

# 74LVC3G14

Triple inverting Schmitt trigger with 5 V tolerant input

Rev. 15 — 3 January 2019

Product data sheet

## 1. General description

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The 74LVC3G14 provides three inverting buffers with Schmitt trigger input. It is capable of transforming slowly changing input signals into sharply defined, jitter-free output signals.

The inputs 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 inputs makes the circuit tolerant of 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

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- 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
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 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
- Unlimited rise and fall times
- Multiple package options
- Specified from  $-40$  °C to  $+85$  °C and  $-40$  °C to  $+125$  °C.

## 3. Applications

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- Wave and pulse shaper for highly noisy environment
- Astable multivibrator
- Monostable multivibrator.

## 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC3G14DP	-40 °C to +125 °C	TSSOP8	plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm	SOT505-2
74LVC3G14DC	-40 °C to +125 °C	VSSOP8	plastic very thin shrink small outline package; 8 leads; body width 2.3 mm	SOT765-1
74LVC3G14GT	-40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 1 × 1.95 × 0.5 mm	SOT833-1
74LVC3G14GF	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm	SOT1089
74LVC3G14GM	-40 °C to +125 °C	XQFN8	plastic, extremely thin quad flat package; no leads; 8 terminals; body 1.6 × 1.6 × 0.5 mm	SOT902-2
74LVC3G14GN	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm	SOT1116
74LVC3G14GS	-40 °C to +125 °C	XSON8	extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm	SOT1203

## 5. Marking

Table 2. Marking codes

Type number	Marking code [1]
74LVC3G14DP	V14
74LVC3G14DC	V14
74LVC3G14GT	V14
74LVC3G14GF	VK
74LVC3G14GM	V14
74LVC3G14GN	VK
74LVC3G14GS	VK

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

## 6. Functional diagram

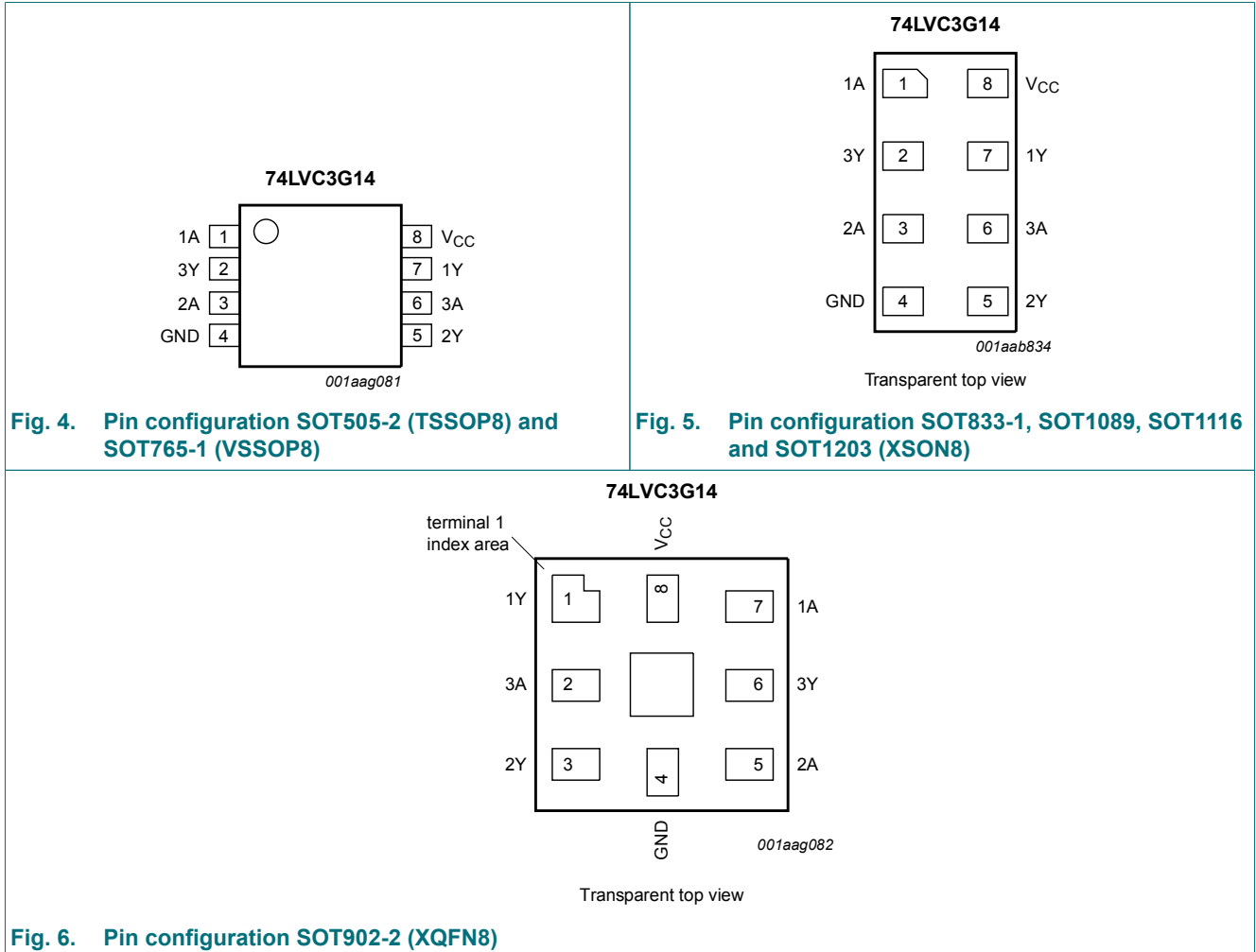
**Fig. 1. Logic symbol**

**Fig. 2. IEC logic symbol**

**Fig. 3. Logic diagram (one Schmitt trigger)**

## 7. Pinning information

### 7.1. Pinning



### 7.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT1116 and SOT1203	SOT902-2	
1A, 2A, 3A	1, 3, 6	7, 5, 2	data input
1Y, 2Y, 3Y	7, 5, 2	1, 3, 6	data output
GND	4	4	ground (0 V)
V <sub>CC</sub>	8	8	supply voltage

## 8. Functional description

**Table 4. Function table**

*H = HIGH voltage level; L = LOW voltage level*

Input nA	Output nY
L	H
H	L

## 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	$V_O > V_{CC}$ or $V_O < 0$ V	-	±50	mA
$V_O$	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
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	±50	mA
$I_{CC}$	supply current		-	100	mA
$I_{GND}$	ground current		-100	-	mA
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to $+125$ °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.

