

# 74LVC1G86

2-input EXCLUSIVE-OR gate

Rev. 12 — 9 March 2017

Product data sheet

## 1 General description

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The 74LVC1G86 provides the 2-input EXCLUSIVE-OR function.

Inputs can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices 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

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- Wide supply voltage range from 1.65 V to 5.5 V
- 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 JESD22-A114F exceeds 2 000 V
  - MM 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
- Inputs accept voltages up to 5 V
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C

### 3 Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC1G86GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G86GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G86GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm	SOT886
74LVC1G86GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm	SOT891
74LVC1G86GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm	SOT1115
74LVC1G86GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm	SOT1202
74LVC1G86GX	-40 °C to +125 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm	SOT1226

### 4 Marking

Table 2. Marking codes

Type number	Marking <sup>[1]</sup>
74LVC1G86GW	VH
74LVC1G86GV	V86
74LVC1G86GM	VH
74LVC1G86GF	VH
74LVC1G86GN	VH
74LVC1G86GS	VH
74LVC1G86GX	VH

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

### 5 Functional diagram

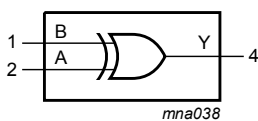


Figure 1. Logic symbol

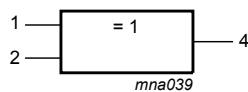


Figure 2. IEC logic symbol

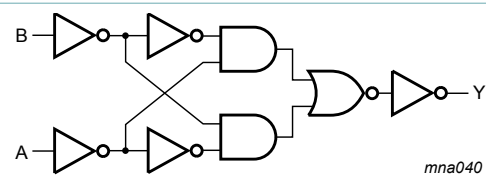


Figure 3. Logic diagram

## 6 Pinning information

### 6.1 Pinning

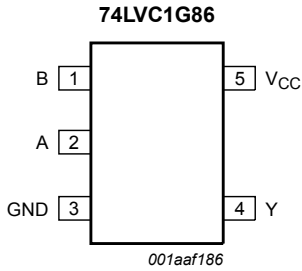


Figure 4. Pin configuration SOT353-1 and SOT753

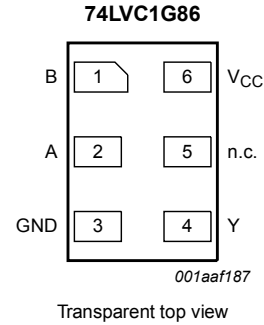


Figure 5. Pin configuration SOT886

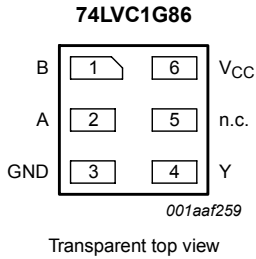


Figure 6. Pin configuration SOT891, SOT1115 and SOT1202

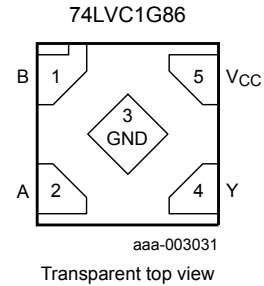


Figure 7. Pin configuration SOT1226 (X2SON5)

### 6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	TSSOP5 and X2SON5	XSON6	
B	1	1	data input
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	supply voltage

## 7 Functional description

Table 4. Function table <sup>[1]</sup>

Input		Output
A	B	Y
L	L	L
L	H	H
H	L	H
H	H	L

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

## 8 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		-0.5	+6.5	V
$I_{OK}$	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V	-	$\pm 50$	mA
$V_O$	output voltage	Active mode <sup>[1] [2]</sup>	-0.5	$V_{CC} + 0.5$	V
		Power-down mode <sup>[1] [2]</sup>	-0.5	+6.5	V
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	+100	mA
$I_{GND}$	ground current		-100	-	mA
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C <sup>[3]</sup>	-	250	mW
$T_{stg}$	storage temperature		-65	+150	°C

[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 TSSOP5 and SC-74A packages: above 87.5 °C the value of  $P_{tot}$  derates linearly with 4.0 mW/K.  
For XSON6 and X2SON5 packages: above 118 °C the value of  $P_{tot}$  derates linearly with 7.8 mW/K.

