74LVC1G86

2-input EXCLUSIVE-OR gate

Rev. 15 — 13 November 2024

Product data sheet

1. General description

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

- Wide supply voltage range from 1.65 V to 5.5 V
- High noise immunity
- Overvoltage tolerant inputs to 5.5 V
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 V)
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power dissipation
- Latch-up performance exceeds 250 mA
- I_{OFF} circuitry provides partial Power-down mode operation
- · Direct interface with TTL levels
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C



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3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
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 × 1.45 × 0.5 mm	<u>SOT886</u>
74LVC1G86GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	<u>SOT1115</u>
74LVC1G86GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74LVC1G86GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3
74LVC1G86GZ	-40 °C to +125 °C	XSON5	plastic thermal enhanced extremely thin small outline package with side-wettable flanks (SWF); no leads; 5 terminals; body 1.1 × 0.85 × 0.5 mm	SOT8065-1

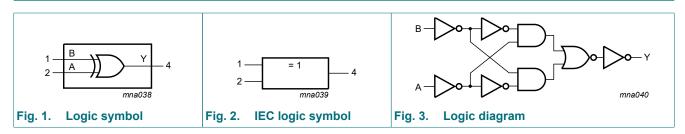
4. Marking

Table 2. Marking codes

Type number	Marking[1]
74LVC1G86GW	VH
74LVC1G86GV	V86
74LVC1G86GM	VH
74LVC1G86GN	VH
74LVC1G86GS	VH
74LVC1G86GX	VH
74LVC1G86GZ	VH

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

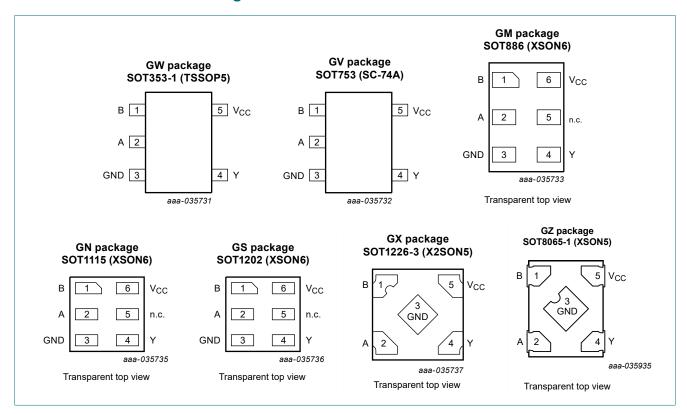
5. Functional diagram



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6. Pinning information

6.1. Pinning



6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	TSSOP5, SC-74A, XSON5 and X2SON5	XSON6	
В	1	1	data input
A	2	2	data input
GND	3	3	ground (0 V)
Υ	4	4	data output
n.c.	-	5	not connected
V _{CC}	5	6	supply voltage

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7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

Input		Output
Α	В	Υ
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

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
VI	input voltage	[1]	-0.5	+6.5	V
I _{OK}	output clamping current	V _O > V _{CC} or V _O < 0 V	-	±50	mA
Vo	output voltage	Active mode [1]	-0.5	V _{CC} + 0.5	V
		Power-down mode; V _{CC} = 0 V [1]	-0.5	+6.5	V
Io	output current	$V_O = 0 \text{ V to } V_{CC}$	-	±50	mA
I _{CC}	supply current		-	+100	mA
I _{GND}	ground current		-100	-	mA
P _{tot}	total power dissipation	$T_{amb} = -40 ^{\circ}\text{C} \text{ to } +125 ^{\circ}\text{C}$ [2]	-	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.

For SOT1115 (XSON6) package: Ptot derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1226-3 (X2SON5) package: Ptot derates linearly with 3.0 mW/K above 67 °C.

For SOT8065-1 (XSON5) package: P_{tot} derates linearly with 3.2 mW/K above 72 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{CC}	supply voltage		1.65	-	5.5	V
VI	input voltage		0	-	5.5	V
Vo	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
Δt/ΔV	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

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^[2] For SOT353-1 (TSSOP5) package: Ptot derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: Ptot derates linearly with 3.8 mW/K above 85 °C.

For SOT886 (XSON6) package: Ptot derates linearly with 3.3 mW/K above 74 °C.