[2] For TSSOP8 package: above 55 °C the value of  $P_{tot}$  derates linearly with 2.5 mW/K.

For VSSOP8 package: above 110 °C the value of  $P_{tot}$  derates linearly with 8 mW/K.

For XSON8 and XQFN8 packages: above 118 °C the value of  $P_{tot}$  derates linearly with 7.8 mW/K.

## 10. Recommended operating conditions

**Table 6. Operating conditions**

Symbol	Parameter	Conditions	Min	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
		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	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>OH</sub>	HIGH-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>						
		I <sub>O</sub> = -100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	V <sub>CC</sub> - 0.1	-	-	V <sub>CC</sub> - 0.1	-	V
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	0.95	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	-	-	1.7	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	1.9	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	-	-	2.0	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	-	-	3.4	-	V
V <sub>OL</sub>	LOW-level output voltage	V <sub>I</sub> = V <sub>T+</sub> or V <sub>T-</sub>						
		I <sub>O</sub> = 100 µA; V <sub>CC</sub> = 1.65 V to 5.5 V	-	-	0.1	-	0.1	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.7	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.3	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	-	0.8	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.55	-	0.8	V
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 5.5 V or GND; V <sub>CC</sub> = 0 V to 5.5 V	-	±0.1	±1	-	±1	µA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 5.5 V; V <sub>CC</sub> = 0 V	-	±0.1	±2	-	±2	µA
I <sub>CC</sub>	supply current	V <sub>I</sub> = 5.5 V or GND; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 1.65 V to 5.5 V	-	0.1	4	-	4	µA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.6 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.3 V to 5.5 V	-	5	500	-	500	µA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	3.5	-	-	-	pF

[1] All typical values are measured at maximum V<sub>CC</sub> and T<sub>amb</sub> = 25 °C.

### 11.1. Transfer characteristics

**Table 8. Transfer characteristics**

Voltages are referenced to GND (ground = 0 V; for test circuit see Fig. 11).

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>T+</sub>	positive-going threshold voltage	see Fig. 7 and Fig. 8						
		V <sub>CC</sub> = 1.8 V	0.70	1.10	1.50	0.70	1.70	V
		V <sub>CC</sub> = 2.3 V	1.00	1.40	1.80	1.00	2.00	V
		V <sub>CC</sub> = 3.0 V	1.30	1.76	2.20	1.30	2.40	V
		V <sub>CC</sub> = 4.5 V	1.90	2.47	3.10	1.90	3.30	V
		V <sub>CC</sub> = 5.5 V	2.20	2.91	3.60	2.20	3.80	V

Triple inverting Schmitt trigger with 5 V tolerant input

Symbol	Parameter	Conditions	T <sub>amb</sub> = -40 °C to +85 °C			T <sub>amb</sub> = -40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Fig. 7</a> and <a href="#">Fig. 8</a>						
		V <sub>CC</sub> = 1.8 V	0.25	0.61	0.90	0.25	1.10	V
		V <sub>CC</sub> = 2.3 V	0.40	0.80	1.15	0.40	1.35	V
		V <sub>CC</sub> = 3.0 V	0.60	1.04	1.50	0.60	1.70	V
		V <sub>CC</sub> = 4.5 V	1.00	1.55	2.00	1.00	2.20	V
		V <sub>CC</sub> = 5.5 V	1.20	1.86	2.30	1.20	2.50	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> - V <sub>T-</sub> ); see <a href="#">Fig. 7</a> , <a href="#">Fig. 8</a> and <a href="#">Fig. 9</a>						
		V <sub>CC</sub> = 1.8 V	0.15	0.49	1.00	0.15	1.20	V
		V <sub>CC</sub> = 2.3 V	0.25	0.60	1.10	0.25	1.30	V
		V <sub>CC</sub> = 3.0 V	0.40	0.73	1.20	0.40	1.40	V
		V <sub>CC</sub> = 4.5 V	0.60	0.92	1.50	0.60	1.70	V
		V <sub>CC</sub> = 5.5 V	0.70	1.02	1.70	0.70	1.90	V

[1] All typical values are measured at T<sub>amb</sub> = 25 °C

11.2. Waveforms transfer characteristics

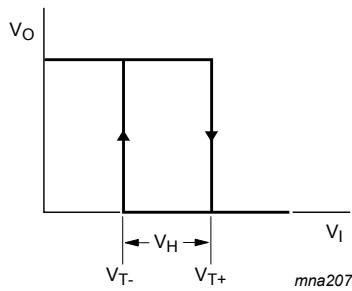
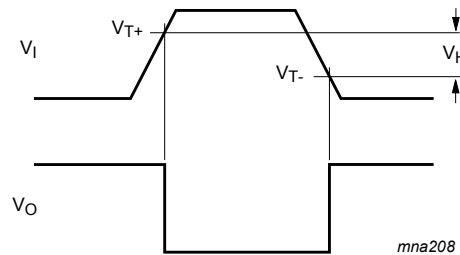
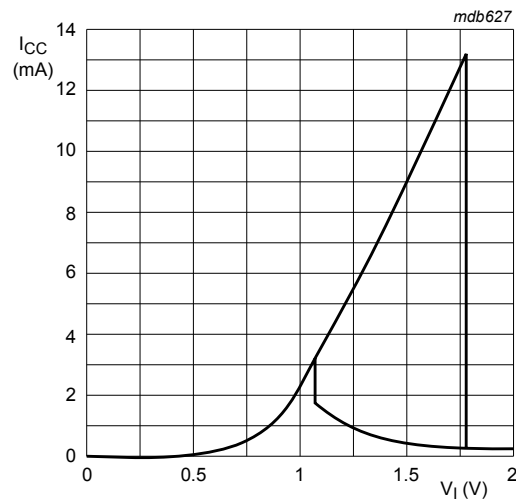


Fig. 7. Transfer characteristic



V<sub>T+</sub> and V<sub>T-</sub> limits at 70 % and 20 %.

