74LVC1G14

Single Schmitt-trigger inverter Rev. 15 — 8 June 2018

Product data sheet

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.

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.

Applications

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



4 Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	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

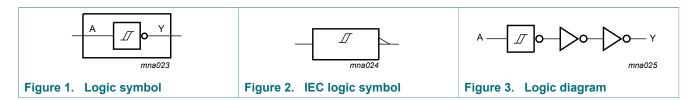
5 Marking

Table 2. Marking

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

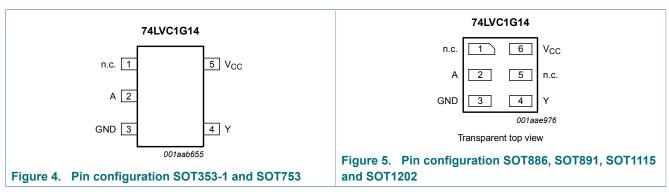
^[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

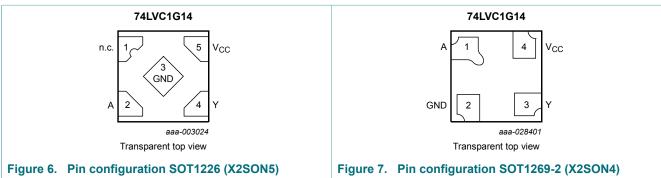
6 Functional diagram



7 Pinning information

7.1 Pinning





7.2 Pin description

Table 3. Pin description

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

74LVC1G14

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Functional description

Table 4. Function table [1]

Input	Output
A	Υ
L	Н
Н	L

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

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
V _I	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
I _{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0 V$		-	±50	mA
Io	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

^[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
[2] 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 P_{tot} derates linearly with 7.8 mW/K. [3] For X2SON4 packages: above 57 °C the value of P_{tot} derates linearly with 1.7 mW/K.

10 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
		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	rameter Conditions		-40 °C to +85 °C			-40 °C to +125 °C	
			Min	Typ ^[1]	Max	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
lı	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} or V_{O} = 5.5 V; V_{CC} = 0 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	°C to +85	°C	-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
ΔI _{CC}	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.3 \text{ V} \text{ to } 5.5 \text{ V}$	-	5	500	-	500	μA
Cı	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	°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.

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	Typ ^[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	$V_{CC} = 3.3 \text{ V}; V_{I} = \text{GND to } V_{CC}$ [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.

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

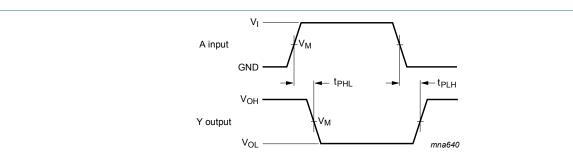
f_i = input frequency in MHz;

f_o = 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.

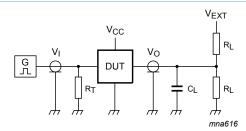
Figure 8. The data input (A) to output (Y) propagation delays

Typical states are as t_{PLH} and t_{PHL}.
 C_{PD} is used to determine the dynamic power dissipation (P_D in µW).

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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 Table 11.

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.

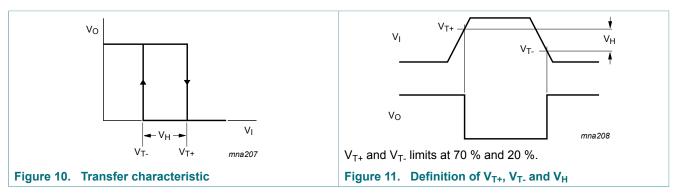
V_{EXT} = External voltage for measuring switching times.

