1 General description

The 74LVC1G14 provides the inverting buffer function with Schmitt-trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The input can be driven from either 3.3 V or 5 V devices. This feature allows the use of this device in a mixed 3.3 V and 5 V environment. Schmitt-trigger action at the input makes the circuit tolerant for slower input rise and fall time.

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
- · Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8-B/JESD36 (2.7 V to 3.6 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
- · Unlimited rise and fall times
- Input accepts voltages up to 5 V
- Multiple package options
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2000 V
 - MM: JESD22-A115-A exceeds 200 V.
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.

3 Applications

- · Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

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4 Ordering information

Type number	Package			
	Temperature Name range		Description	Version
74LVC1G14GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G14GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G14GM	-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
74LVC1G14GF	-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
74LVC1G14GN	-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
74LVC1G14GS	-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
74LVC1G14GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm	SOT1226
74LVC1G14GX4	-40 °C to +125 °C	X2SON4	plastic thermal enhanced extremely thin small outline package; no leads; 4 terminals; body 0.6 x 0.6 x 0.32 mm	SOT1269-2

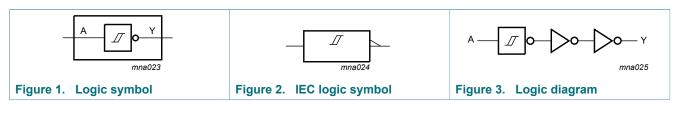
5 Marking

Table 2. Marking						
Type number	Marking code ^[1]					
74LVC1G14GW	VF					
74LVC1G14GV	V14					
74LVC1G14GM	VF					
74LVC1G14GF	VF					
74LVC1G14GN	VF					
74LVC1G14GS	VF					
74LVC1G14GX	VF					
74LVC1G14GX4	VF					

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

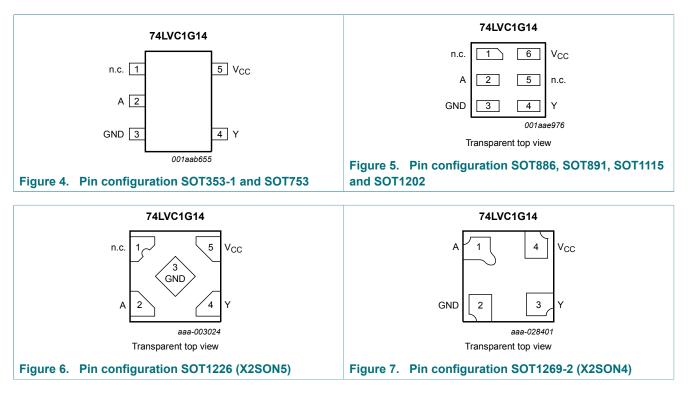
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6 Functional diagram



7 Pinning information

7.1 Pinning



7.2 Pin description

Symbol	Pin	Pin				
	TSSOP5, SC-74A and X2SON5	XSON6	X2SON4			
n.c.	1	1, 5	-	not connected		
A	2	2	1	data input		
GND	3	3	2	ground (0 V)		
Y	4	4	3	data output		
V _{CC}	5	6	4	supply voltage		

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Functional description 8

Table 4. Function table ^[1]

Input	Output
A	Y
L	н
Н	L

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

Limiting values 9

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	Мах	Unit
V _{CC}	supply voltage			-0.5	+6.5	V
VI	input voltage		[1]	-0.5	+6.5	V
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
I _{IK}	input clamping current	V _I < 0 V		-50	-	mA
l _{ок}	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 0 V		-	±50	mA
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				
		TSSOP5, SC-74A, XSON6 and X2SON5 package	[2]	-	250	mW
		X2SON4 package	[3]	-	150	mW

The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
 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 package: above 118 °C the value of Ptot derates linearly with 7.8 mW/K. [3] For X2SON4 packages: above 57 °C the value of Ptot derates linearly with 1.7 mW/K.

