

# 74LVC3G14

## Triple inverting Schmitt trigger with 5 V tolerant input

Rev. 12 — 9 April 2013

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			
	Temperature range	Name	Description	Version
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
74LVC3G14GD	–40 °C to +125 °C	XSON8	plastic extremely thin small outline package; no leads; 8 terminals; body 3 × 2 × 0.5 mm	SOT996-2
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

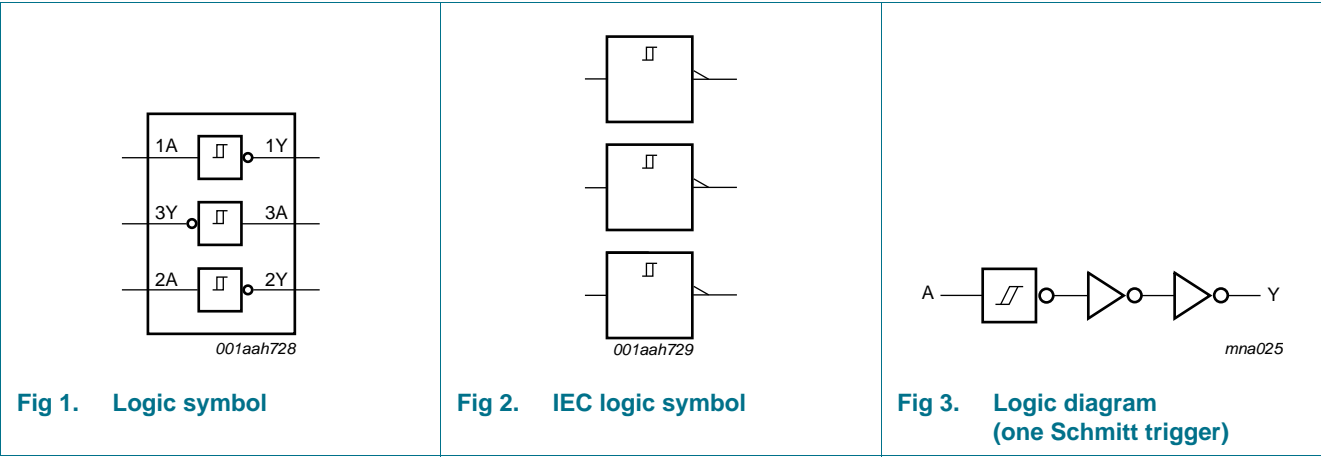
## 5. Marking

Table 2. Marking codes

Type number	Marking code <sup>[1]</sup>
74LVC3G14DP	V14
74LVC3G14DC	V14
74LVC3G14GT	V14
74LVC3G14GF	VK
74LVC3G14GD	V14
74LVC3G14GM	V14
74LVC3G14GN	VK
74LVC3G14GS	VK

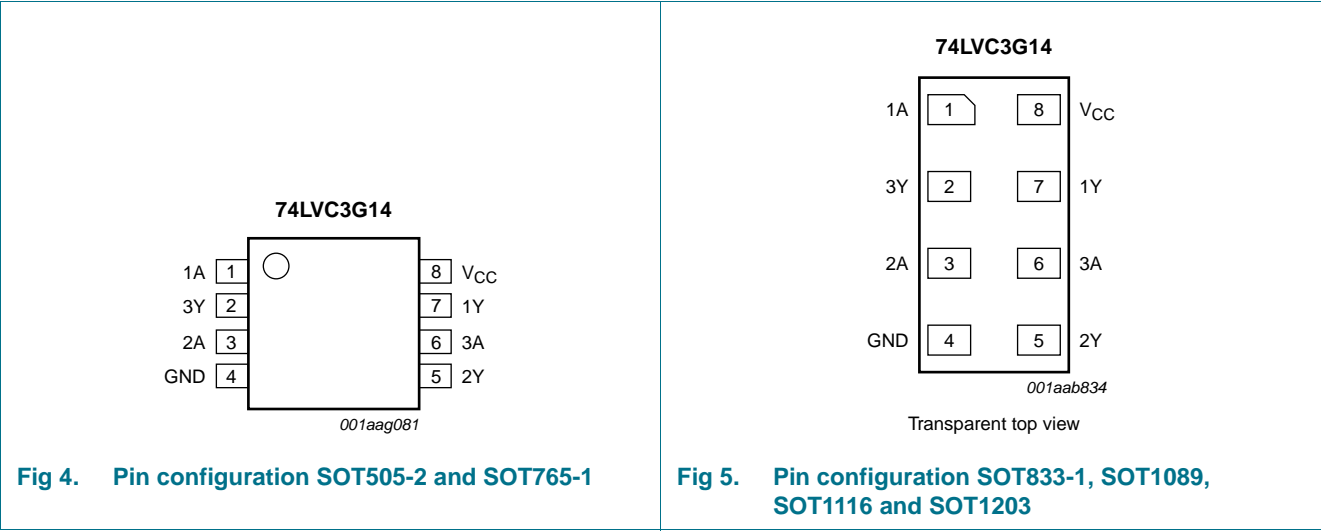
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