## 9 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	Active mode	0	-	$V_{CC}$	V
		$V_{CC} = 0$ V; Power-down mode	0	-	5.5	V
$T_{amb}$	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC} = 1.65$ V to 2.7 V	-	-	20	ns/V
		$V_{CC} = 2.7$ V to 5.5 V	-	-	10	ns/V

## 10 Static characteristics

Table 7. Static 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 <sup>[1]</sup>	Max	Min	Max	
$V_{IH}$	HIGH-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	$0.65V_{CC}$	-	-	$0.65V_{CC}$	-	V
		$V_{CC} = 2.3$ V to 2.7 V	1.7	-	-	1.7	-	V
		$V_{CC} = 2.7$ V to 3.6 V	2.0	-	-	2.0	-	V
		$V_{CC} = 4.5$ V to 5.5 V	$0.7V_{CC}$	-	-	$0.7V_{CC}$	-	V
$V_{IL}$	LOW-level input voltage	$V_{CC} = 1.65$ V to 1.95 V	-	-	$0.35V_{CC}$	-	$0.35V_{CC}$	V
		$V_{CC} = 2.3$ V to 2.7 V	-	-	0.7	-	0.7	V
		$V_{CC} = 2.7$ V to 3.6 V	-	-	0.8	-	0.8	V
		$V_{CC} = 4.5$ V to 5.5 V	-	-	$0.3V_{CC}$	-	$0.3V_{CC}$	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	$V_{CC} - 0.1$	-	-	$V_{CC} - 0.1$	-	V
		$I_O = -4$ mA; $V_{CC} = 1.65$ V	1.2	-	-	0.95	-	V
		$I_O = -8$ mA; $V_{CC} = 2.3$ V	1.9	-	-	1.7	-	V
		$I_O = -12$ mA; $V_{CC} = 2.7$ V	2.2	-	-	1.9	-	V
		$I_O = -24$ mA; $V_{CC} = 3.0$ V	2.3	-	-	2.0	-	V
$V_{OL}$	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	-	-	0.10	-	0.10	V
		$I_O = 4$ mA; $V_{CC} = 1.65$ V	-	-	0.45	-	0.70	V
		$I_O = 8$ mA; $V_{CC} = 2.3$ V	-	-	0.30	-	0.45	V
		$I_O = 12$ mA; $V_{CC} = 2.7$ V	-	-	0.40	-	0.60	V

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
		$I_O = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	-	0.80	V
		$I_O = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.55	-	0.80	V
$I_I$	input leakage current	$V_I = 5.5 \text{ V or GND}; V_{CC} = 0 \text{ V to } 5.5 \text{ V}$	-	$\pm 0.1$	$\pm 1$	-	$\pm 1$	$\mu\text{A}$
$I_{OFF}$	power-off leakage current	$V_{CC} = 0 \text{ V}; V_I \text{ or } V_O = 5.5 \text{ V}$	-	$\pm 0.1$	$\pm 2$	-	$\pm 2$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = 5.5 \text{ V or GND}; I_O = 0 \text{ A}; V_{CC} = 1.65 \text{ V to } 5.5 \text{ V}$	-	0.1	4	-	4	$\mu\text{A}$
$\Delta I_{CC}$	additional supply current	per pin; $V_{CC} = 2.3 \text{ V to } 5.5 \text{ V}; V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A}$	-	5	500	-	500	$\mu\text{A}$
$C_I$	input capacitance	$V_{CC} = 3.3 \text{ V}; V_I = \text{GND to } V_{CC}$	-	5	-	-	-	pF

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

## 11 Dynamic characteristics

**Table 8. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for test circuit see [Figure 9](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
$t_{pd}$	propagation delay	A, B to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.0	3.7	9.9	1.0	13.0	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.5	2.5	5.5	0.5	7.0	ns
		$V_{CC} = 2.7 \text{ V}$	0.5	2.8	5.8	0.5	7.5	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	0.5	2.3	5.0	0.5	6.5	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0.5	1.9	4.0	0.5	5.5	ns
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC}$ <sup>[3]</sup>						
		$V_{CC} = 3.3 \text{ V}$	-	25	-	-	-	pF

[1] All typical values are measured at nominal  $V_{CC}$ .

[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  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