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10 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
		Power-down mode; V_{CC} = 0 V	0	-	5.5	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	-40	°C to +85	°C	-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Мах	Min	Max	
V _{OH}	HIGH-level	$V_{I} = V_{T+} \text{ or } V_{T-}$						
	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	1.54	-	0.95	-	V
		I _O = -8 mA; V _{CC} = 2.3 V	1.9	2.15	-	1.7	-	V
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	2.50	-	1.9	-	V
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	2.62	-	2.0	-	V
		I _O = -32 mA; V _{CC} = 4.5 V	3.8	4.11	-	3.4	-	V
V _{OL}	LOW-level output voltage	$V_{I} = V_{T+} \text{ or } V_{T-}$						
		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	-	0.07	0.45	-	0.70	V
		I _O = 8 mA; V _{CC} = 2.3 V	-	0.12	0.30	-	0.45	V
		I _O = 12 mA; V _{CC} = 2.7 V	-	0.17	0.40	-	0.60	V
		I _O = 24 mA; V _{CC} = 3.0 V	-	0.33	0.55	-	0.80	V
		I _O = 32 mA; V _{CC} = 4.5 V	-	0.39	0.55	-	0.80	V
l _l	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	$V_{I} \text{ or } V_{O} = 5.5 \text{ V}; V_{CC} = 0 \text{ V}$	-	±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

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Symbol	Parameter Conditions		-40	-40 °C to +85 °C			-40 °C to +125 °C		
			Min	Typ ^[1]	Max	Min	Max		
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	-	500	μA	
CI	input capacitance	V_{CC} = 3.3 V; V_{I} = GND to V_{CC}	-	5.0	-	-	-	pF	

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

Table 8. Transfer characteristics

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

Symbol	Parameter	Conditions	-40) °C to +85	S°C	-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
V _{T+}	positive-going	see Figure 10 and Figure 11						
	threshold voltage	V _{CC} = 1.8 V	0.82	1.0	1.14	0.79	1.14	V
		V _{CC} = 2.3 V	1.03	1.2	1.40	1.00	1.40	V
		V _{CC} = 3.0 V	1.29	1.5	1.71	1.26	1.71	V
		V _{CC} = 4.5 V	1.84	2.1	2.36	1.81	2.36	V
		V _{CC} = 5.5 V	2.19	2.5	2.79	2.16	2.79	V
V _{T-}	negative-going threshold voltage	see Figure 10 and Figure 11						
		V _{CC} = 1.8 V	0.46	0.6	0.75	0.46	0.78	V
		V _{CC} = 2.3 V	0.65	0.8	0.96	0.65	0.99	V
		V _{CC} = 3.0 V	0.88	1.0	1.24	0.88	1.27	V
		V _{CC} = 4.5 V	1.32	1.5	1.84	1.32	1.87	V
		V _{CC} = 5.5 V	1.58	1.8	2.24	1.58	2.27	V
V _H	hysteresis voltage	$(V_{T+} - V_{T-})$; see <u>Figure 10</u> , <u>Figure 11</u> and <u>Figure 12</u>						
		V _{CC} = 1.8 V	0.26	0.4	0.51	0.19	0.51	V
		V _{CC} = 2.3 V	0.28	0.4	0.57	0.22	0.57	V
		V _{CC} = 3.0 V	0.31	0.5	0.64	0.25	0.64	V
		V _{CC} = 4.5 V	0.40	0.6	0.77	0.34	0.77	V
		V _{CC} = 5.5 V	0.47	0.6	0.88	0.41	0.88	V

[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.

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12 Dynamic characteristics

Table 9. 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	Тур ^[1]	Max	Min	Max	
t _{pd}	propagation delay	A to Y; see Figure 8 [2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	4.1	11.0	1.0	14.0	ns
		V_{CC} = 2.3 V to 2.7 V	0.7	2.8	6.5	0.7	8.5	ns
		V _{CC} = 2.7 V	0.7	3.2	6.5	0.7	8.5	ns
		V _{CC} = 3.0 V to 3.6 V	0.7	3.0	5.5	0.7	7.0	ns
		V_{CC} = 4.5 V to 5.5 V	0.7	2.2	5.0	0.7	6.5	ns
C _{PD}	power dissipation capacitance	V_{CC} = 3.3 V; V ₁ = GND to V_{CC} ^[3]	-	15.4	-	-	-	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 μ W).