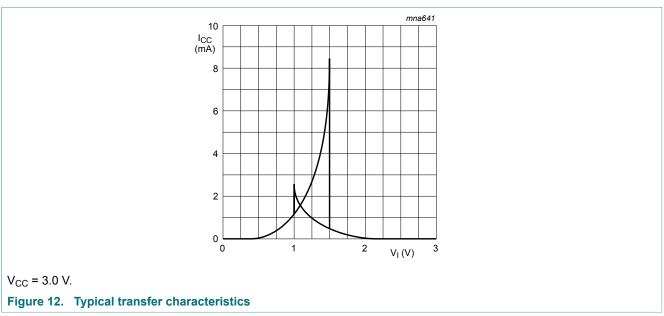
Figure 9. Test circuit for measuring switching times

Table 11. Test data

Supply voltage	Input		Load	V _{EXT}	
V _{CC}	VI	$t_r = t_f$	CL	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

12.2 Waveforms transfer characteristics





13 Application information

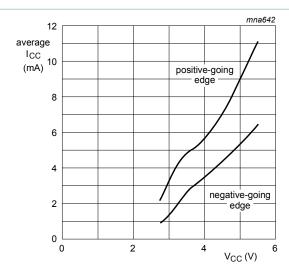
The slow input rise and fall times cause additional power dissipation, this can be calculated using the following formula:

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

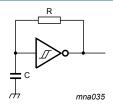
An example of a relaxation circuit using the 74LVC1G14 is shown in Figure 14.



Linear change of V_I between 0.8 V to 2.0 V.

All values given are typical unless otherwise specified.

Figure 13. Average additional supply current as a function of supply voltage



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

For K-factor, see Figure 15

Figure 14. Relaxation oscillator

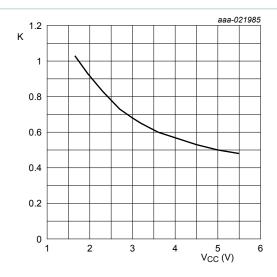


Figure 15. Typical K-factor for relaxation oscillator

14 Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm SOT353-1 = v (M) A detail X DIMENSIONS (mm are the original dimensions) D(1) E⁽¹⁾ Z⁽¹⁾ UNIT С ΗЕ Lp θ max. 0.30 0.25 1.35 2.25 0.46 0.60 0.1 1.0 2.25 0.15 0.65 0.425 mm 1.1 0.15 0.08 1.85 1.15

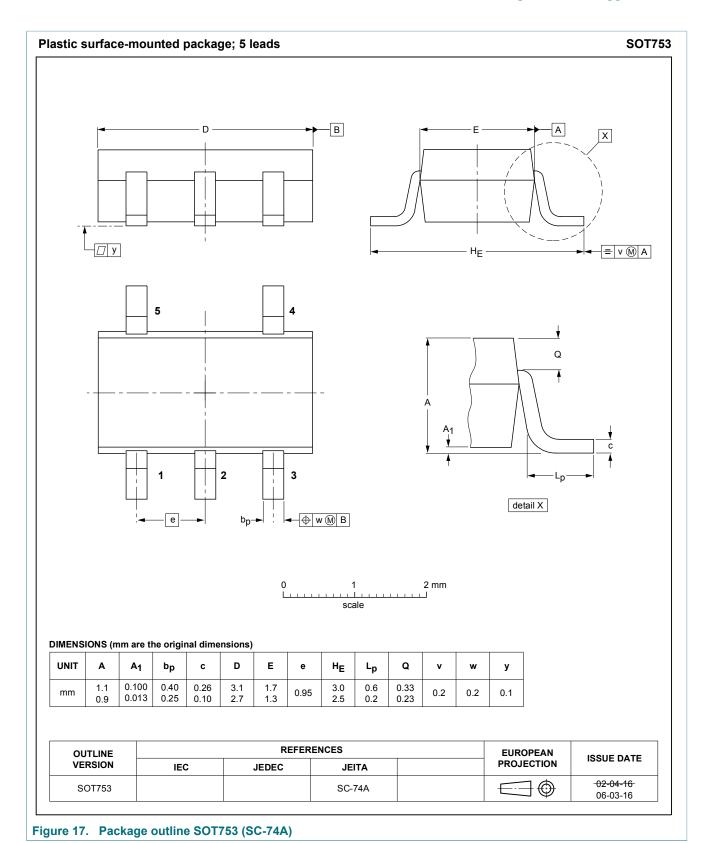
1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

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

Figure 16. Package outline SOT353-1 (TSSOP5)