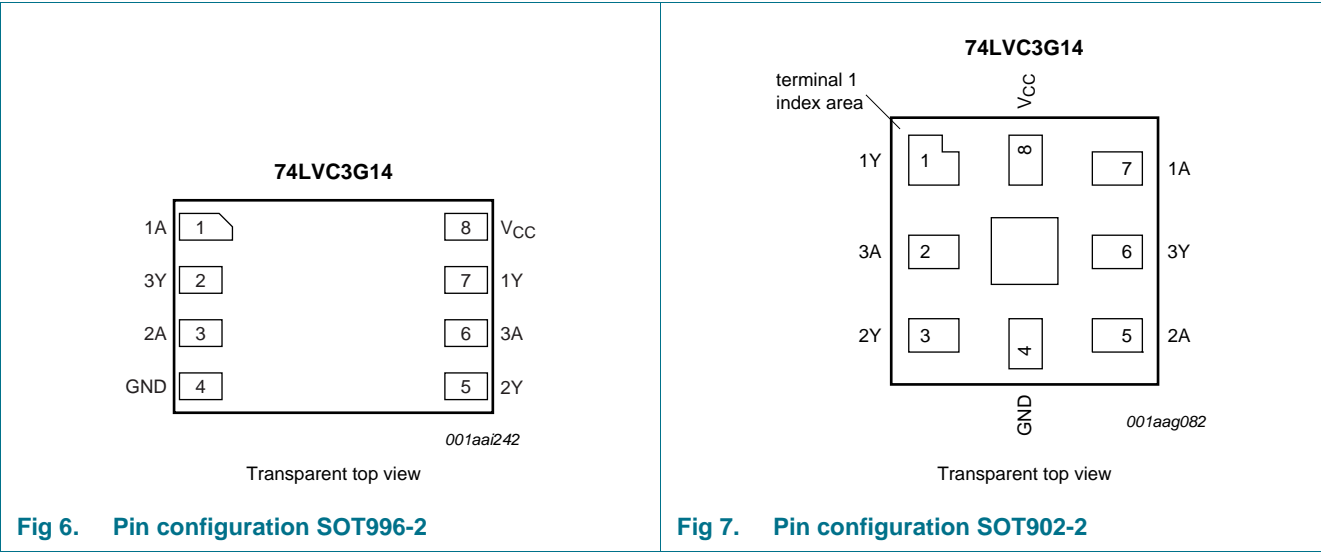
6. Functional diagram



7. Pinning information

7.1 Pinning





7.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT996-2, 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 [\[1\]](#)

Input nA	Output nY
L	H
H	L

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

## 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	-	$\pm 50$	mA
$V_O$	output voltage	Active mode	[1][2] -0.5	$V_{CC} + 0.5$	V
		Power-down mode	[1][2] -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	[3] -	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 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	Min	Typ <sup>[1]</sup>	Max	Unit
<b>T<sub>amb</sub> = -40 °C to +85 °C</b>						
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
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	-	-	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	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.3	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.4	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.55	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	0.55	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	±5	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	±10	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	10	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	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
<b>T<sub>amb</sub> = -40 °C to +125 °C</b>						
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
		I <sub>O</sub> = -4 mA; V <sub>CC</sub> = 1.65 V	0.95	-	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.7	-	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	1.9	-	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.0	-	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	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	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	-	0.7	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	-	0.6	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	-	0.8	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	-	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	-	-	±20	µA

**Table 7.** Static characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ <sup>[1]</sup>	Max	Unit
$I_{OFF}$	power-off leakage current	$V_I$ or $V_O = 5.5$ V; $V_{CC} = 0$ V	-	-	$\pm 20$	$\mu$ A
$I_{CC}$	supply current	$V_I = 5.5$ V or GND; $I_O = 0$ A; $V_{CC} = 1.65$ V to 5.5 V	-	-	40	$\mu$ A
$\Delta I_{CC}$	additional supply current	$V_I = V_{CC} - 0.6$ V; $I_O = 0$ A; $V_{CC} = 2.3$ V to 5.5 V	-	-	5000	$\mu$ A

[1] All typical values are measured at maximum  $V_{CC}$  and  $T_{amb} = 25$  °C.**Table 8.** Transfer characteristicsVoltages 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	
$V_{T+}$	positive-going threshold voltage	see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>						
		$V_{CC} = 1.8$ V	0.70	1.10	1.50	0.70	1.70	V
		$V_{CC} = 2.3$ V	1.00	1.40	1.80	1.00	2.00	V
		$V_{CC} = 3.0$ V	1.30	1.76	2.20	1.30	2.40	V
		$V_{CC} = 4.5$ V	1.90	2.47	3.10	1.90	3.30	V
		$V_{CC} = 5.5$ V	2.20	2.91	3.60	2.20	3.80	V
$V_{T-}$	negative-going threshold voltage	see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>						
		$V_{CC} = 1.8$ V	0.25	0.61	0.90	0.25	1.10	V
		$V_{CC} = 2.3$ V	0.40	0.80	1.15	0.40	1.35	V
		$V_{CC} = 3.0$ V	0.60	1.04	1.50	0.60	1.70	V
		$V_{CC} = 4.5$ V	1.00	1.55	2.00	1.00	2.20	V
		$V_{CC} = 5.5$ V	1.20	1.86	2.30	1.20	2.50	V
$V_H$ <sup>[2]</sup>	hysteresis voltage	see <a href="#">Figure 10</a> , <a href="#">Figure 11</a> and <a href="#">Figure 12</a>						
		$V_{CC} = 1.8$ V	0.15	0.49	1.00	0.15	1.20	V
		$V_{CC} = 2.3$ V	0.25	0.60	1.10	0.25	1.30	V
		$V_{CC} = 3.0$ V	0.40	0.73	1.20	0.40	1.40	V
		$V_{CC} = 4.5$ V	0.60	0.92	1.50	0.60	1.70	V
		$V_{CC} = 5.5$ V	0.70	1.02	1.70	0.70	1.90	V

[1] All typical values are measured at  $T_{amb} = 25$  °C[2]  $V_H = V_{T+} - V_{T-}$

## 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 <sup>[1]</sup>	Max	Min	Max	
$t_{pd}$	propagation delay	nA to nY; see <a href="#">Figure 8</a> <sup>[2]</sup>						
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	1.0	4.2	11.0	1.0	12.0	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$	0.5	3.0	6.5	0.5	7.2	ns
		$V_{CC} = 2.7 \text{ V}$	0.5	3.8	7.0	0.5	7.7	ns
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}$	0.5	3.2	6.0	0.5	6.7	ns
		$V_{CC} = 4.5 \text{ V to } 5.5 \text{ V}$	0.5	2.4	4.3	0.5	4.7	ns
$C_{PD}$	power dissipation capacitance	$V_I = \text{GND to } V_{CC}; V_{CC} = 3.3 \text{ V}$ <sup>[3]</sup>	-	18.1	-	-	-	pF

[1] Typical values are measured at  $T_{amb} = 25 \text{ °C}$  and  $V_{CC} = 1.8 \text{ V}, 2.5 \text{ V}, 2.7 \text{ V}, 3.3 \text{ V}$  and  $5.0 \text{ V}$  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  $\mu\text{W}$ ).