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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	5 °C	-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	1
V _{IH}	HIGH-level input	V _{CC} = 1.65 V to 1.95 V	0.65V _{CC}	-	-	0.65V _{CC}	-	V
	voltage	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	V _{CC} = 1.65 V to 1.95 V	-	-	0.35V _{CC}	-	0.35V _{CC}	V
	voltage	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	$V_I = V_{IH}$ or V_{IL}						
	output voltage	I _O = -100 μA; 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
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	-	-	3.4	-	V
V _{OL}	LOW-level output	V _I = V _{IH} or V _{IL}						
	voltage	I _O = 100 μA; 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
		$I_O = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.40	-	0.60	V
		I _O = 24 mA; V _{CC} = 3.0 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 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	-	±1	μA
I _{OFF}	power-off leakage current	$V_{CC} = 0 \text{ V}; V_{I} \text{ or } V_{O} = 5.5 \text{ V}$	-	±0.1	±2	-	±2	μA
I _{CC}	supply current	V _I = 5.5 V or GND; I _O = 0 A; V _{CC} = 1.65 V to 5.5 V	-	0.1	4	-	4	μA
ΔI _{CC}	additional supply current	per pin; V_{CC} = 2.3 V to 5.5 V; V_I = V_{CC} - 0.6 V; I_O = 0 A	-	5	500	-	500	μA
Cı	input capacitance	V_{CC} = 3.3 V; V_I = GND to V_{CC}	-	5	-	-	-	pF

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

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11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 5.

Symbol	Parameter	Conditions	-40	°C to +85	°C	-40 °C to	+125 °C	Unit
			Min	Typ[1]	Max	Min	Max	
t _{pd}	propagation delay	A, B to Y; see <u>Fig. 4</u> [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	3.7	9.9	1.0	13.0	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	2.5	5.5	0.5	7.0	ns
		V _{CC} = 2.7 V	0.5	2.8	5.8	0.5	7.5	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	2.3	5.0	0.5	6.5	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	1.9	4.0	0.5	5.5	ns
C _{PD}	power dissipation	$V_I = GND \text{ to } V_{CC}$ [3]						
	capacitance	V _{CC} = 3.3 V	-	25	-	-	-	pF

- All typical values are measured at nominal V_{CC}.
- t_{pd} is the same as t_{PLH} and t_{PHL} 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;

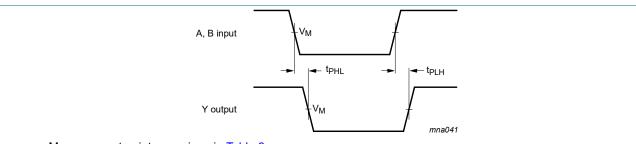
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

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

11.1. Waveforms and test circuit



Measurement points are given in Table 9.

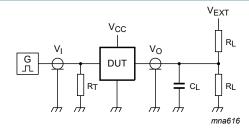
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output.

The input A and B to output Y propagation delay times

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}

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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.

Fig. 5. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V _{EXT}	
V _{CC}	VI	t _r = t _f	CL	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	

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12. Package outline

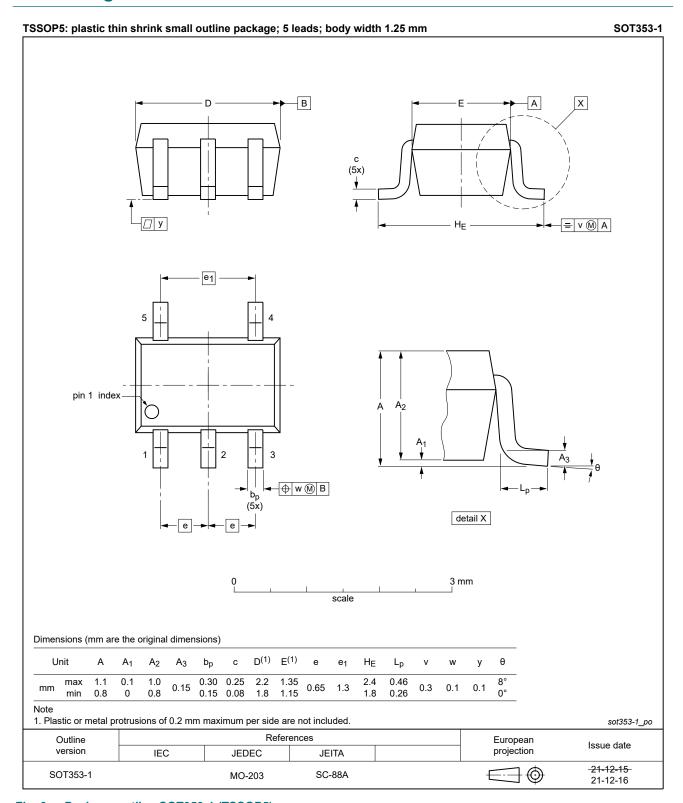


Fig. 6. Package outline SOT353-1 (TSSOP5)