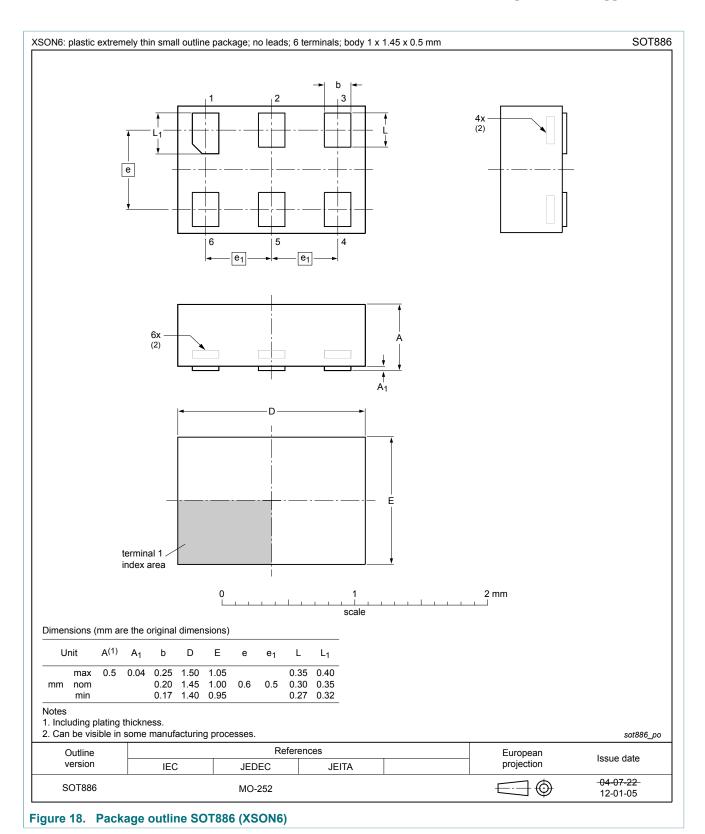
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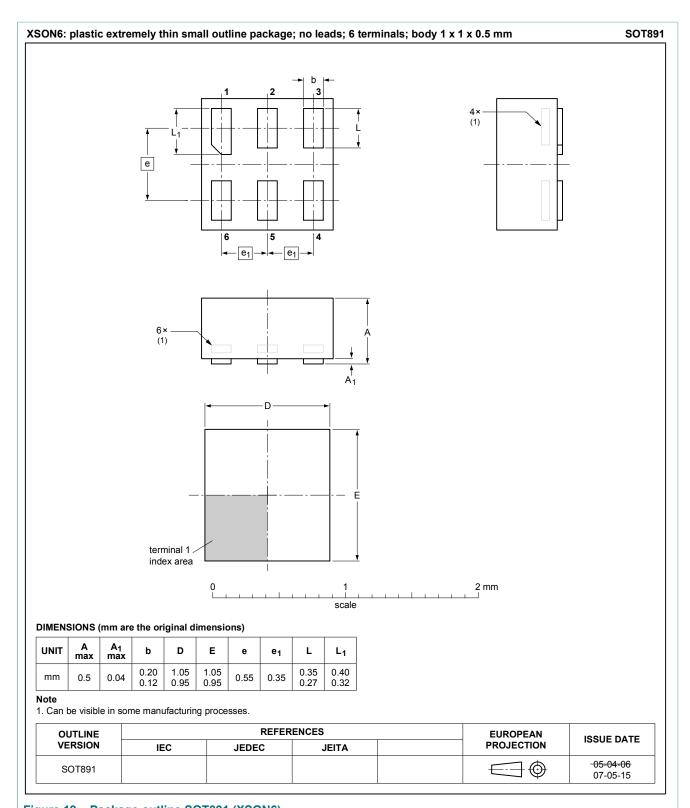


Figure 19. Package outline SOT891 (XSON6)