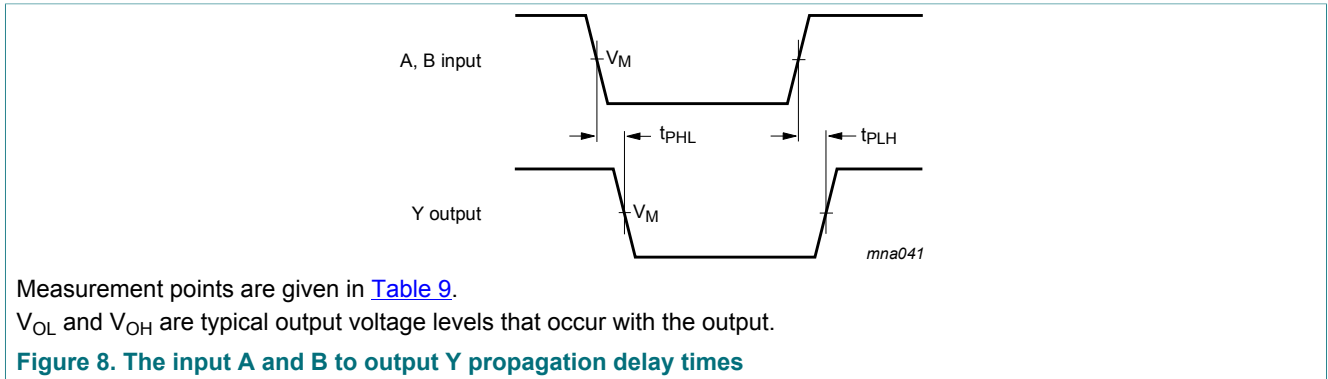
$C_L$  = output load capacitance in pF;

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

$N$  = number of inputs switching;

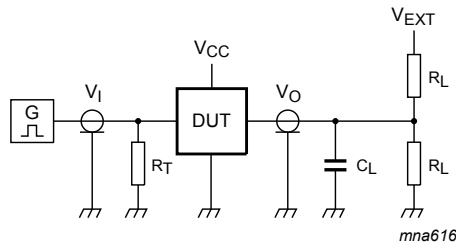
$\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## 11.1 Waveforms and test circuit



**Table 9. Measurement points**

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
1.65 V to 1.95 V	$0.5V_{CC}$	$0.5V_{CC}$
2.3 V to 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$
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	$0.5V_{CC}$	$0.5V_{CC}$



Test data is given in [Table 10](#).

Definitions test circuit:

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

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

$R_L$  = Load resistance.

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

**Figure 9. Test circuit for measuring switching times**

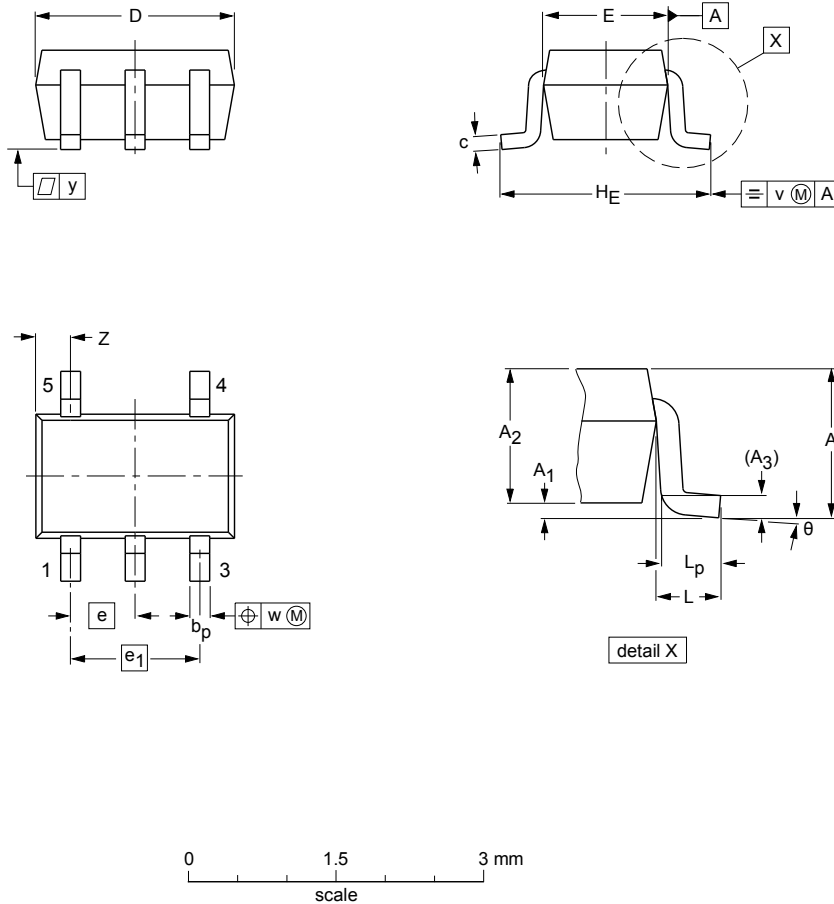
**Table 10. Test data**

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	$V_{CC}$	$\leq 2.0$ ns	30 pF	1 k $\Omega$	open
2.3 V to 2.7 V	$V_{CC}$	$\leq 2.0$ ns	30 pF	500 $\Omega$	open
2.7 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open
3.0 V to 3.6 V	2.7 V	$\leq 2.5$ ns	50 pF	500 $\Omega$	open
4.5 V to 5.5 V	$V_{CC}$	$\leq 2.5$ ns	50 pF	500 $\Omega$	open