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

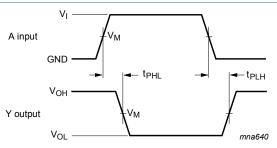
 f_i = input frequency in MHz;

fo = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

12.1 Waveform and test circuit



Measurement points are given in Table 10.

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

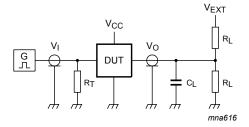
Figure 8. The data input (A) to output (Y) propagation delays

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Table 10. Measurement points							
Supply voltage	Input	Output					
V _{cc}	V _M	V _M					
1.65 V to 1.95 V	0.5 x V _{CC}	0.5 x V _{CC}					
2.3 V to 2.7 V	0.5 x V _{CC}	0.5 x 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 x V _{CC}	0.5 x V _{CC}					



Test data is given in <u>Table 11</u>.

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 the output impedance Z_o of the pulse generator.

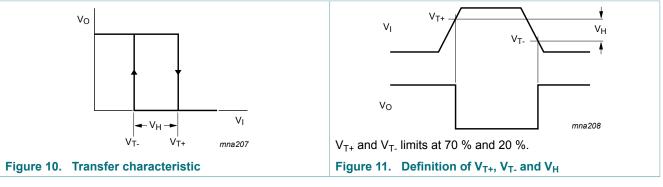
V_{EXT} = External voltage for measuring switching times.

Figure 9. Test circuit for measuring switching times

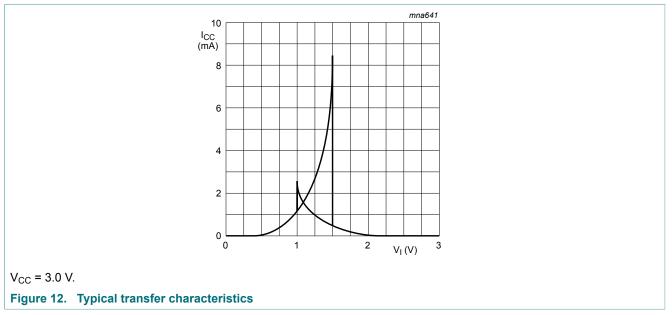
Table 11. Test data

Supply voltage	Input		Load	V _{EXT}	
V _{cc}	VI	t _r = t _f	CL	RL	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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12.2 Waveforms transfer characteristics



13 Application information

The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

 $P_{add} = f_i x (t_r x \Delta I_{CC(AV)} + t_f x \Delta I_{CC(AV)}) x V_{CC}$ where:

- P_{add} = additional power dissipation (µW);
- f_i = input frequency (MHz);
- t_r = input rise time (ns); 10 % to 90 %;
- t_f = input fall time (ns); 90 % to 10 %;
- $\Delta I_{CC(AV)}$ = average additional supply current (µA).

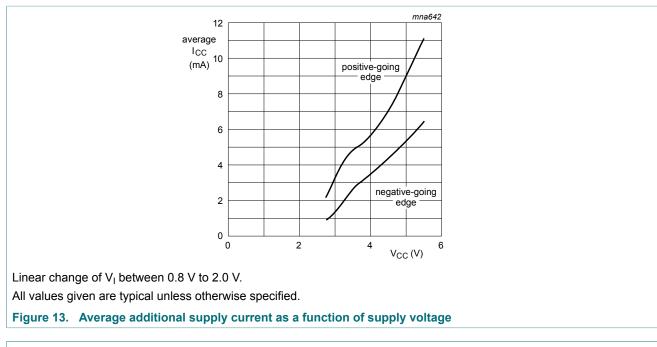
Average $\Delta I_{CC(AV)}$ differs with positive or negative input transitions, as shown in Figure 13.