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

$f_i$  = input frequency in MHz;

$f_o$  = output frequency in MHz;

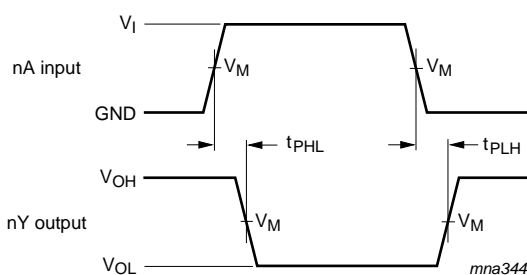
$C_L$  = output load capacitance in pF;

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

$N$  = number of inputs switching;

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

## 13. Waveforms



Measurement points are given in [Table 10](#).  $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

**Fig 8. The data input (nA) to output (nY) propagation delays**



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>

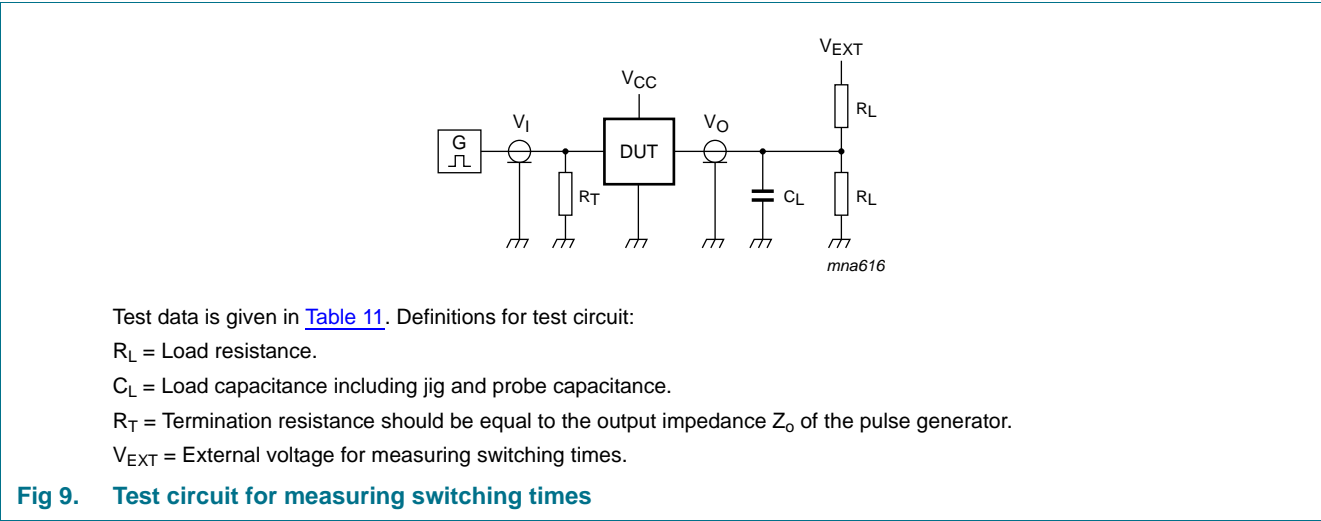
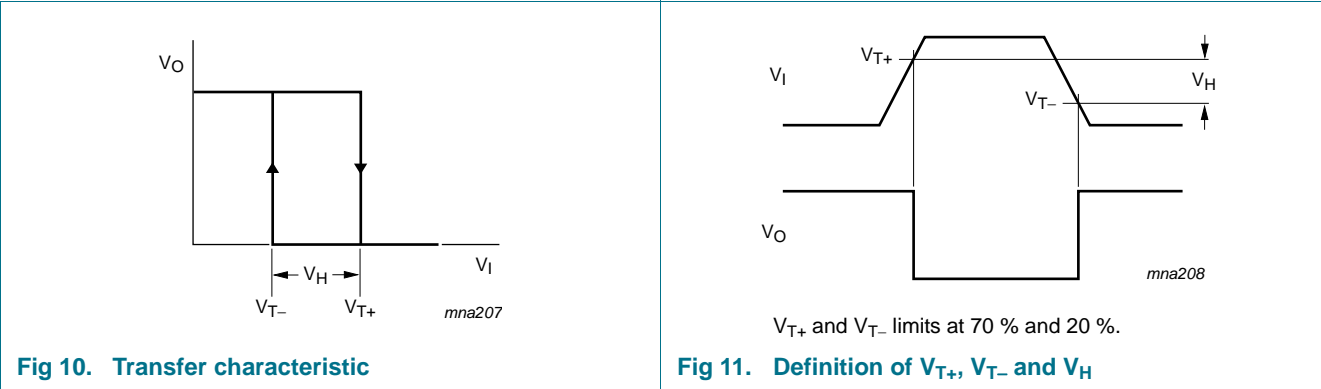


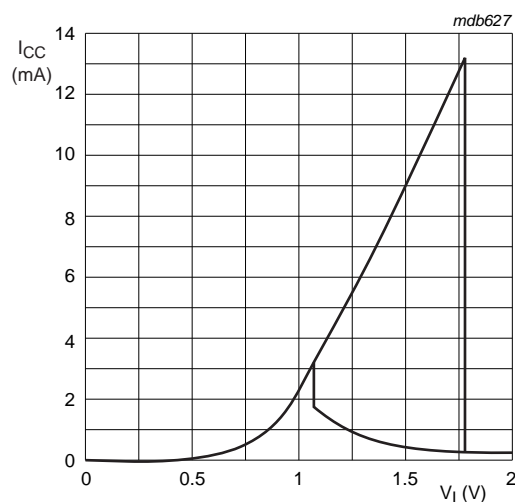
Fig 9. Test circuit for measuring switching times

Table 11. Test data

Supply voltage	Input		Load		V <sub>EXT</sub>
V <sub>CC</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	C <sub>L</sub>	R <sub>L</sub>	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	≤ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	≤ 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 <sub>CC</sub>	≤ 2.5 ns	50 pF	500 Ω	open

14. Waveforms transfer characteristics





$V_{CC} = 3.0\text{ V}$

Fig 12. Typical transfer characteristics

## 15. Application information

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

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

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

$f_i$  = input frequency (MHz);

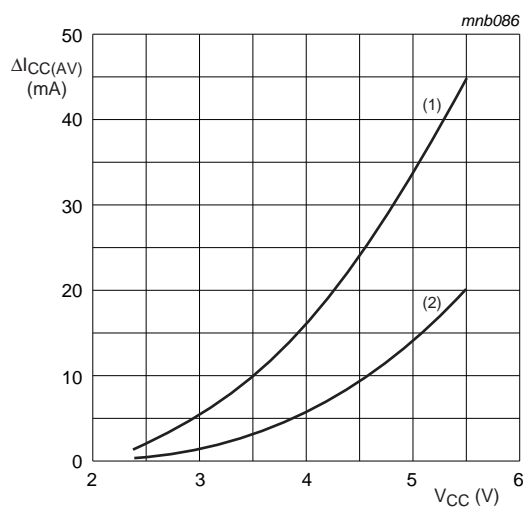
$t_r$  = input rise time (ns); 10 % to 90 %;

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

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

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

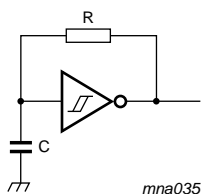
An example of a relaxation circuit using the 74LVC3G14 is shown in [Figure 14](#).