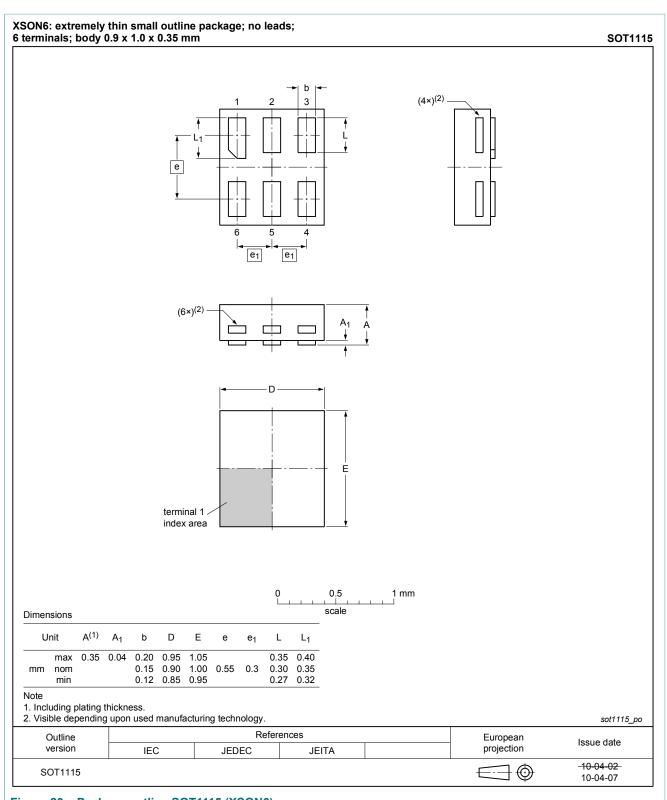
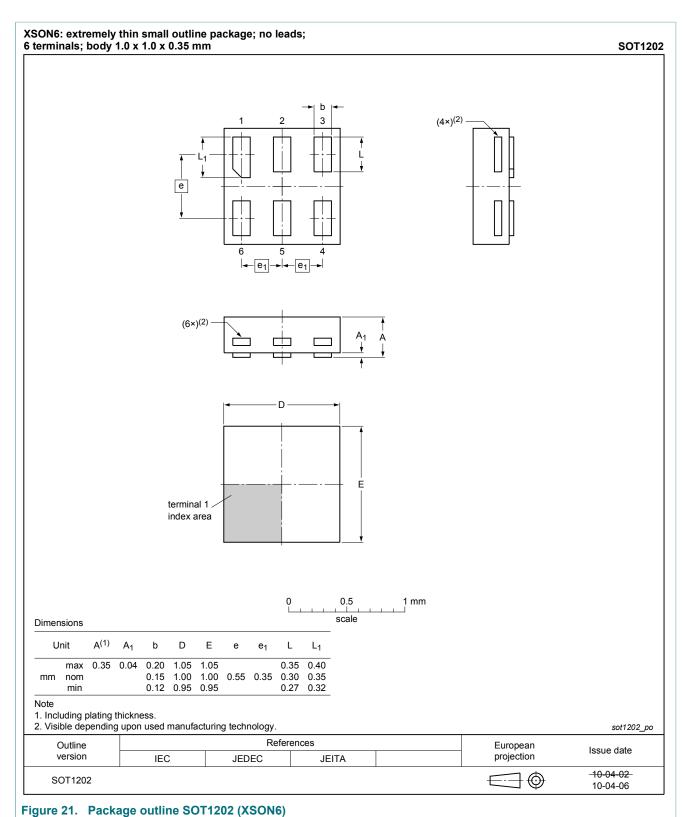
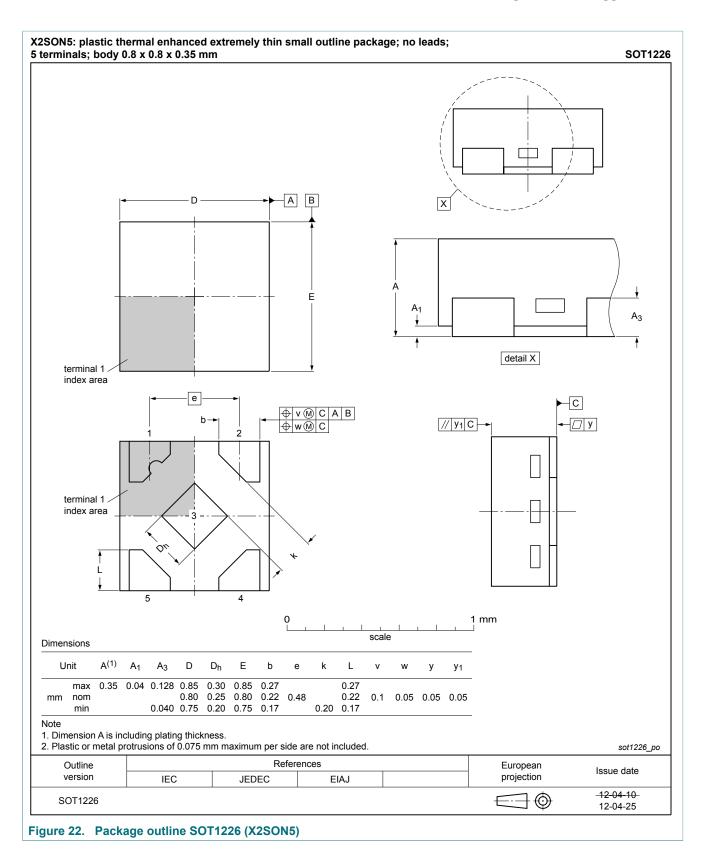