Fig. 8. Definition of V<sub>T+</sub>, V<sub>T-</sub> and V<sub>H</sub>



V<sub>CC</sub> = 3.0 V

Fig. 9. Typical transfer characteristics

## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 11.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	nA to nY; see Fig. 10 [2]						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	4.2	11.0	1.0	12.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.5	3.0	6.5	0.5	7.2	ns
		V <sub>CC</sub> = 2.7 V	0.5	3.8	7.0	0.5	7.7	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.5	3.2	6.0	0.5	6.7	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.5	2.4	4.3	0.5	4.7	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>I</sub> = GND to V <sub>CC</sub> ; V <sub>CC</sub> = 3.3 V [3]	-	18.1	-	-	-	pF

[1] Typical values are measured at T<sub>amb</sub> = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> in μW).

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

f<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

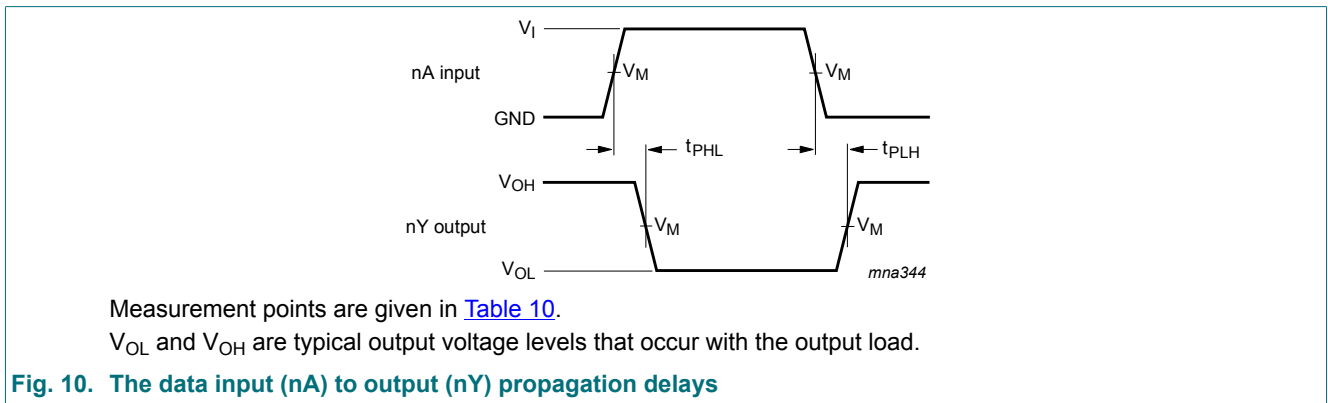
C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching;

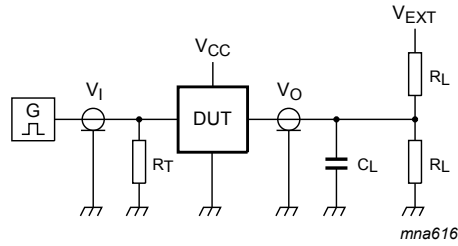
∑(C<sub>L</sub> × V<sub>CC</sub><sup>2</sup> × f<sub>o</sub>) = sum of outputs.

### 12.1. Waveforms and test circuit



**Table 10. Measurement points**

V <sub>CC</sub>	Input V <sub>M</sub>	Output V <sub>M</sub>
1.65 V to 1.95 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
2.3 V to 2.7 V	0.5 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>
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 × V <sub>CC</sub>	0.5 × V <sub>CC</sub>



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.

**Fig. 11. Test circuit for measuring switching times**

**Table 11. 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

### 13. Application information

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

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

$P_{add}$  = additional power dissipation ( $\mu W$ );

$f_i$  = input frequency (MHz);

$t_r$  = input rise time (ns); 10 % to 90 %;

$t_f$  = input fall time (ns); 90 % to 10 %;

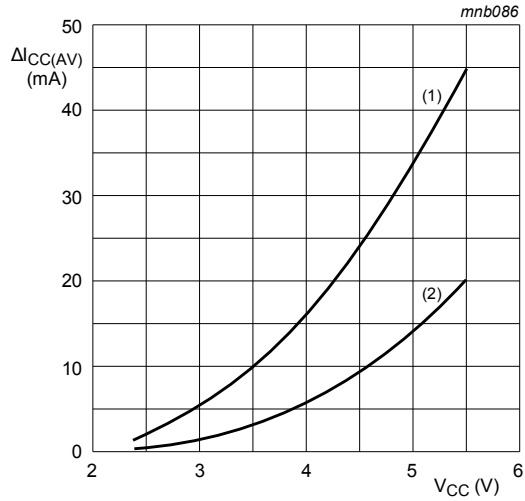
$\Delta I_{CC(AV)}$  = average additional supply current ( $\mu A$ ).

$\Delta I_{CC(AV)}$  differs with positive or negative input transitions, as shown in [Fig. 12](#).

An example of a relaxation circuit using the 74LVC3G14 is shown in [Fig. 13](#).

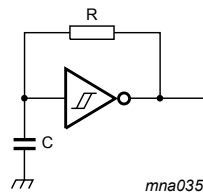


Triple inverting Schmitt trigger with 5 V tolerant input



Linear change of V<sub>I</sub> between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.  
 (1) Positive-going edge.  
 (2) Negative-going edge.