12 Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	b <sub>p</sub>	c	D <sup>(1)</sup>	E <sup>(1)</sup>	e	e <sub>1</sub>	H <sub>E</sub>	L	L <sub>p</sub>	v	w	y	Z <sup>(1)</sup>	θ
mm	1.1	0.1 0	1.0 0.8	0.15	0.30 0.15	0.25 0.08	2.25 1.85	1.35 1.15	0.65	1.3	2.25 2.0	0.425	0.46 0.21	0.3	0.1	0.1	0.60 0.15	7° 0°

Note

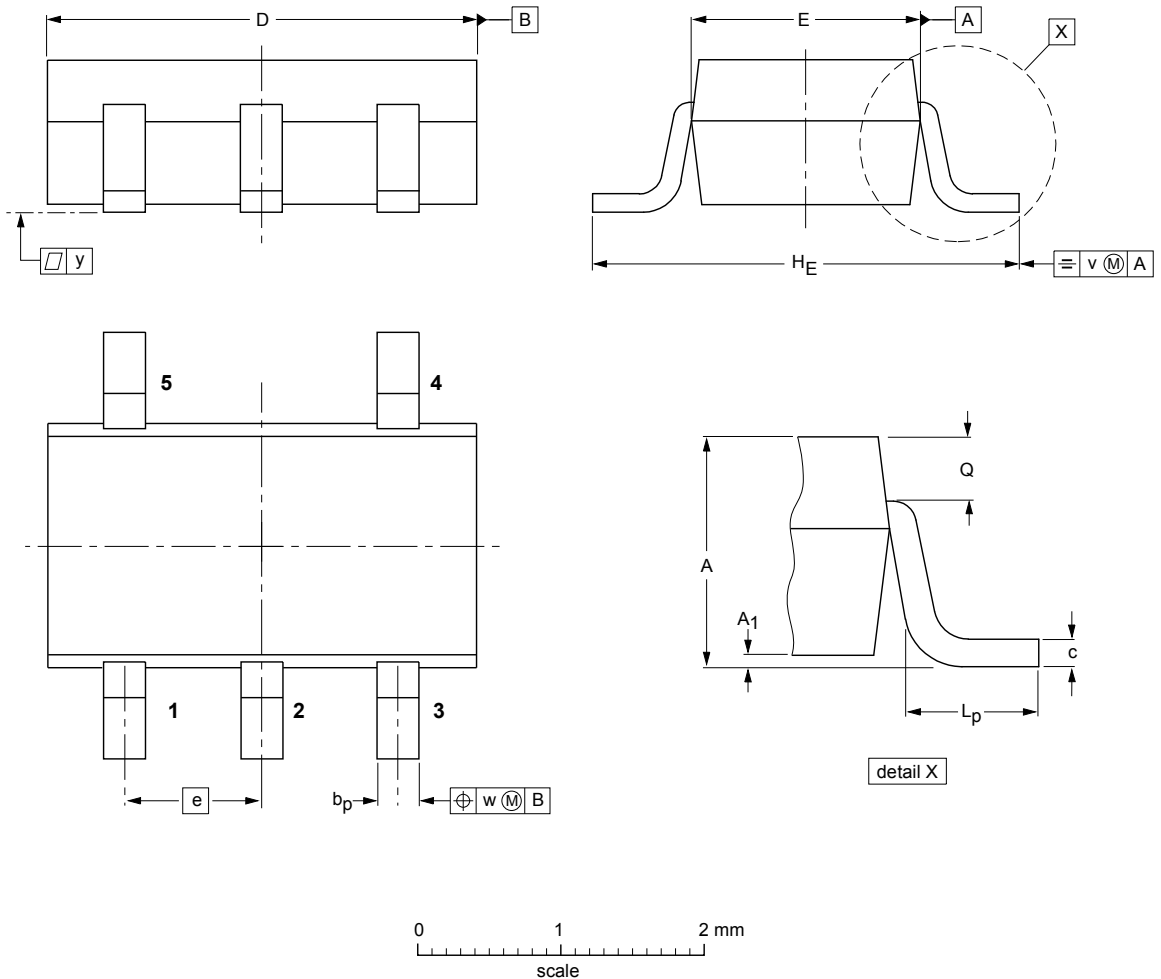
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT353-1		MO-203	SC-88A		00-09-01 03-02-19

Figure 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753



DIMENSIONS (mm are the original dimensions)