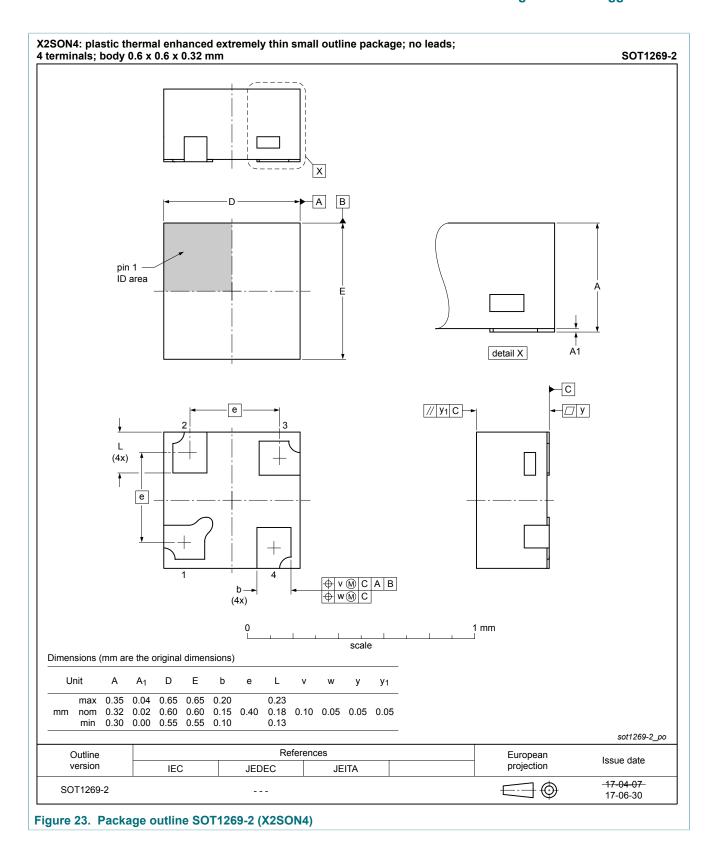
Figure 20. Package outline SOT1115 (XSON6)



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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

Table 13. 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 ha	this data sheet has been rede we been adapted to the new c umber 74LVC1G14GX4 (SOT	ompany name where	, ,		
74LVC1G14 v.14	20161202	Product data sheet	-	74LVC1G14 v.13		
Modifications:	• Table 7: The r	• <u>Table 7</u> : The maximum limits for leakage current and supply current have changed.				
74LVC1G14 v.13	20160315	Product data sheet	-	74LVC1G14 v.12		
Modifications:	• Figure 15 add	ed (typical K-factor for relaxati	ion oscillator).			
74LVC1G14 v.12	20120806	Product data sheet	-	74LVC1G14 v.11		
Modifications:	Package outling	Package outline drawing of SOT1226 (<u>Figure 22</u>) modified.				
74LVC1G14 v.11	20120412	Product data sheet	-	74LVC1G14 v.10		
Modifications:	, , ,	umber 74LVC1G14GX (SOT12 ne drawing of SOT886 (<u>Figure</u>	,			
74LVC1G14 v.10	20111206	Product data sheet	-	74LVC1G14 v.9		
Modifications:	• Legal pages u	ipdated.				
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	-	-		

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.
- 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.

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Single Schmitt-trigger inverter

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