Fig. 12. ΔI<sub>CC(AV)</sub> as a function of V<sub>CC</sub>



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

For K-factor, see Fig. 14

Fig. 13. Relaxation oscillator

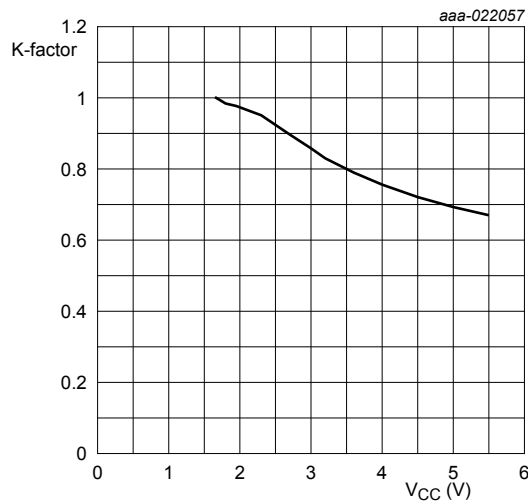


Fig. 14. Typical K-factor for relaxation oscillator

14. Package outline

TSSOP8: plastic thin shrink small outline package; 8 leads; body width 3 mm; lead length 0.5 mm SOT505-2

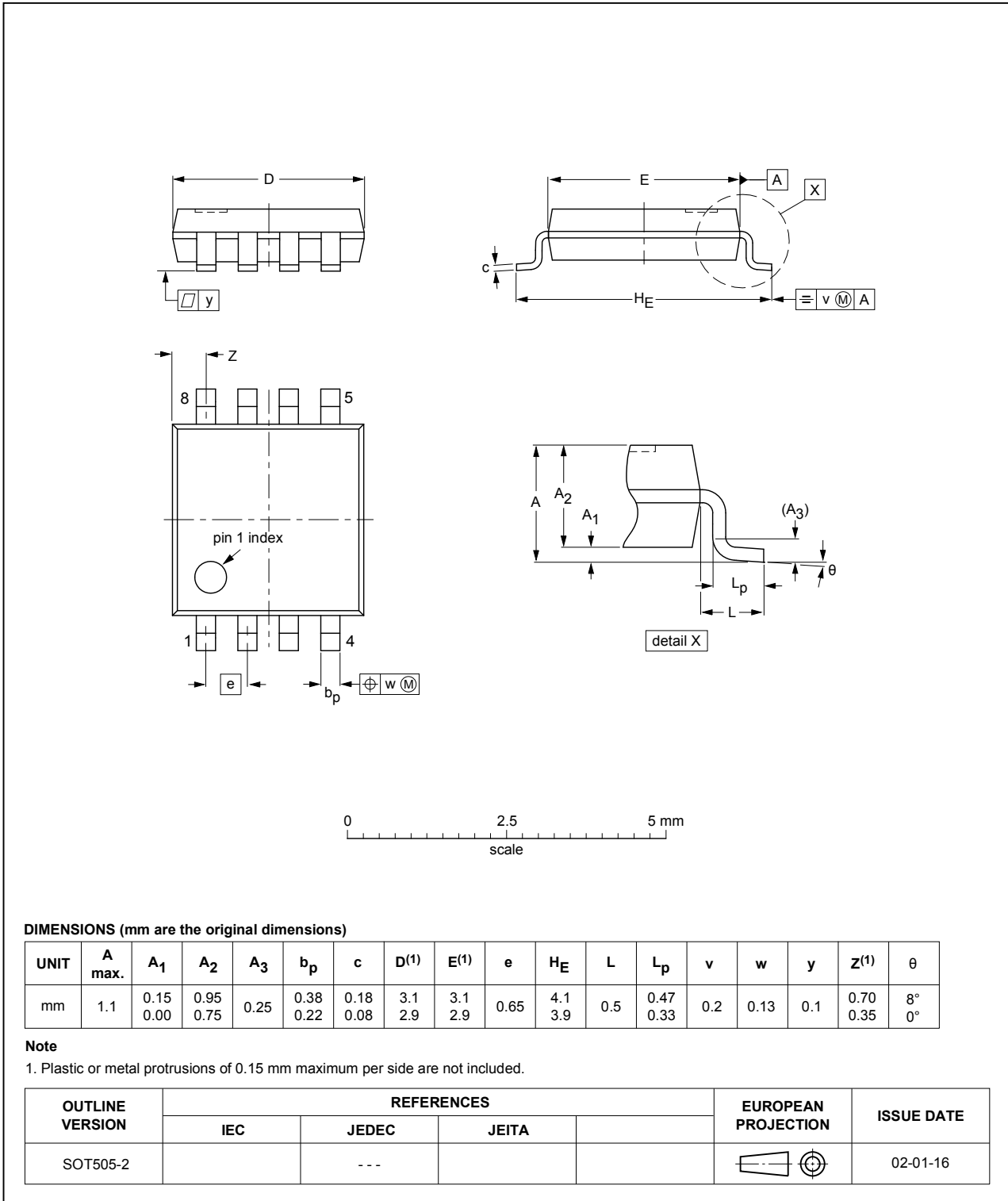


Fig. 15. Package outline SOT505-2 (TSSOP8)

VSSOP8: plastic very thin shrink small outline package; 8 leads; body width 2.3 mm