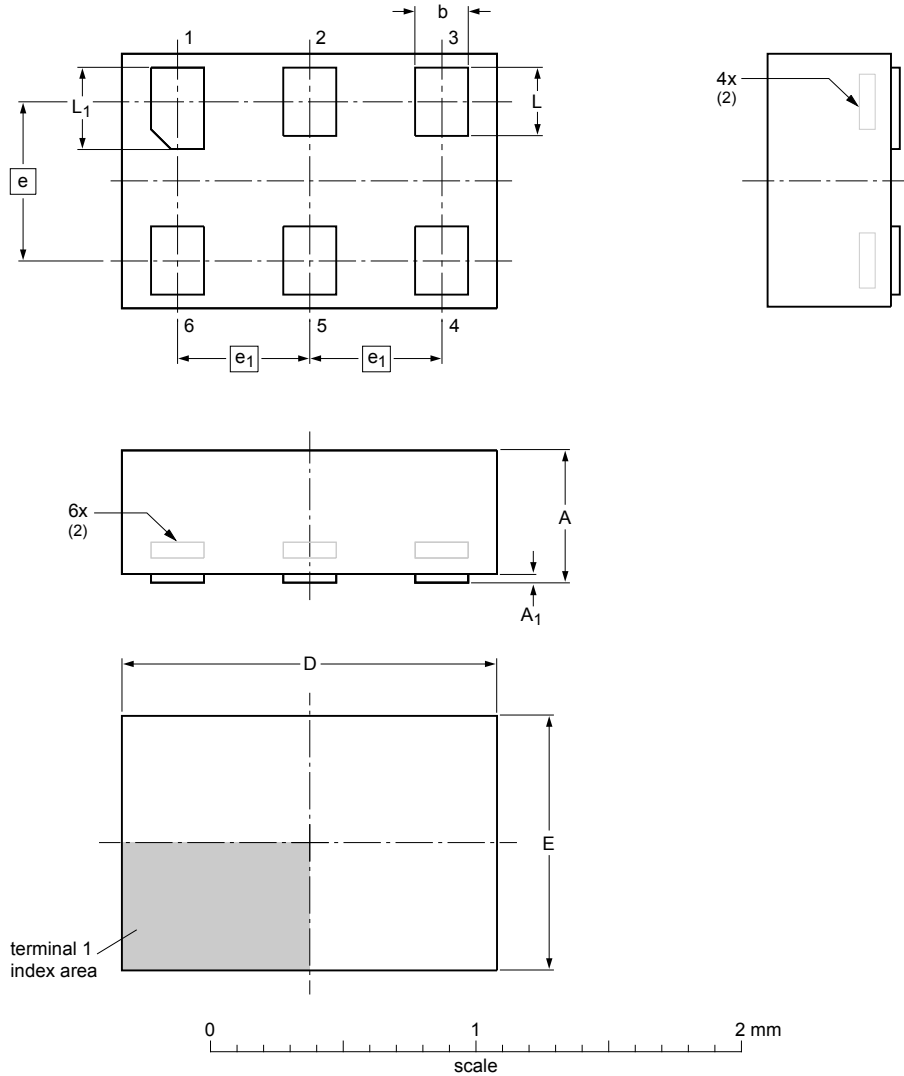
UNIT	A	A <sub>1</sub>	b <sub>p</sub>	c	D	E	e	H <sub>E</sub>	L <sub>p</sub>	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT753			SC-74A		02-04-16 06-03-16

Figure 11. Package outline SOT753 (SC-74A)

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>	A <sub>1</sub>	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
min			0.17	1.40	0.95			0.27	0.32

Notes

- Including plating thickness.
- Can be visible in some manufacturing processes.