Linear change of  $V_I$  between 0.8 V to 2.0 V. All values given are typical unless otherwise specified.

- (1) Positive-going edge.
- (2) Negative-going edge.

**Fig 13.**  $\Delta I_{CC(av)}$  as a function of  $V_{CC}$



$$f = \frac{1}{T} \approx \frac{1}{0.8 \times RC}$$

**Fig 14.** Relaxation oscillator

16. Package outline

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

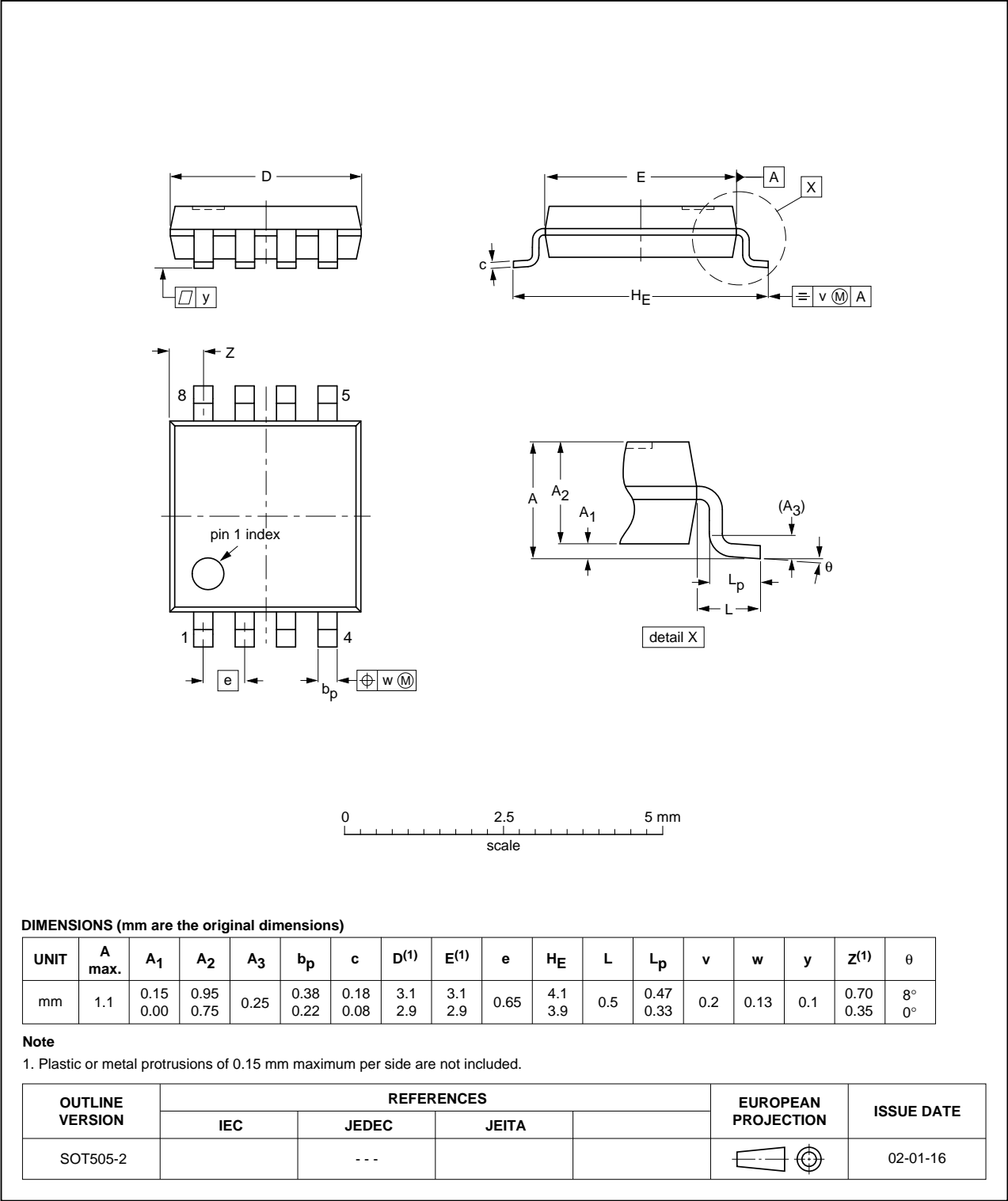


Fig 15. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

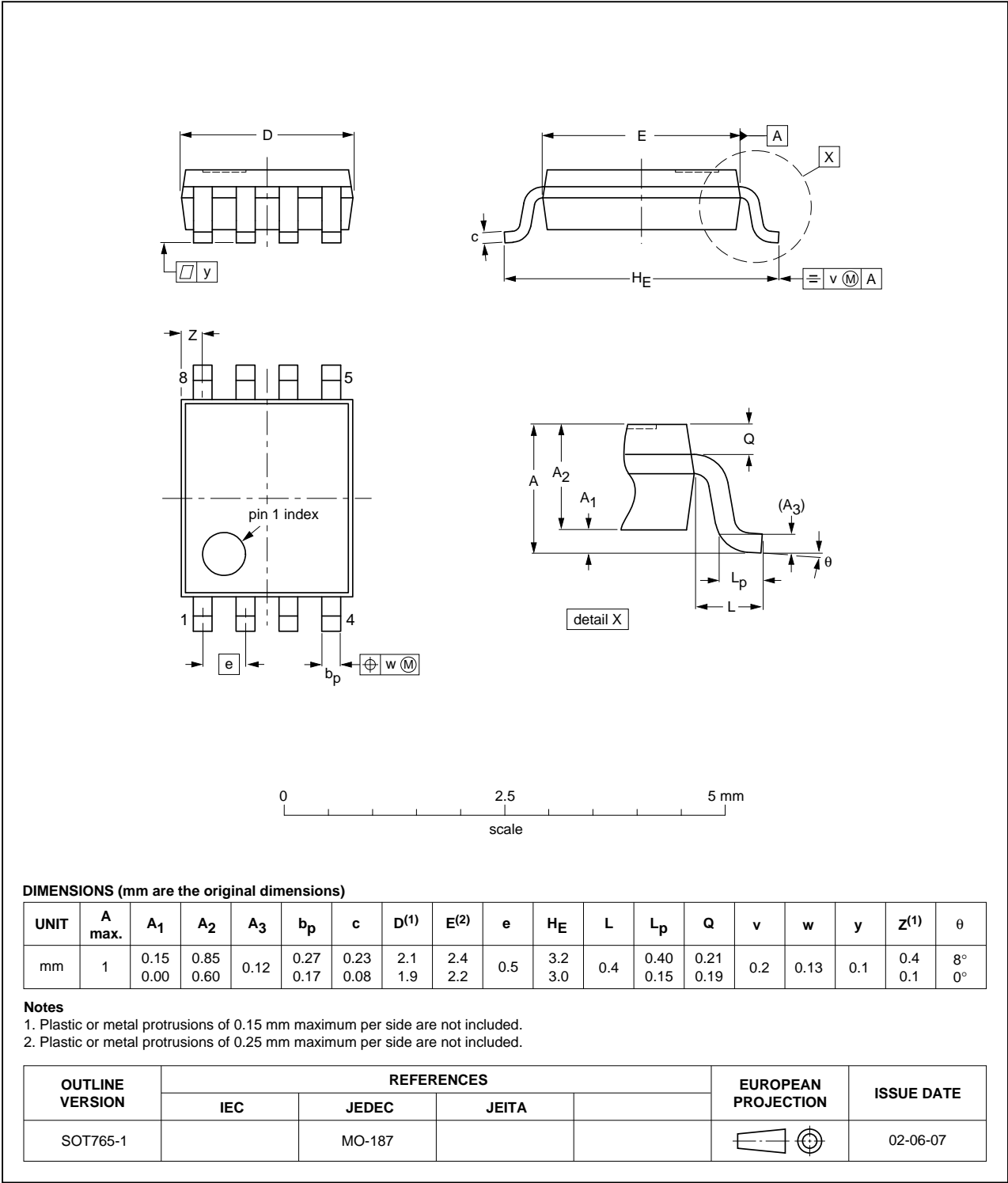


Fig 16. Package outline SOT765-1 (VSSOP8)

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

SOT833-1

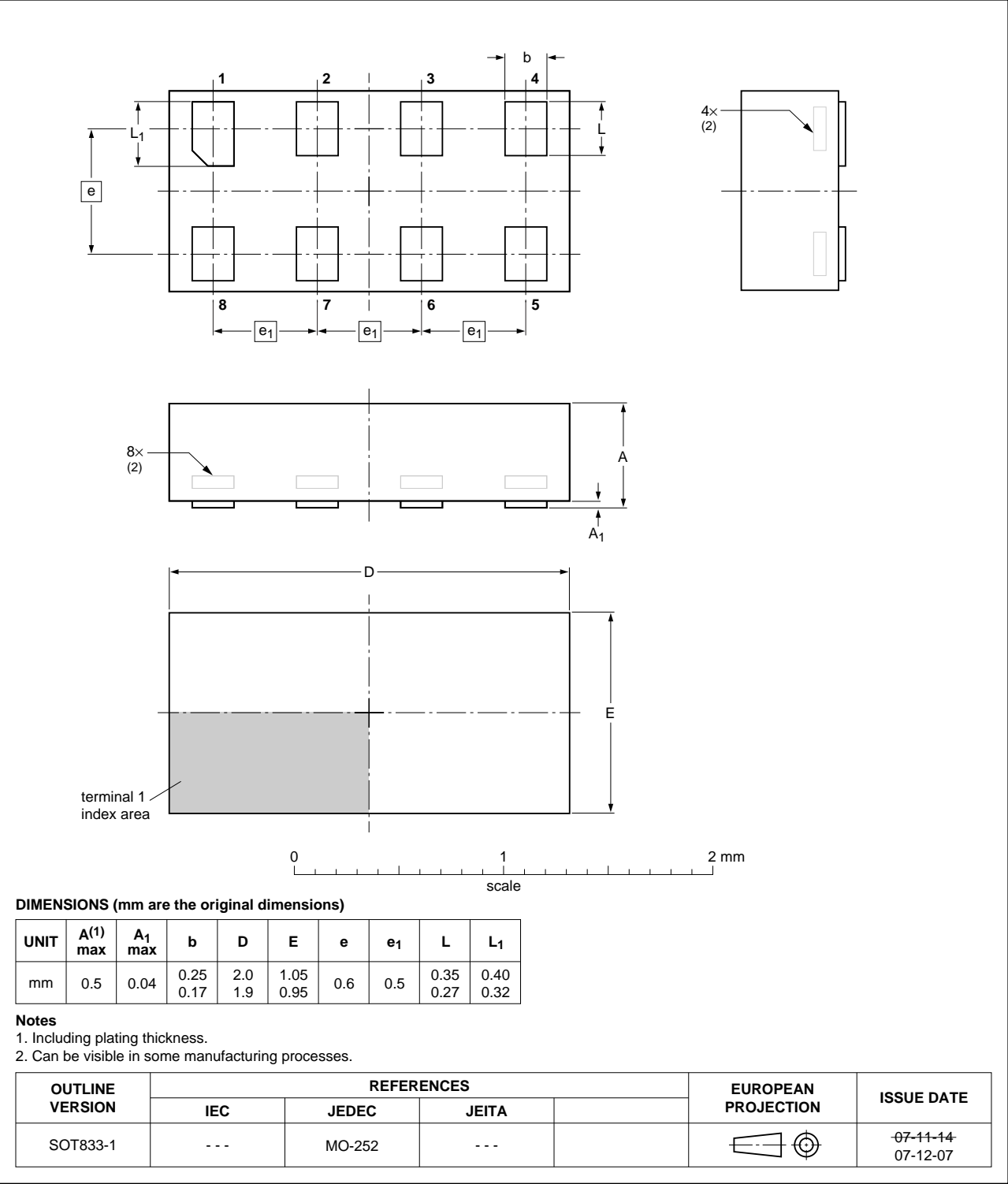


Fig 17. Package outline SOT833-1 (XSON8)