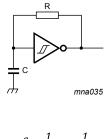
An example of a relaxation circuit using the 74LVC1G14 is shown in Figure 14.

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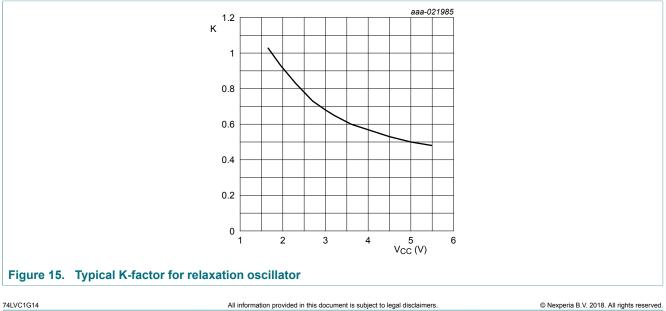




$$f = \frac{1}{T} \approx \frac{1}{K \times \text{RC}}$$

For K-factor, see Figure 15

Figure 14. Relaxation oscillator



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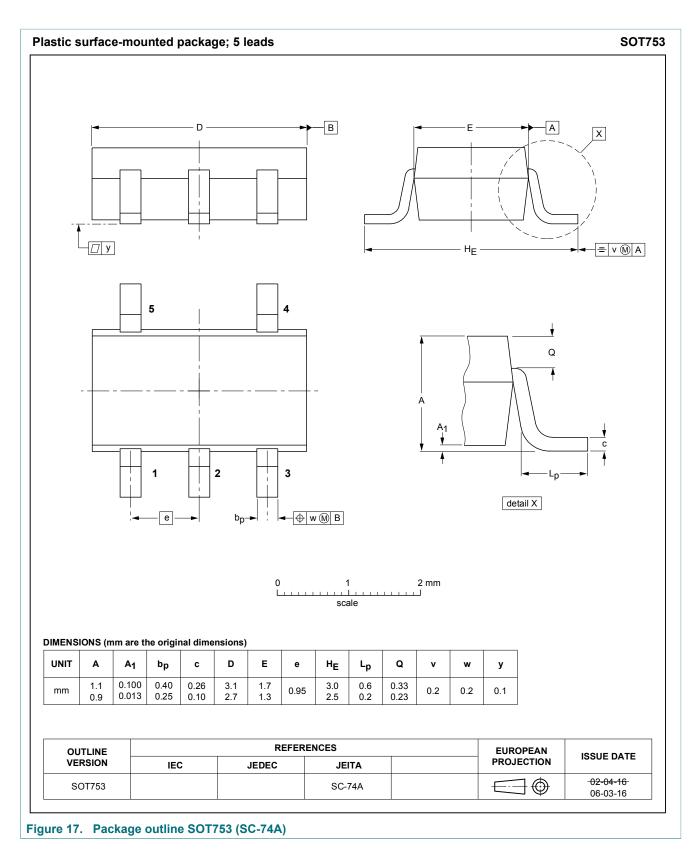
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14 Package outline

