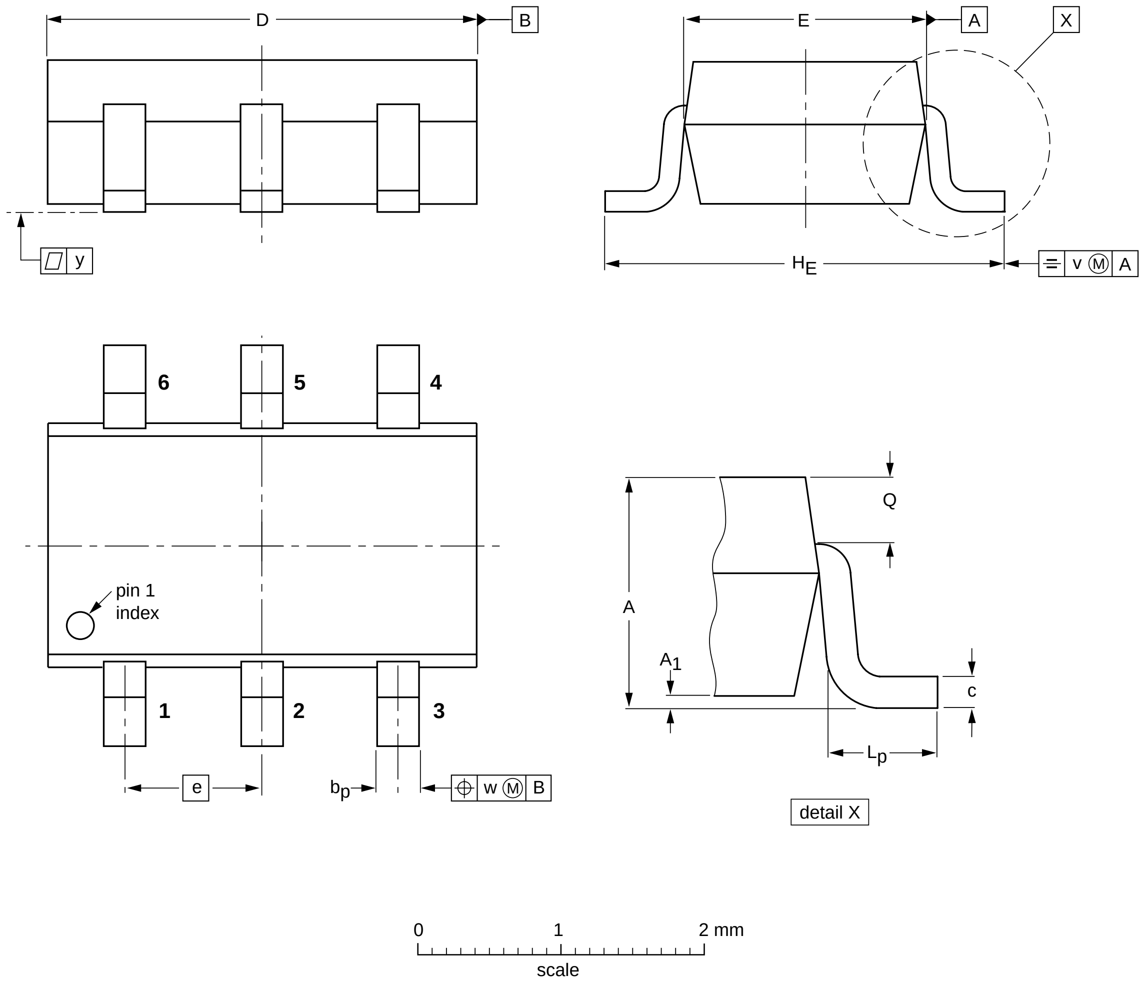
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w	y
mm	1.1 0.8	0.1	0.30 0.20	0.25 0.10	2.2 1.8	1.35 1.15	1.3	0.65	2.2 2.0	0.45 0.15	0.25 0.15	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT363			SC-88			~~04-11-08~~ 06-03-16

Fig 13. Package outline SOT363 (SC-88)