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

SOT1089

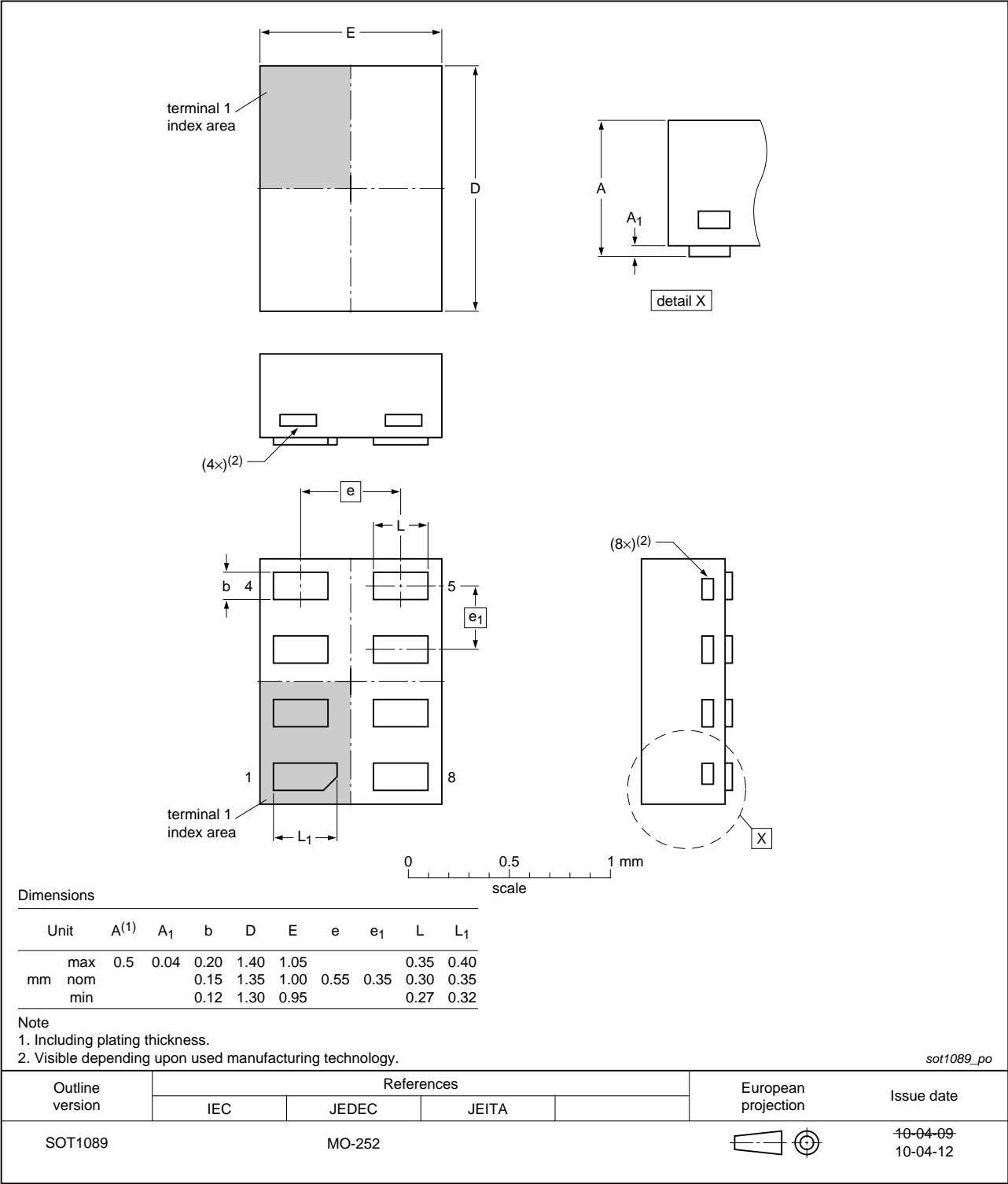


Fig 18. Package outline SOT1089 (XSON8)

XSON8: plastic extremely thin small outline package; no leads;  
8 terminals; body 3 x 2 x 0.5 mm

SOT996-2

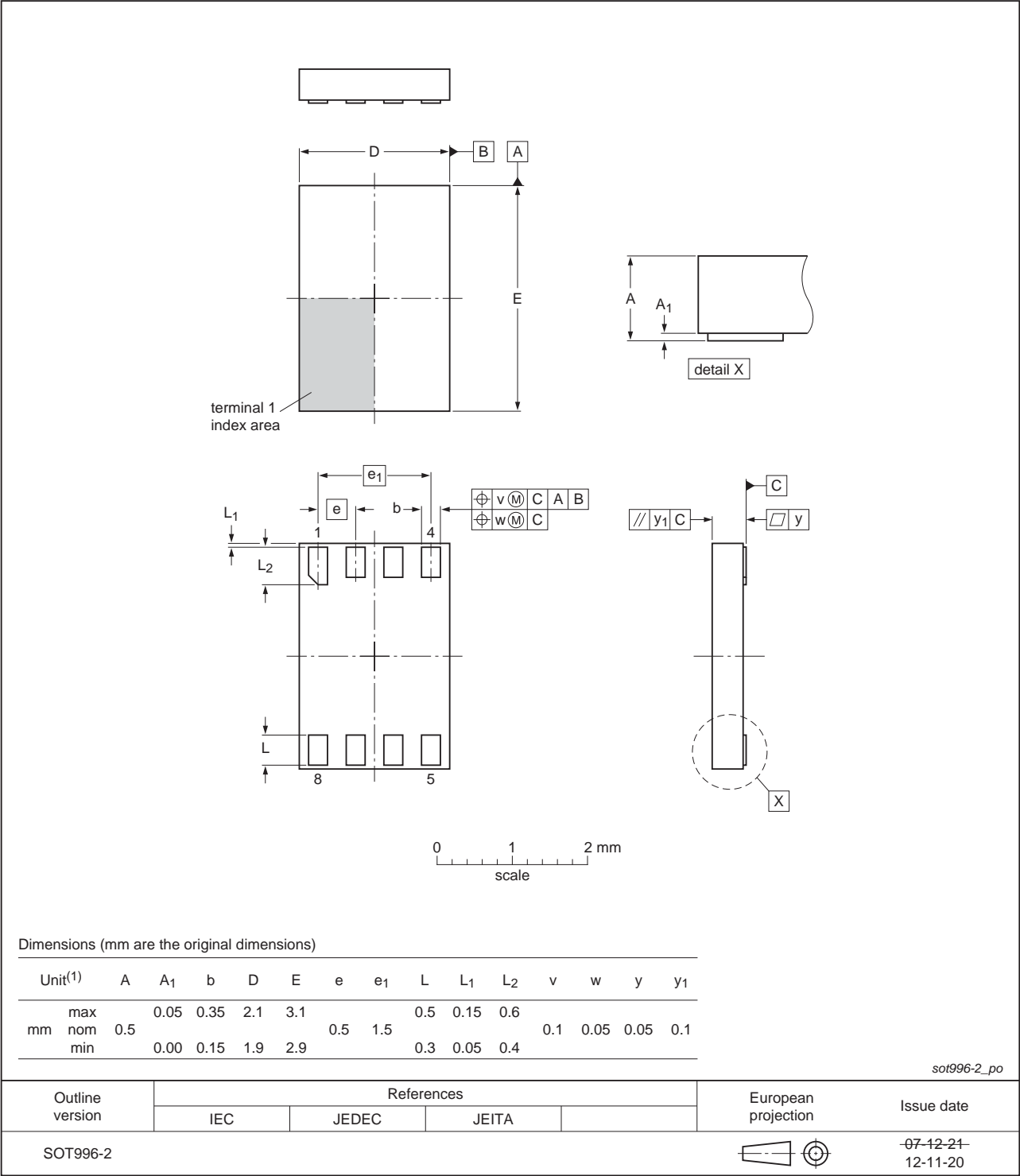


Fig 19. Package outline SOT996-2 (XSON8)