SOT765-1

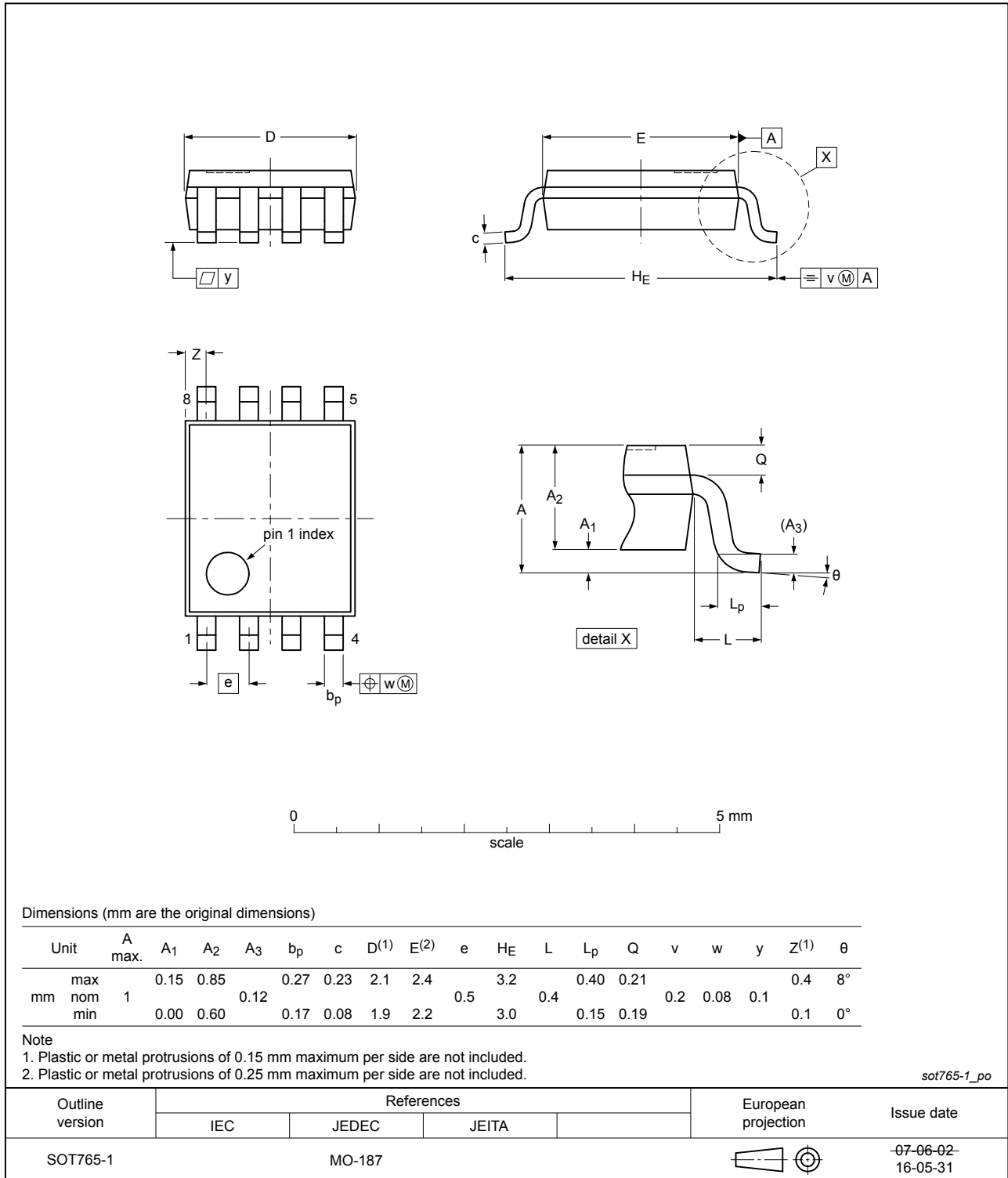


Fig. 16. Package outline SOT765-1 (VSSOP8)

XSON8: plastic extremely thin small outline package; no leads; 8 terminals; body 1 x 1.95 x 0.5 mm

SOT833-1

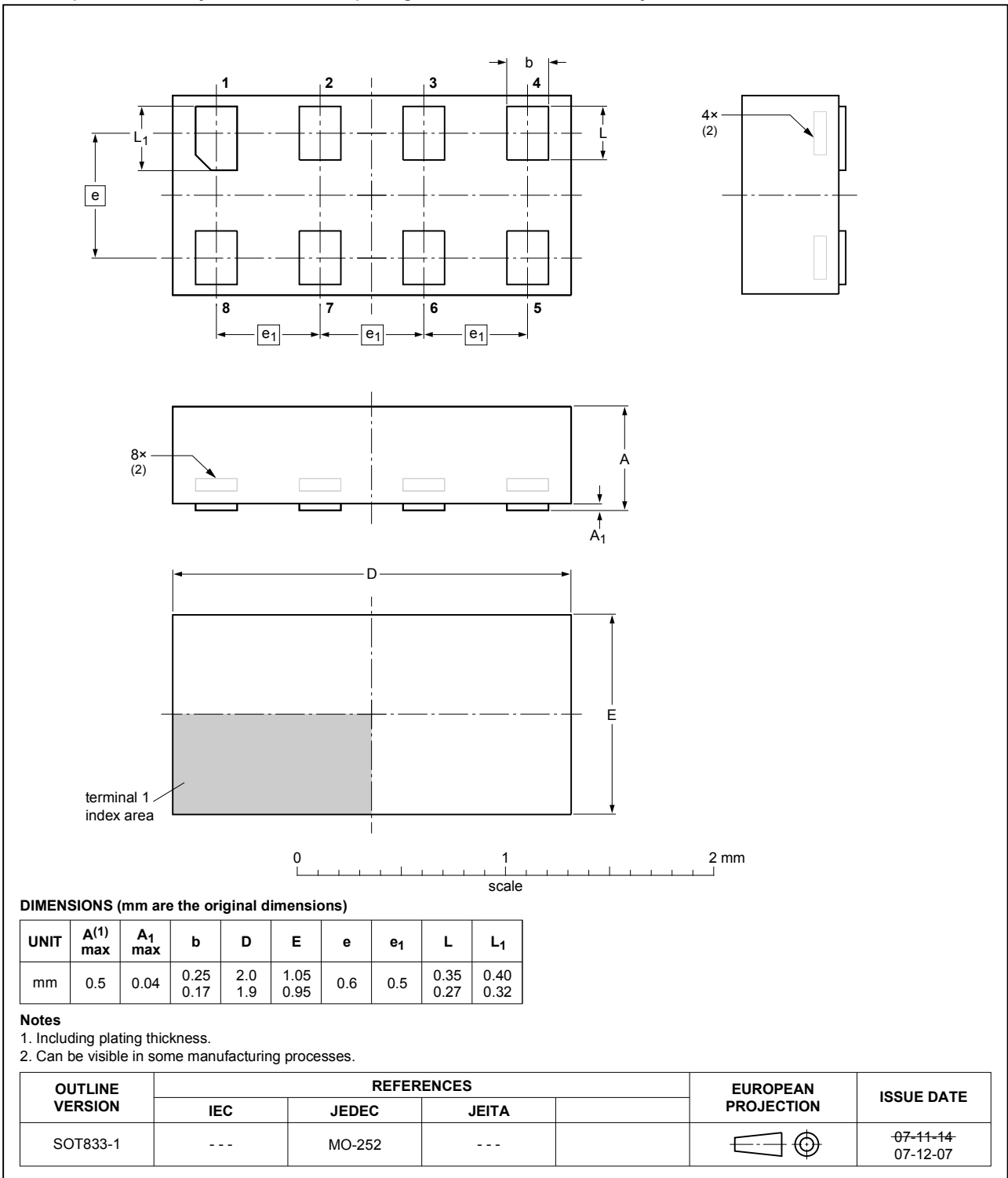


Fig. 17. Package outline SOT833-1 (XSON8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1 x 0.5 mm