	5: plas	tic th	in shr	ink sr	nall ou	utline	packa	age; 5	i lead	s; boc	ly wid	lth 1.2	5 mm	1			SC	DT353
		Ĩ		— D -					с	¥ ¥				X) () A			
		-		- Z		4 ┃ 3 • ⊕ w					A₁ ¥	detail	Lp Lp X	(A ₃)	A A A A A A A A A A A A A A A A A A A			
DIMENS	iONS (n	ım are	the orig	inal din	0 L	5)	1.5 sca			3 mm 								
DIMENS	ilONS (n A max.	ım are A ₁	the orig	inal din A ₃		5) C	1		e	3 mm	HE	L	Lp	v	w	У	Z ⁽¹⁾	θ
			-		nension		sca	le	e 0.65		Н _Е 2.25 2.0	L 0.425	L р 0.46 0.21	v 0.3	w 0.1	y 0.1	Z(1) 0.60 0.15	θ 7° 0°
UNIT mm Note	A max. 1.1	A₁ 0.1 0	A ₂ 1.0 0.8	A 3 0.15	b p 0.30 0.15	c 0.25 0.08	sca D(1) 2.25 1.85	E(1) 1.35 1.15	0.65	e1			0.46				0.60	7°
UNIT mm Note I. Plastic	A max. 1.1 c or meta	A₁ 0.1 0	A ₂ 1.0 0.8	A 3 0.15	b p 0.30 0.15	c 0.25 0.08	sca D(1) 2.25 1.85 side are	E(1) 1.35 1.15	0.65 cluded.	e1			0.46 0.21	0.3	0.1 PEAN	0.1	0.60 0.15	7° 0°
UNIT mm Note I. Plastic	A max. 1.1 c or meta	A₁ 0.1 0	A2 1.0 0.8	A 3 0.15	b p 0.30 0.15	c 0.25 0.08	D(1) 2.25 1.85 side are	E(1) 1.35 1.15 e not inc	0.65 cluded.	e ₁			0.46 0.21	0.3	0.1 PEAN	0.1	0.60	7° 0°