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

SOT902-2

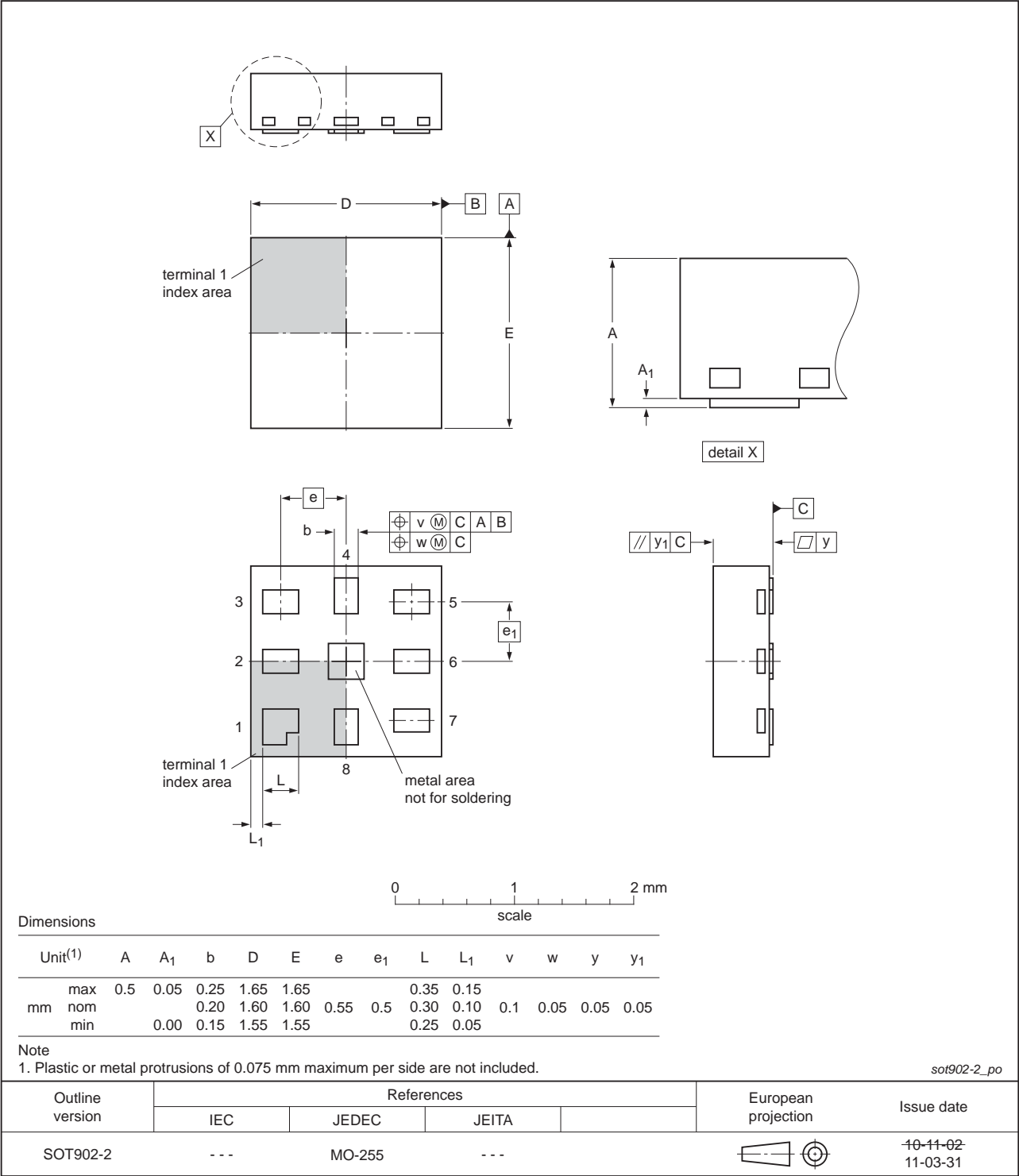


Fig 20. Package outline SOT902-2 (XQFN8)