SOT1089

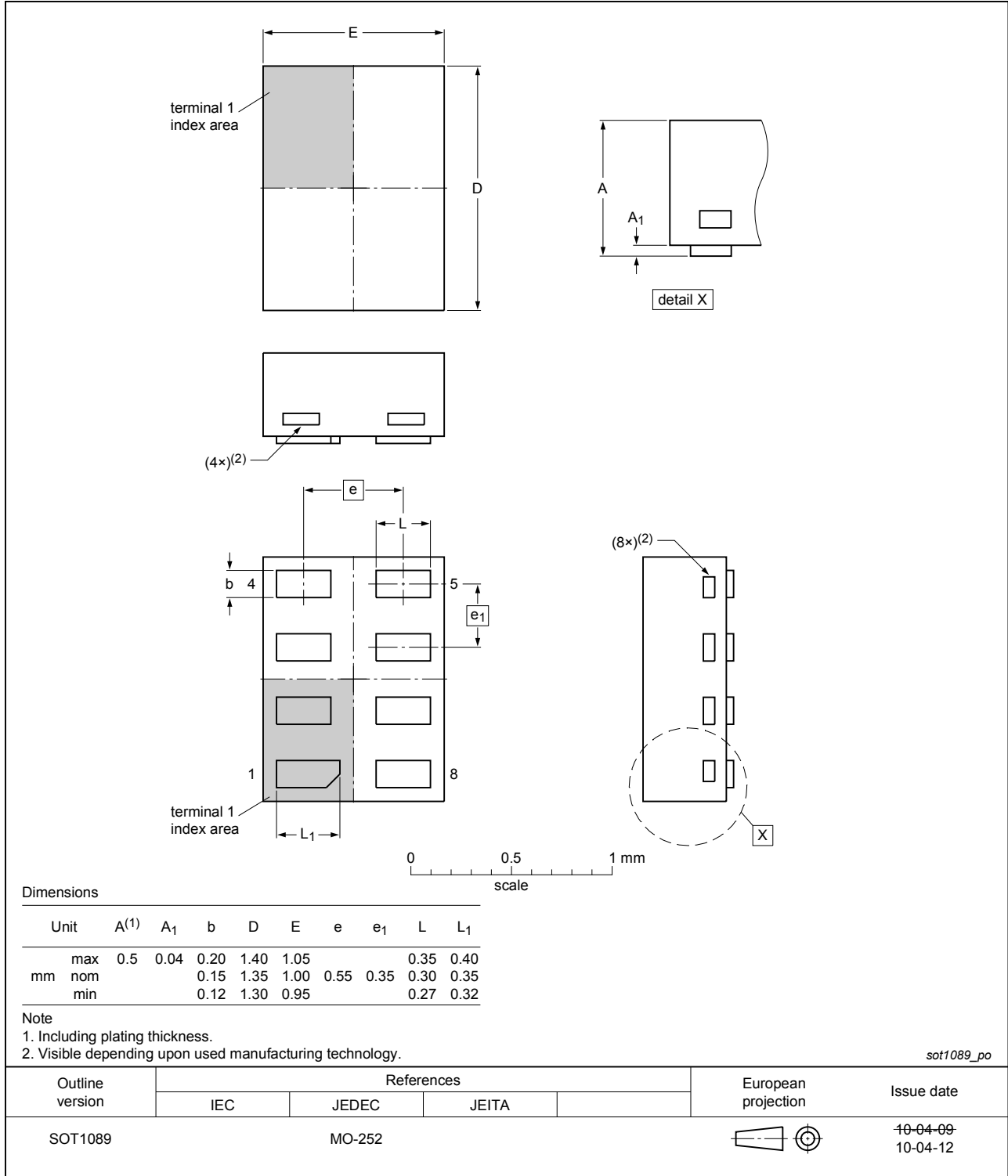


Fig. 18. Package outline SOT1089 (XSON8)