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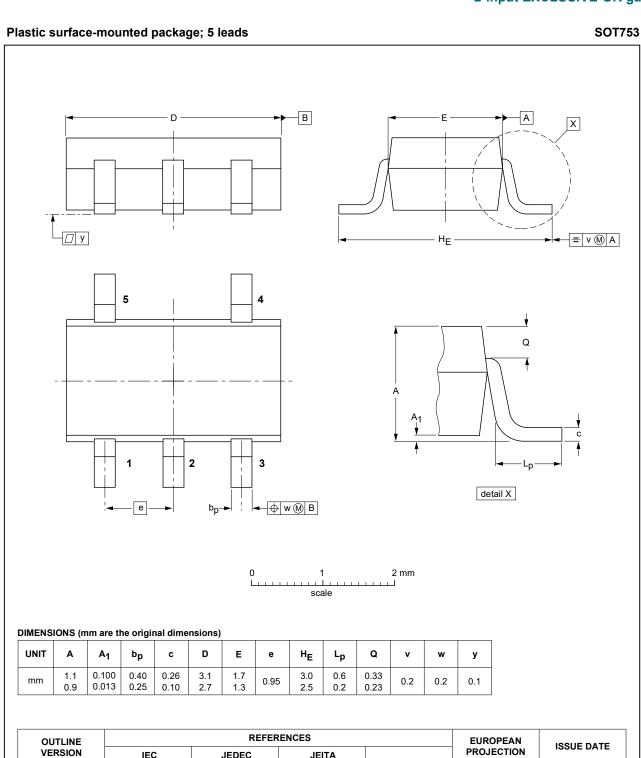


Fig. 7. Package outline SOT753 (SC-74A)

SOT753

IEC

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SC-74A

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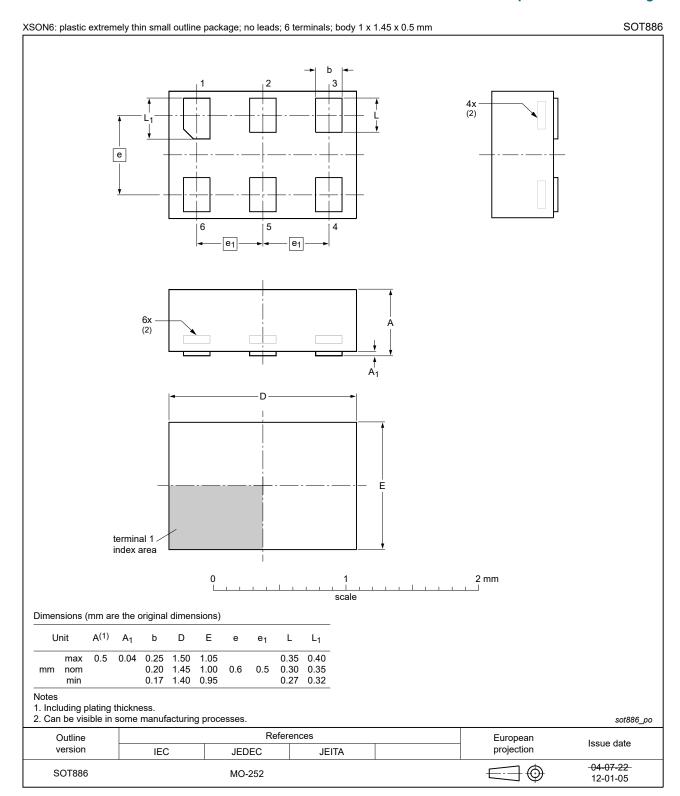


Fig. 8. Package outline SOT886 (XSON6)