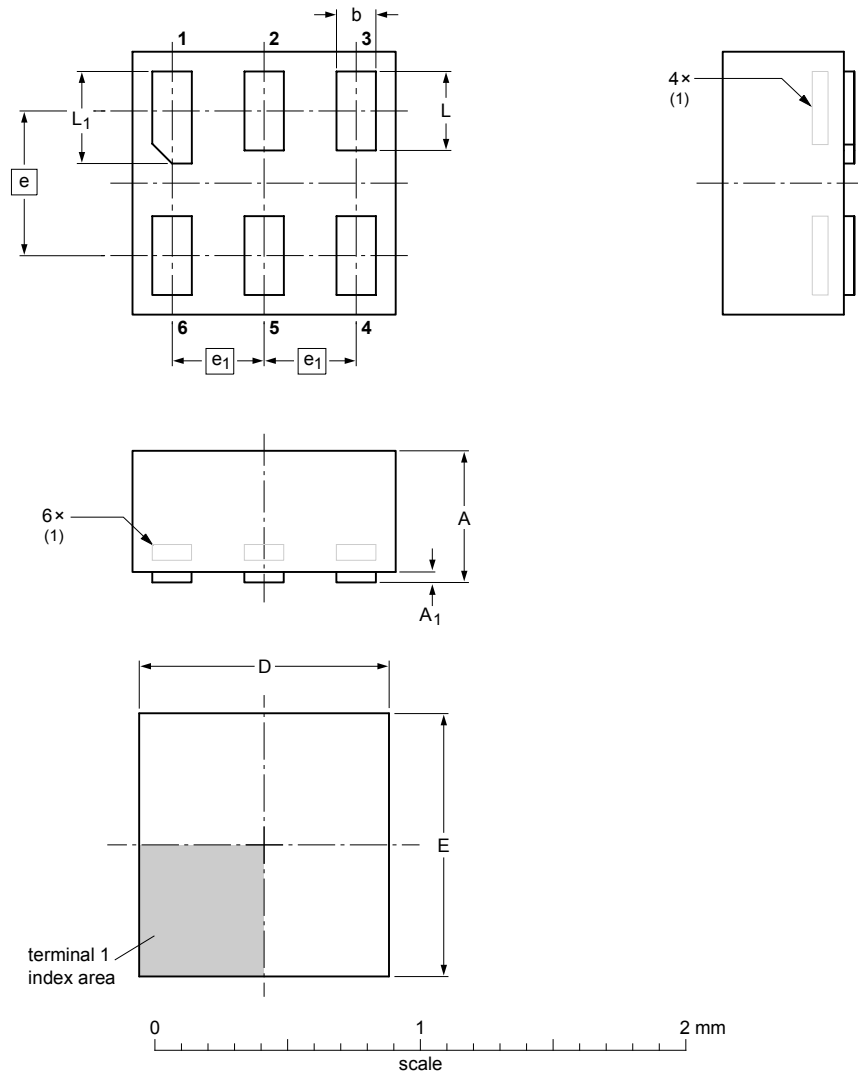
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Outline version	References			European projection	Issue date
	IEC	JEDEC	JEITA		
SOT886		MO-252			<del>04-07-22</del> 12-01-05

Figure 12. 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 <sub>max</sub>	A <sub>1max</sub>	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
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

**Note**

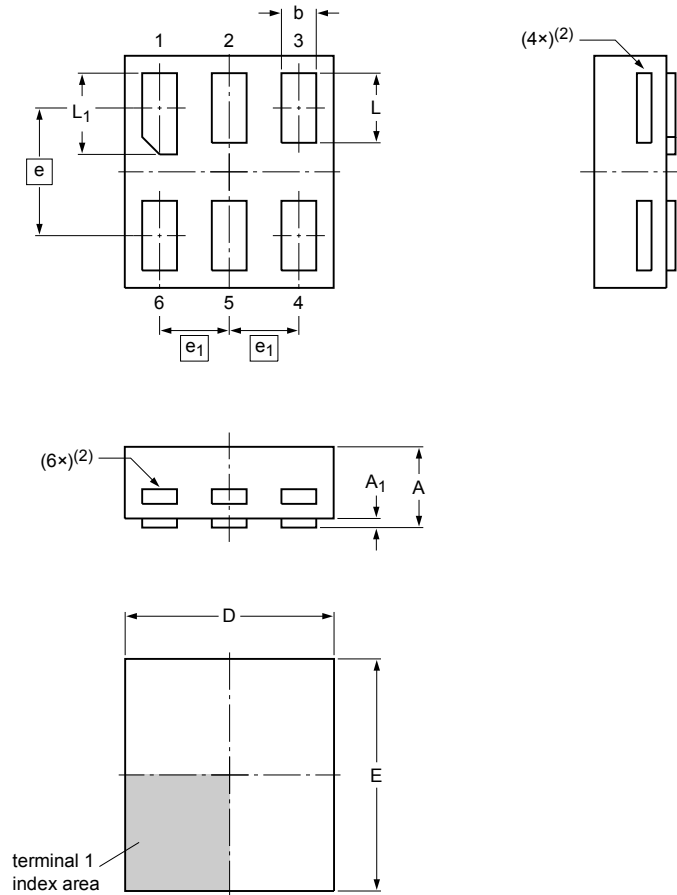
1. Can be visible in some manufacturing processes.

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT891					-05-04-06 07-05-15

Figure 13. Package outline SOT891 (XSON6)

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

SOT1115



Dimensions

Unit	A <sup>(1)</sup>	A <sub>1</sub>	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
max	0.35	0.04	0.20	0.95	1.05			0.35	0.40
nom			0.15	0.90	1.00	0.55	0.3	0.30	0.35
min			0.12	0.85	0.95			0.27	0.32

Note

- Including plating thickness.
- Visible depending upon used manufacturing technology.