**XQFN8:** plastic, extremely thin quad flat package; no leads;  
8 terminals; body 1.6 x 1.6 x 0.5 mm

SOT902-2

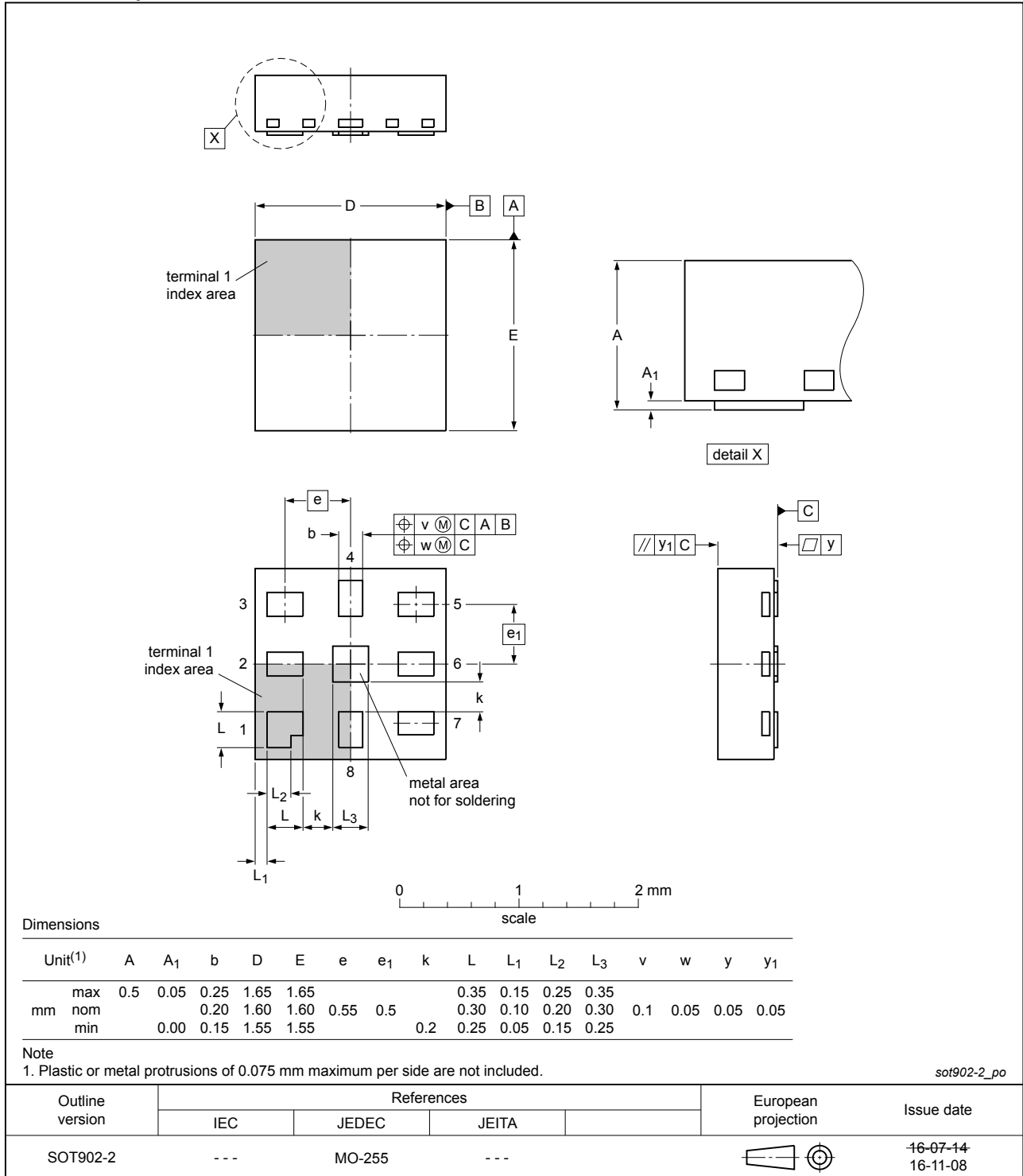


Fig. 19. Package outline SOT902-2 (XQFN8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.2 x 1.0 x 0.35 mm

SOT1116

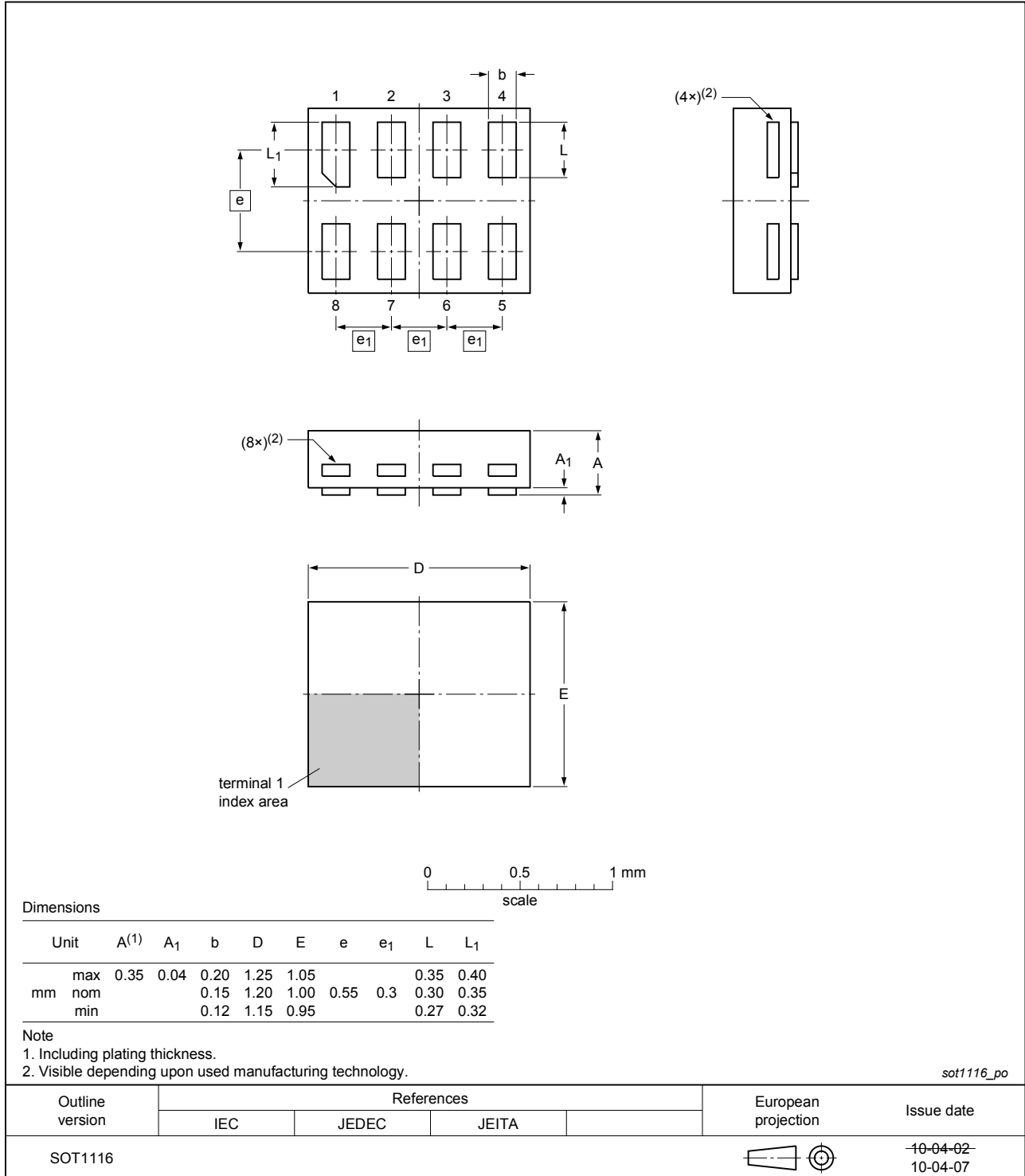


Fig. 20. Package outline SOT1116 (XSON8)