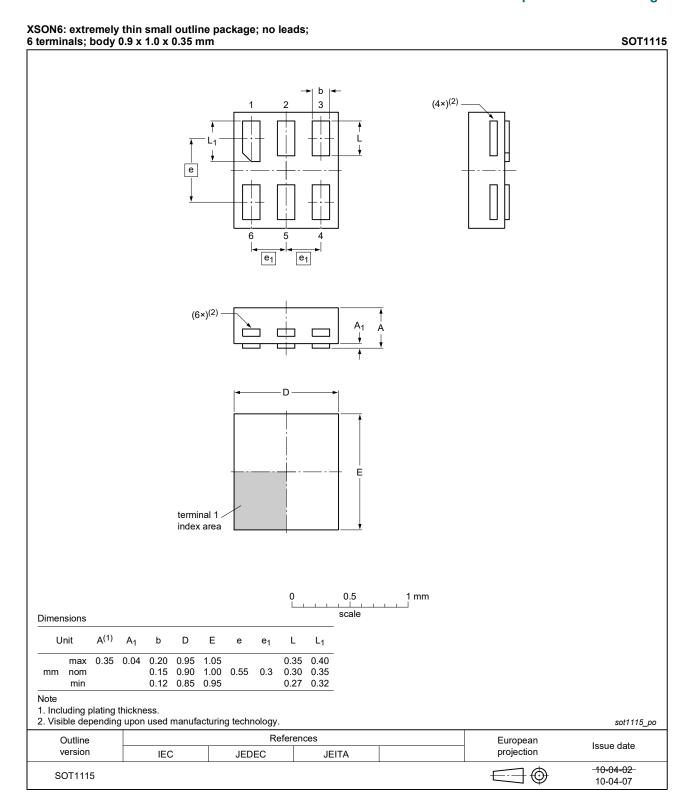


Fig. 9. Package outline SOT1115 (XSON6)

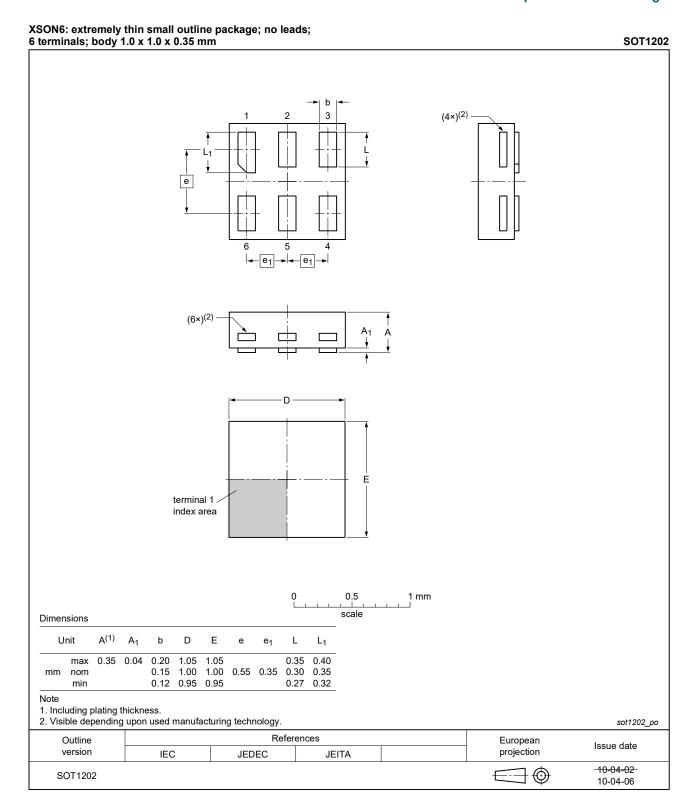


Fig. 10. Package outline SOT1202 (XSON6)

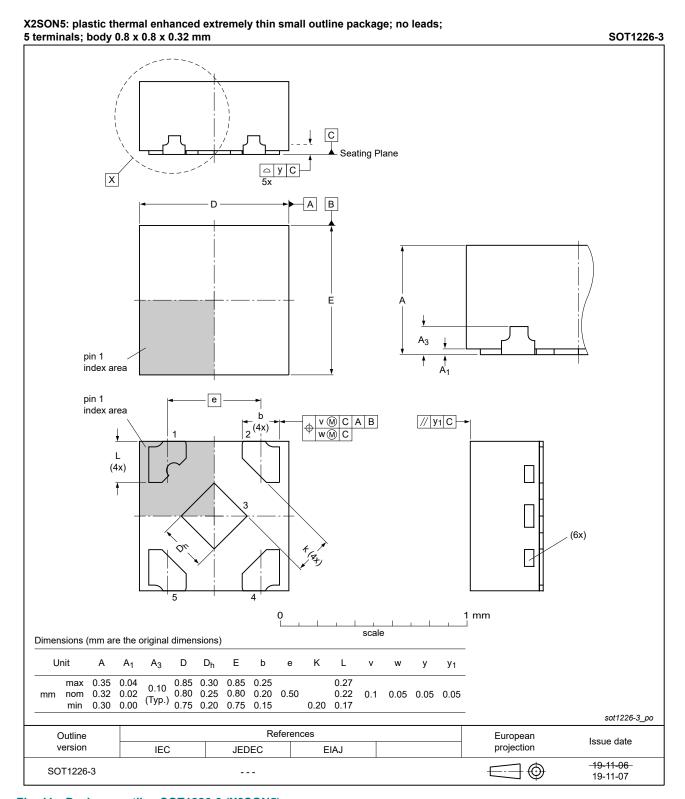


Fig. 11. Package outline SOT1226-3 (X2SON5)