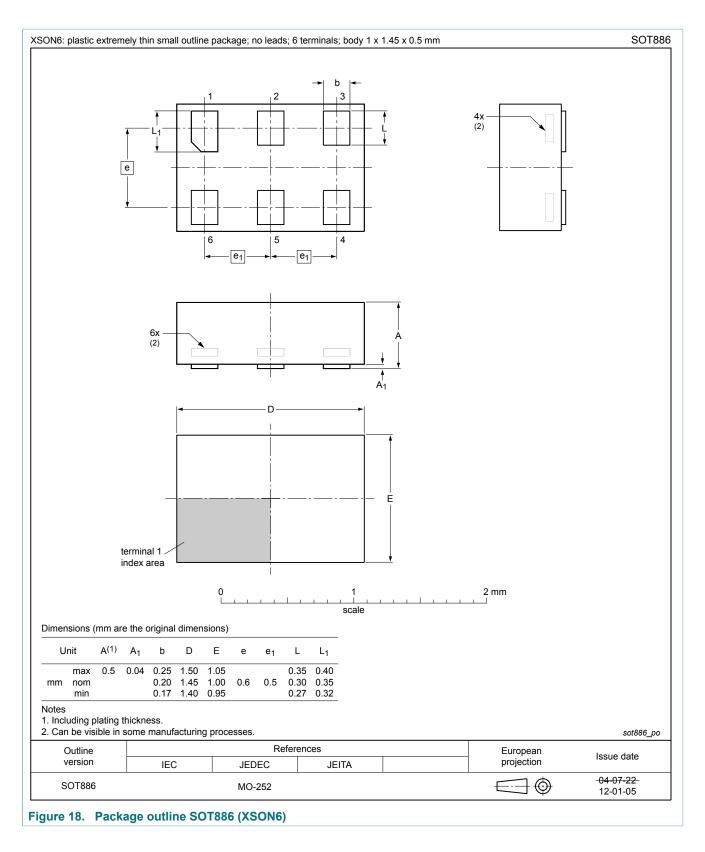
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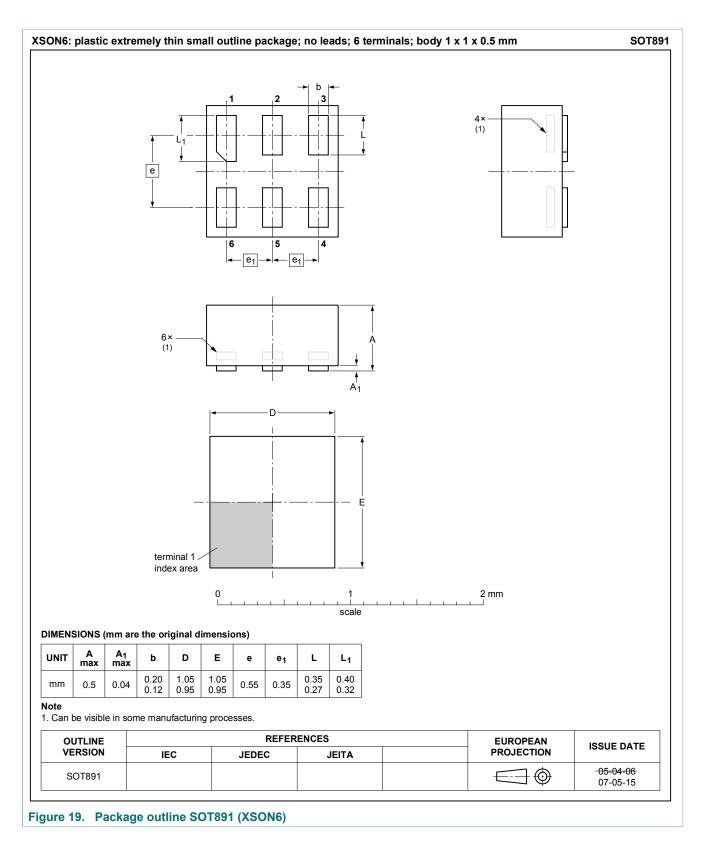
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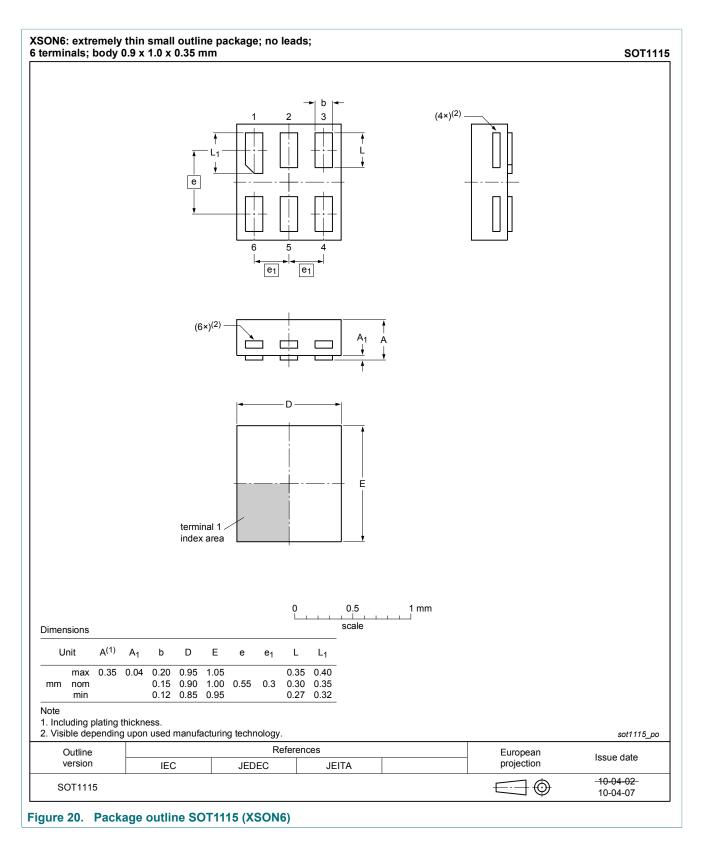
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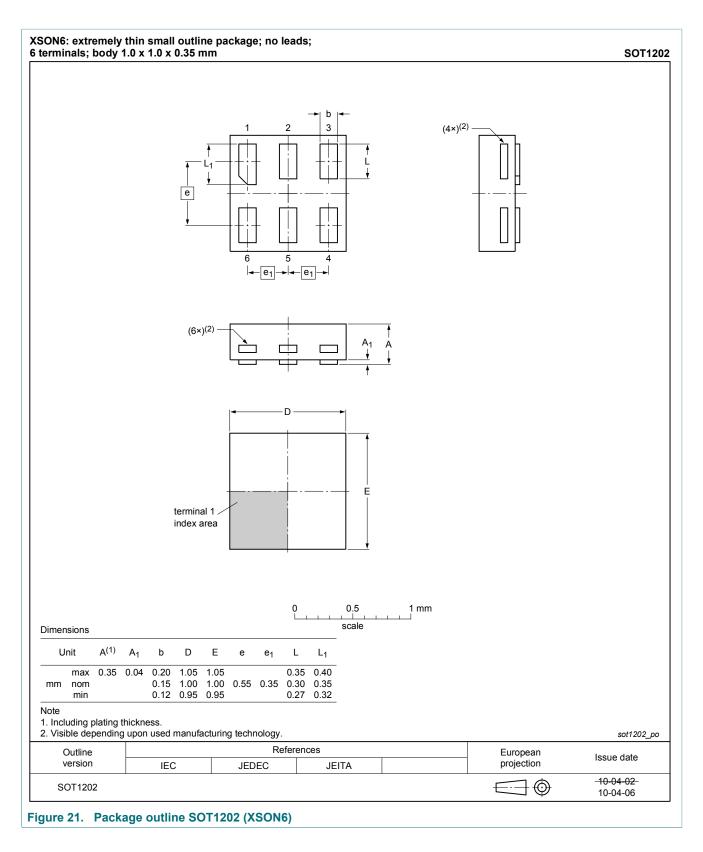