XSON8: extremely thin small outline package; no leads;  
8 terminals; body 1.35 x 1.0 x 0.35 mm

SOT1203

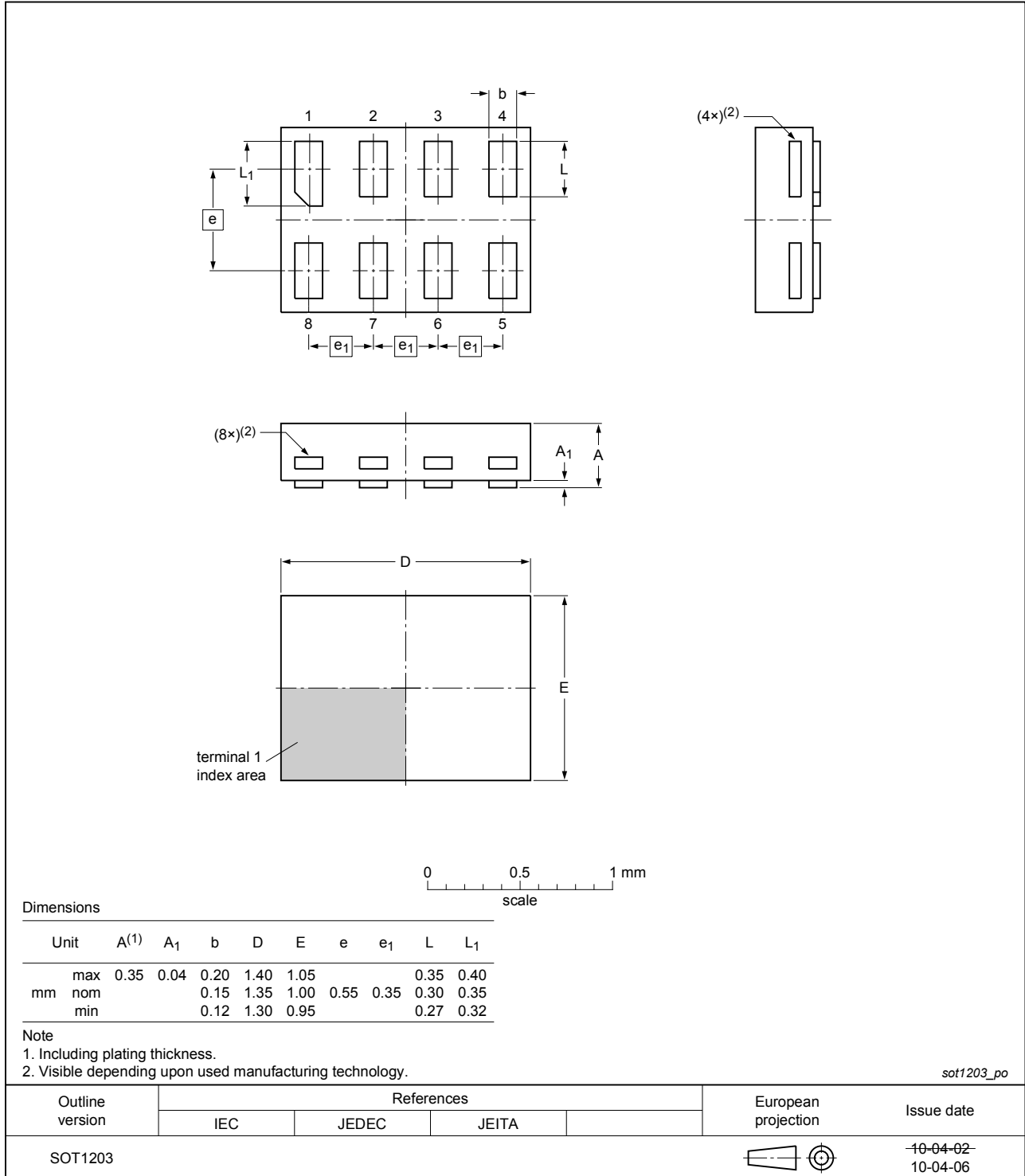


Fig. 21. Package outline SOT1203 (XSON8)



## 15. 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

## 16. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC3G14 v.15	20190103	Product data sheet	-	74LVC3G14 v.14
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> <li>Type number 74LVC3G14GD (SOT996-2) removed.</li> </ul>			
74LVC3G14 v.14	20161215	Product data sheet	-	74LVC3G14 v.13
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>			
74LVC3G14 v.13	20160315	Product data sheet	-	74LVC3G14 v.12
Modifications:	<ul style="list-style-type: none"> <li><a href="#">Fig. 14</a> added (typical K-factor for relaxation oscillator).</li> </ul>			
74LVC3G14 v.12	20130409	Product data sheet	-	74LVC3G14 v.11
Modifications:	<ul style="list-style-type: none"> <li>For type number 74LVC3G14GD XSON8U has changed to XSON8.</li> </ul>			
74LVC3G14 v.11	20120706	Product data sheet	-	74LVC3G14 v.10
Modifications:	<ul style="list-style-type: none"> <li>For type number 74LVC3G14GM the SOT code has changed to SOT902-2.</li> </ul>			
74LVC3G14 v.10	20111123	Product data sheet	-	74LVC3G14 v.9
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
74LVC3G14 v.9	20110922	Product data sheet	-	74LVC3G14 v.8
74LVC3G14 v.8	20100819	Product data sheet	-	74LVC3G14 v.7
74LVC3G14 v.7	20080612	Product data sheet	-	74LVC3G14 v.6
74LVC3G14 v.6	20080207	Product data sheet	-	74LVC3G14 v.5
74LVC3G14 v.5	20071005	Product data sheet	-	74LVC3G14 v.4
74LVC3G14 v.4	20070314	Product data sheet	-	74LVC3G14 v.3
74LVC3G14 v.3	20050131	Product data sheet	-	74LVC3G14 v.2
74LVC3G14 v.2	20041027	Product data sheet	-	74LVC3G14 v.1
74LVC3G14 v.1	20040510	Product data sheet	-	-

## 17. 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.

- [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".
- [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 <https://www.nexperia.com>.

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