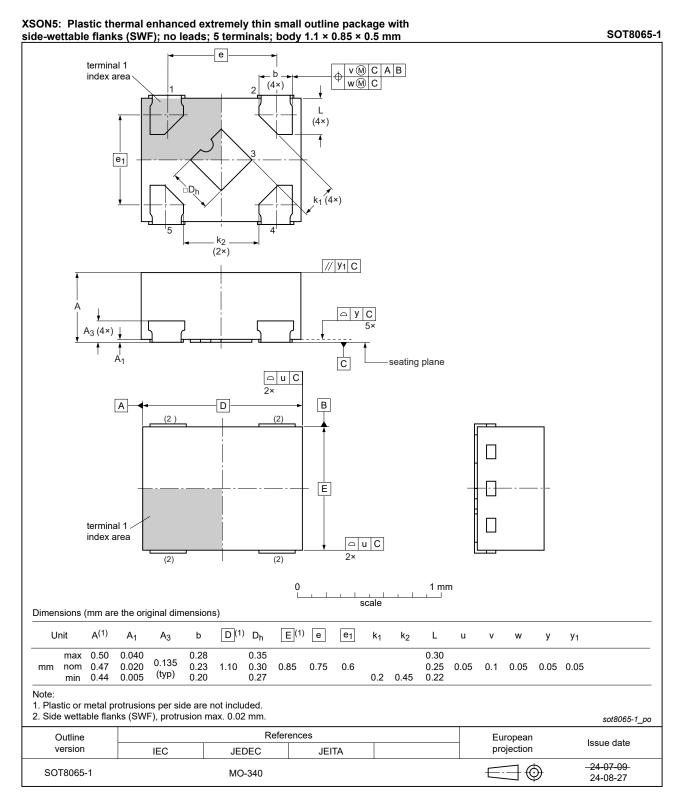


Fig. 12. Package outline SOT8065-1 (XSON5)

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13. Abbreviations

Table 11. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CMOS	Complementary Metal-Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
НВМ	Human Body Model
JEDEC	Joint Electron Device Engineering Council
TTL	Transistor-Transistor Logic

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G86 v.15	20241113	Product data sheet	-	74LVC1G86 v.14
Modifications:	Type number 74LV	C1G86GZ (SOT8065-1/XS0	ON5) added.	
74LVC1G86 v.14	20230822	Product data sheet	-	74LVC1G86 v.13
Modifications:	<u>Section 2</u> : ESD spe	ecification updated accordin	g to the latest JEDEC	standard.
• 74LVC1G86 v.13	20220107	Product data sheet	-	74LVC1G86 v.12
Modifications:	SOT1226 (X2SON)Fig. 6: Package out	C1G86GF removed. b) package changed to SOT thine drawing for SOT353-1 alues for P _{tot} total power dis	(TSSOP5) has change	-
74LVC1G86 v.12	20170309	Product data sheet	-	74LVC1G86 v.11
Modifications:	Nexperia.	lata sheet has been redesig		
74LVC1G86 v.11	20161212	Product data sheet	-	74LVC1G86 v.10
Modifications:	<u>Table 7</u> : The maxim	num limits for leakage curre	nt and supply current l	nave changed.
74LVC1G86 v.10	20120702	Product data sheet	-	74LVC1G86 v.9
Modifications:	Added type number	r 74LVC1G86GX (SOT1226	5)	
74LVC1G86 v.9	20120305	Product data sheet	-	74LVC1G86 v.8
Modifications:	Package outline dra	awing of SOT886 (<u>Fig. 8</u>) m	odified.	
74LVC1G86 v.8	20111201	Product data sheet	-	74LVC1G86 v.7
Modifications:	Legal pages update	ed.		,
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

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Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G86 v.2	20010406	Preliminary specification	-	74LVC1G86 v.1
74LVC1G86 v.1	20001222	Preliminary specification	-	-

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15. Legal information

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.

- 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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2-input EXCLUSIVE-OR gate

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