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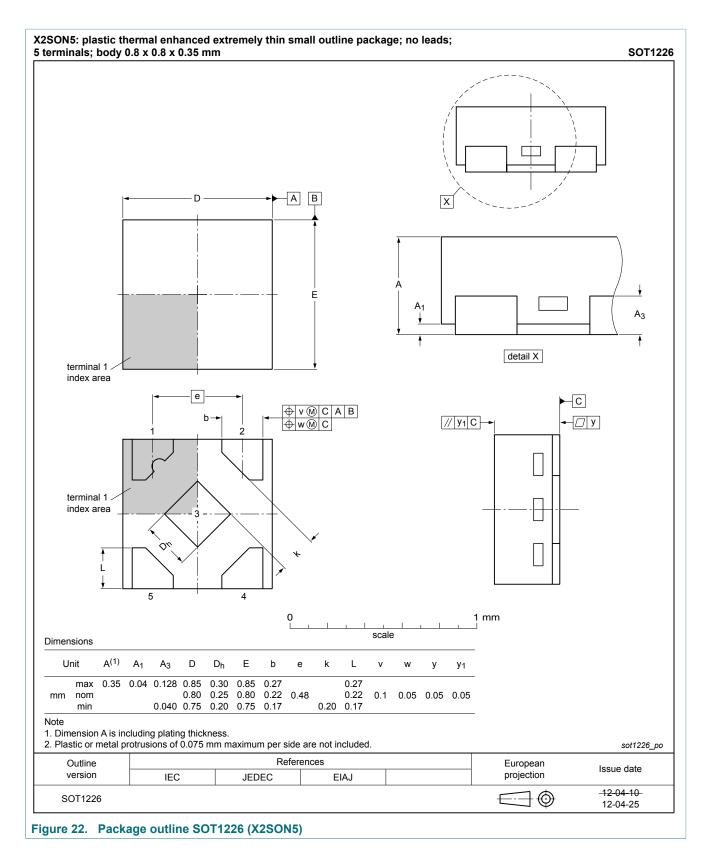
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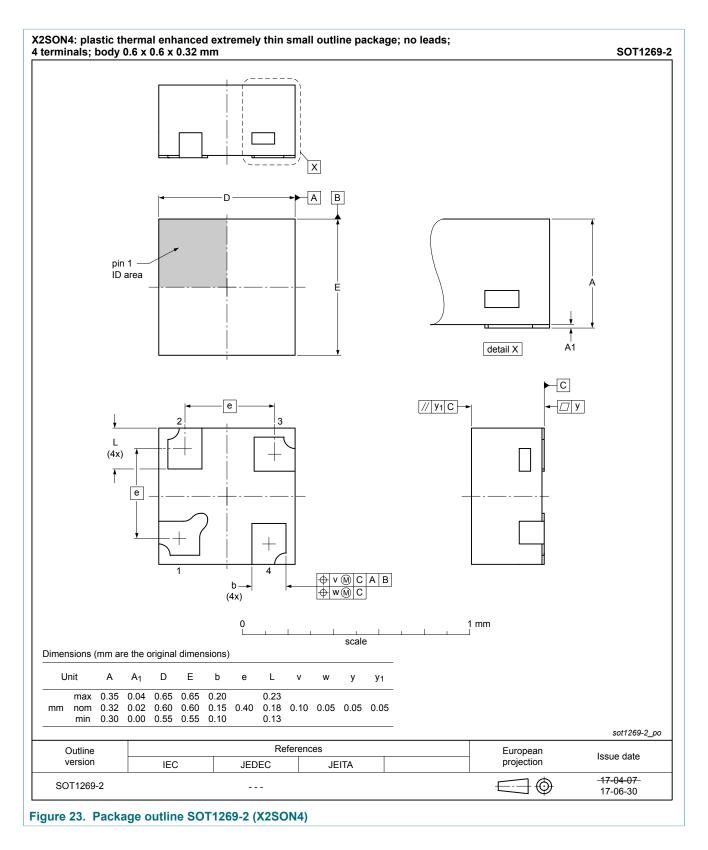
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15 Abbreviations