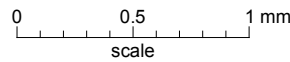
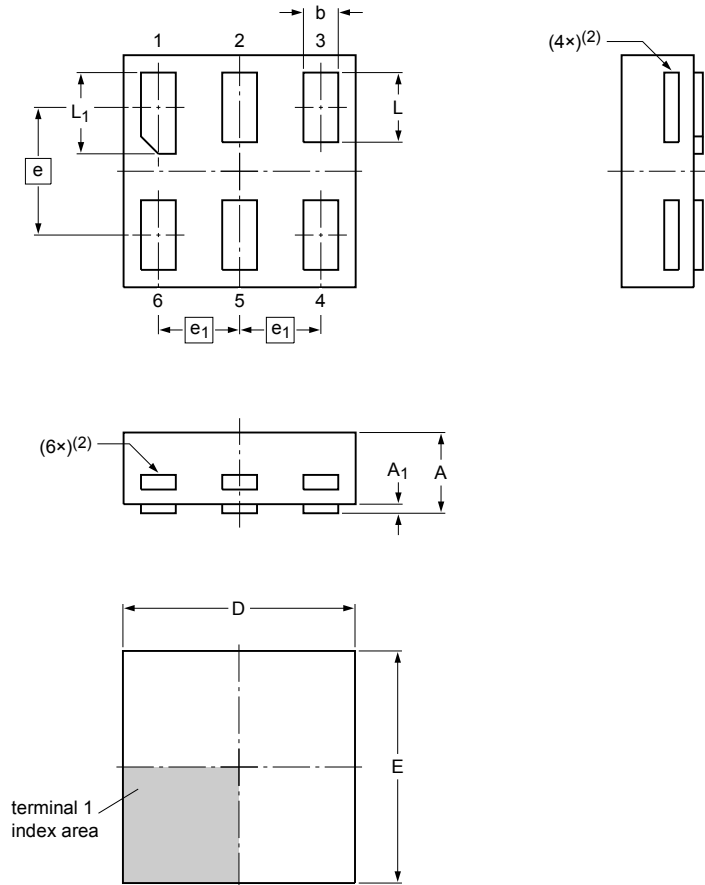
sot1115\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1115						-10-04-02- 10-04-07

Figure 14. Package outline SOT1115 (XSON6)

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

SOT1202



Dimensions

Unit	A <sup>(1)</sup>	A <sub>1</sub>	b	D	E	e	e <sub>1</sub>	L	L <sub>1</sub>
max	0.35	0.04	0.20	1.05	1.05			0.35	0.40
nom			0.15	1.00	1.00	0.55	0.35	0.30	0.35
min			0.12	0.95	0.95			0.27	0.32

Note

- Including plating thickness.
- Visible depending upon used manufacturing technology.