Plastic surface-mounted package (TSOP6); 6 leads **SOT457**



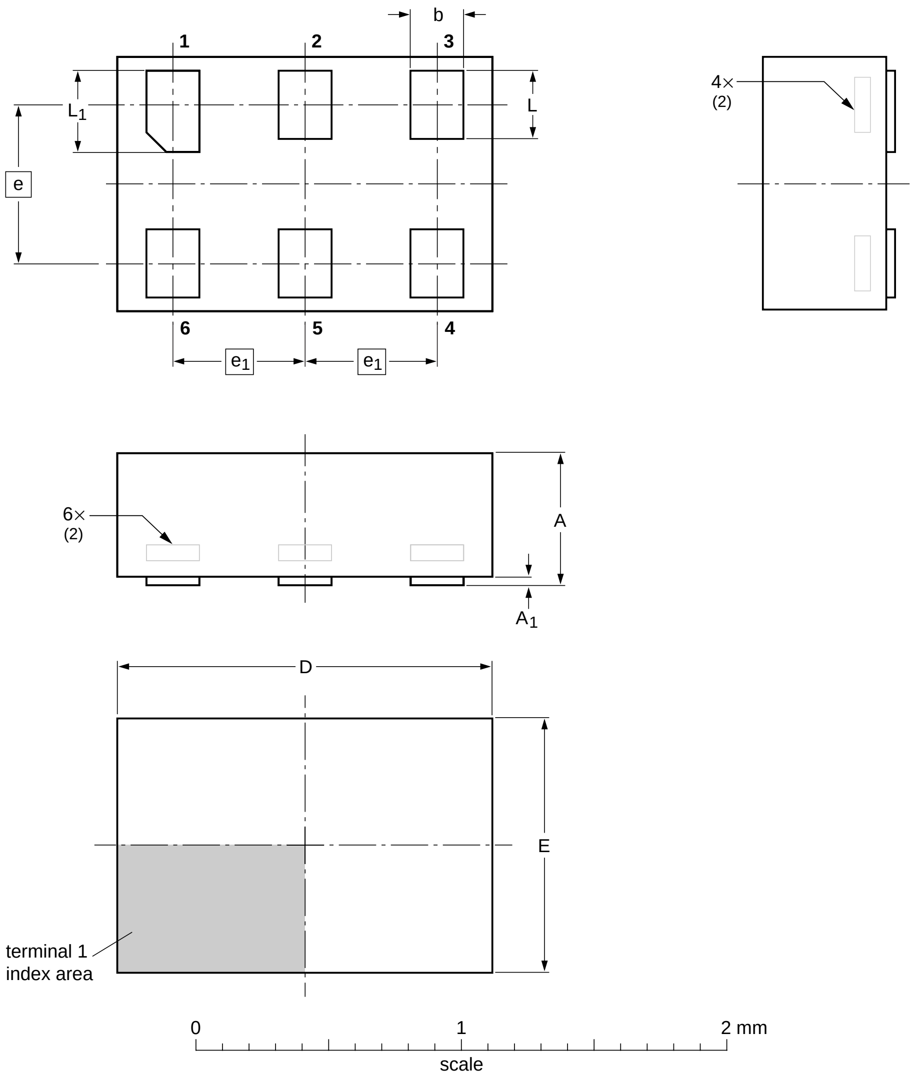
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	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	JEITA			
SOT457			SC-74			~~05-11-07~~ 06-03-16

Fig 14. Package outline SOT457 (SC-74)

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$^{(1)}$ max	A$_1$ max	b	D	E	e	e$_1$	L	L$_1$
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

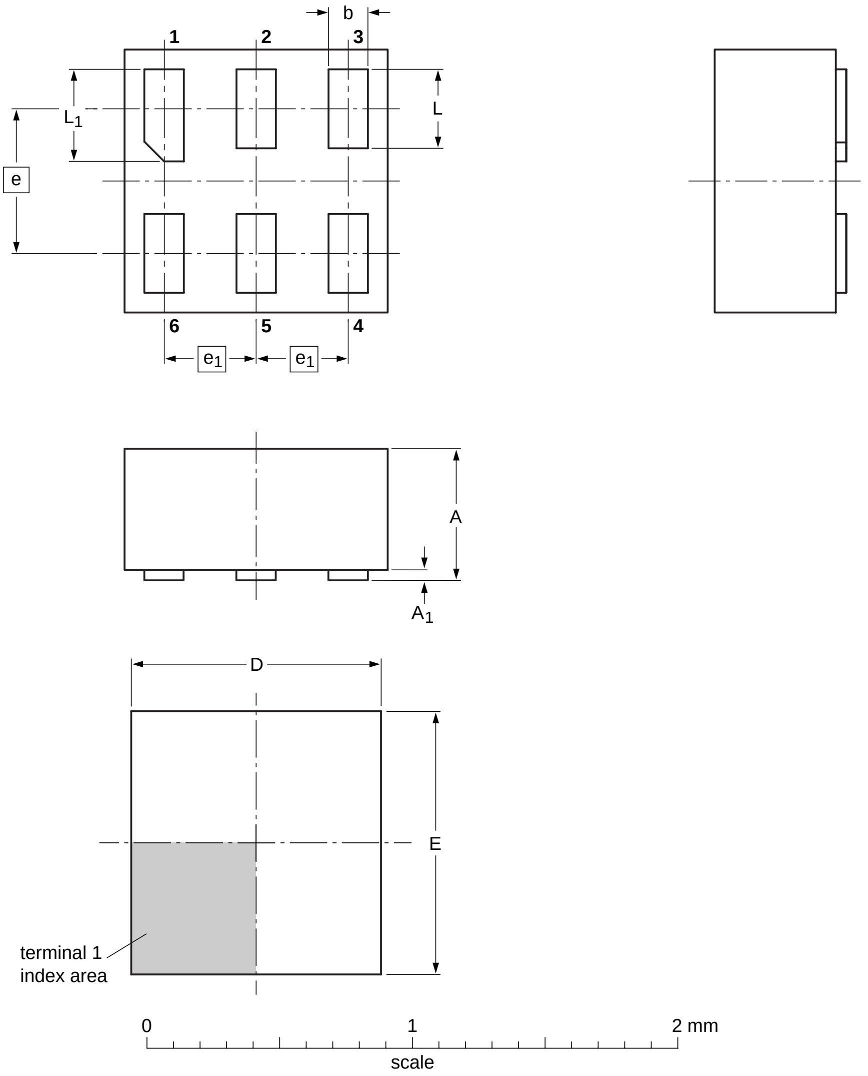
Notes

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

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_1 max	b	D	E	e	e_1	L	L_1
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

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT891						~~05-03-11~~ 05-04-06

Fig 16. Package outline SOT891 (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_4	20061009	Product data sheet	-	74LVC2G17_3
Modifications:	• The format of this data sheet has been redesigned to comply with the new identity guidelines of NXP Semiconductors. • Legal texts have been adapted to the new company name where appropriate. • Added type number 74LVC2G17GF (SOT891 package).			
74LVC2G17_3	20050926	Product data sheet	-	74LVC2G17_2
74LVC2G17_2	20040908	Product specification	-	74LVC2G17_1
74LVC2G17_1	20030813	Product specification	-	-

19. Legal information

19.1 Data sheet status

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.
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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