Table 12. Abbreviations						
Acronym	Description					
CMOS	Complementary Metal Oxide Semiconductor					
TTL	Transistor-Transistor Logic					
НВМ	Human Body Model					
ESD	ElectroStatic Discharge					
MM	Machine Model					
DUT	Device Under Test					

16 Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G14 v.15	20180608	Product data sheet	-	74LVC1G14 v.15
Modifications:	Nexperia. Legal texts have 	this data sheet has been red ve been adapted to the new Imber 74LVC1G14GX4 (SO	company name where	
74LVC1G14 v.14	20161202	Product data sheet	-	74LVC1G14 v.13
Modifications:	• <u>Table 7</u> : The m	naximum limits for leakage c	urrent and supply curre	ent have changed.
74LVC1G14 v.13	20160315	Product data sheet	-	74LVC1G14 v.12
Modifications:	• Figure 15 adde	ed (typical K-factor for relaxa	ation oscillator).	
74LVC1G14 v.12	20120806	Product data sheet	-	74LVC1G14 v.11
Modifications:	 Package outling 	ne drawing of SOT1226 (Fig	ure 22) modified.	
74LVC1G14 v.11	20120412	Product data sheet	-	74LVC1G14 v.10
Modifications:		mber 74LVC1G14GX (SOT ne drawing of SOT886 (Figur	,	,
74LVC1G14 v.10	20111206	Product data sheet	-	74LVC1G14 v.9
Modifications:	 Legal pages u 	pdated.	·	
74LVC1G14 v.9	20110922	Product data sheet	-	74LVC1G14 v.8
74LVC1G14 v.8	20101110	Product data sheet	-	74LVC1G14 v.7
74LVC1G14 v.7	20070718	Product data sheet	-	74LVC1G14 v.6
74LVC1G14 v.6	20060615	Product data sheet	-	74LVC1G14 v.5
74LVC1G14 v.5	20040910	Product specification	-	74LVC1G14 v.4
74LVC1G14 v.4	20021119	Product specification	-	74LVC1G14 v.3
74LVC1G14 v.3	20020521	Product specification	-	74LVC1G14 v.2
74LVC1G14 v.2	20010406	Product specification	-	74LVC1G14 v.1
74LVC1G14 v.1	20001212	Product specification	_	_

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17 Legal information

17.1 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.

Please consult the most recently issued document before initiating or completing a design. [1]

The term 'short data sheet' is explained in section "Definitions".

[2] [3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nexperia.com.

17.2 Definitions

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Single Schmitt-trigger inverter

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Single Schmitt-trigger inverter

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