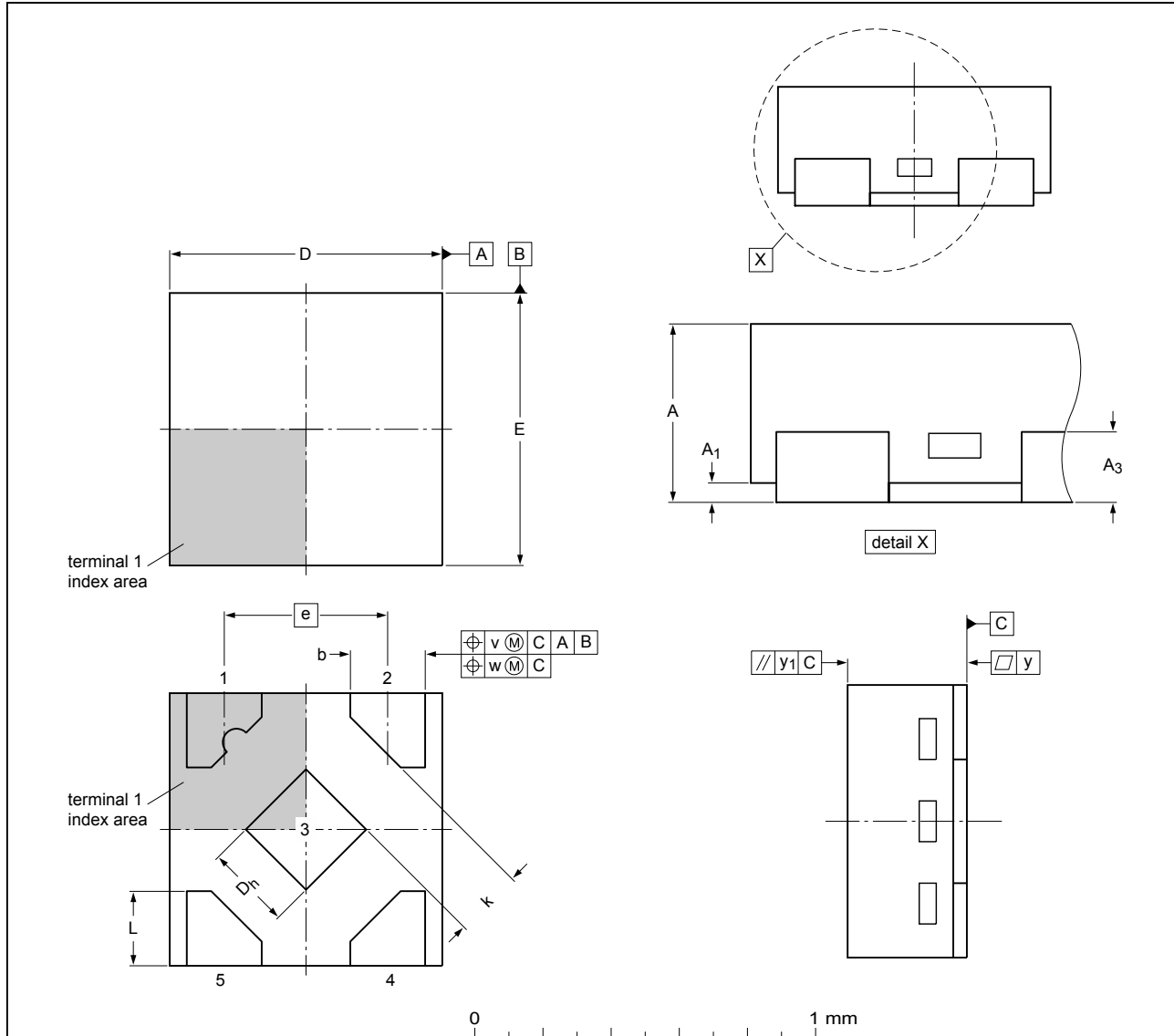
sot1202\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1202						-10-04-02- 10-04-06

Figure 15. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;  
5 terminals; body 0.8 x 0.8 x 0.35 mm

SOT1226



Dimensions

Unit	A <sup>(1)</sup>	A <sub>1</sub>	A <sub>3</sub>	D	D <sub>h</sub>	E	b	e	k	L	v	w	y	y <sub>1</sub>
max	0.35	0.04	0.128	0.85	0.30	0.85	0.27			0.27				
mm nom				0.80	0.25	0.80	0.22	0.48		0.22	0.1	0.05	0.05	0.05
min			0.040	0.75	0.20	0.75	0.17		0.20	0.17				

Note

1. Dimension A is including plating thickness.
2. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1226\_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	EIAJ			
SOT1226						12-04-10 12-04-25

Figure 16. Package outline SOT1226 (X2SON5)

## 13 Abbreviations

Table 11. 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

## 14 Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G86 v.12	20170309	Product data sheet	-	74LVC1G86 v.11
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> </ul>			
74LVC1G86 v.11	20161212	Product data sheet	-	74LVC1G86 v.10
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Table 7</a>: The maximum limits for leakage current and supply current have changed.</li> </ul>			
74LVC1G86 v.10	20120702	Product data sheet	-	74LVC1G86 v.9
Modifications:	<ul style="list-style-type: none"> <li>Added type number 74LVC1G86GX (SOT1226)</li> </ul>			
74LVC1G86 v.9	20120305	Product data sheet	-	74LVC1G86 v.8
Modifications:	<ul style="list-style-type: none"> <li>Package outline drawing of SOT886 (<a href="#">Figure 12</a>) modified.</li> </ul>			
74LVC1G86 v.8	20111201	Product data sheet	-	74LVC1G86 v.7
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
74LVC1G86 v.7	20100914	Product data sheet	-	74LVC1G86 v.6
74LVC1G86 v.6	20070718	Product data sheet	-	74LVC1G86 v.5
74LVC1G86 v.5	20060913	Product data sheet	-	74LVC1G86 v.4
74LVC1G86 v.4	20040908	Product specification	-	74LVC1G86 v.3
74LVC1G86 v.3	20021115	Product specification	-	74LVC1G86 v.2
74LVC1G86 v.2	20010406	Preliminary specification	-	74LVC1G86 v.1
74LVC1G86 v.1	20001222	Preliminary specification	-	-

## 15 Legal information

### 15.1 Data sheet status

Document status <sup>[1][2]</sup>	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".

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