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

SOT1116

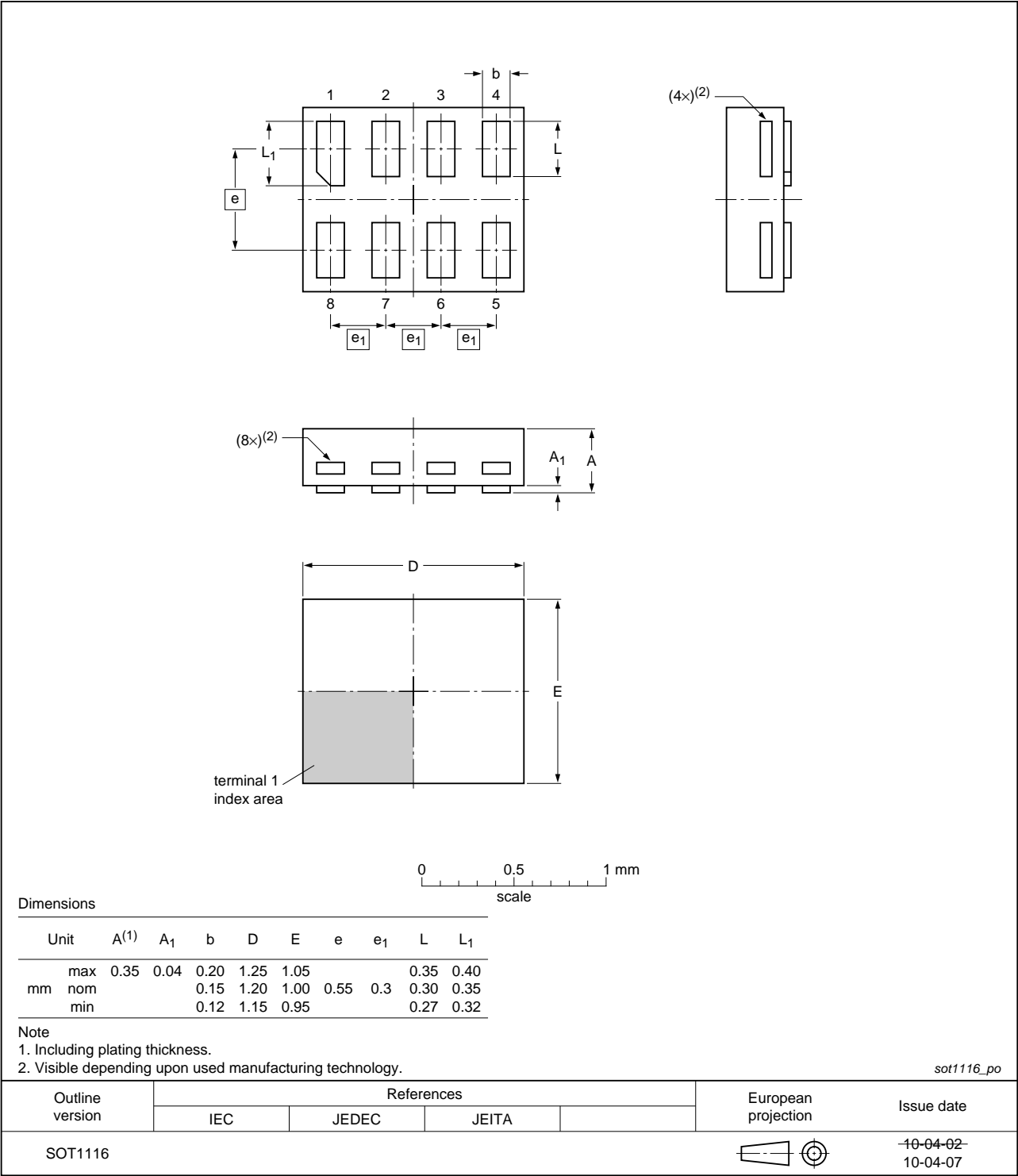


Fig 21. Package outline SOT1116 (XSON8)

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

SOT1203

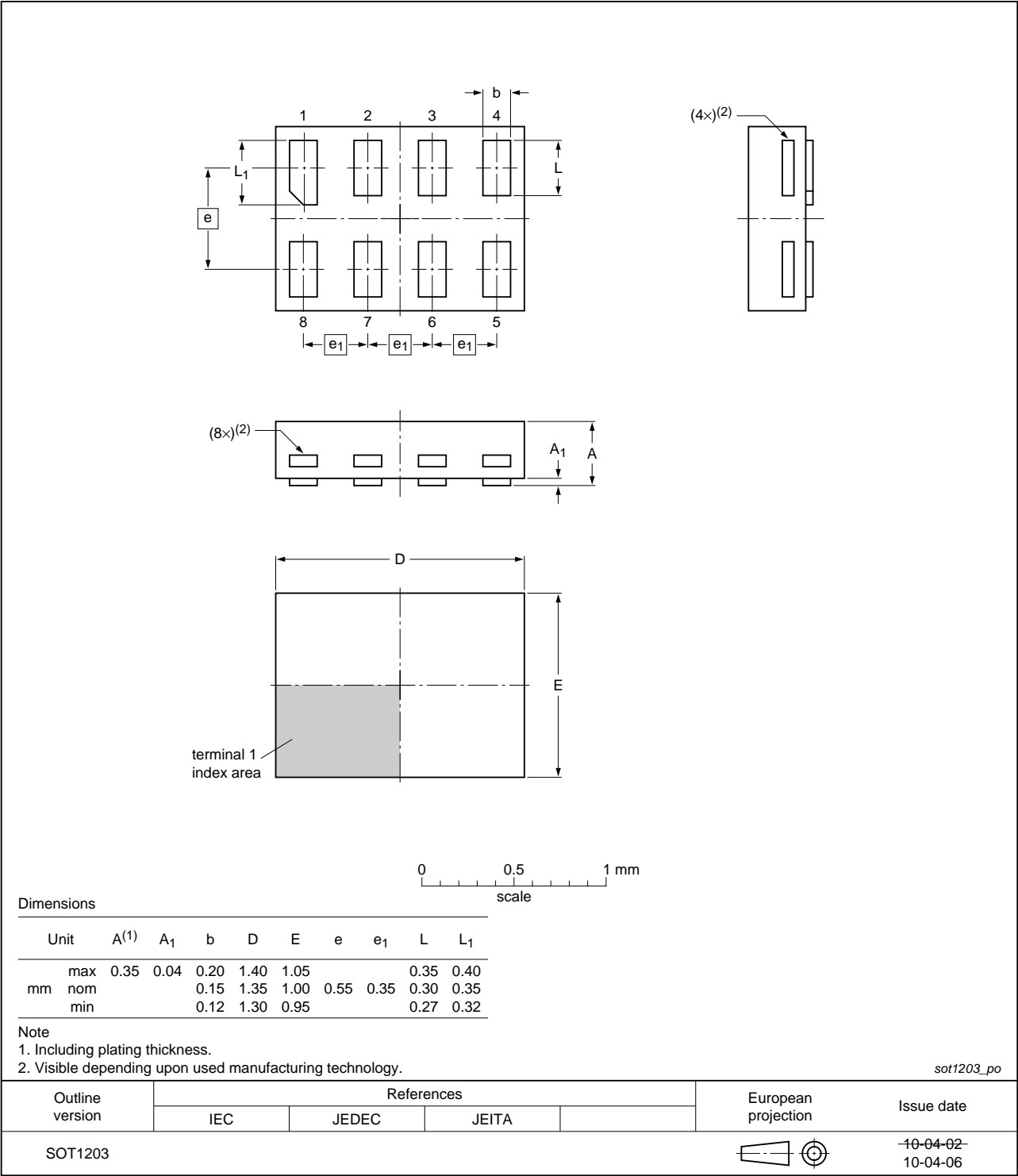


Fig 22. Package outline SOT1203 (XSON8)

## 17. 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
UTLP	Ultra-Thin Leadless Package

## 18. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
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	-	-

## 19. Legal information

### 19.1 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".

[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.nxp.com>.

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## 21. Contents

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<b>1</b>	<b>General description</b> .....	<b>1</b>
<b>2</b>	<b>Features and benefits</b> .....	<b>1</b>
<b>3</b>	<b>Applications</b> .....	<b>1</b>
<b>4</b>	<b>Ordering information</b> .....	<b>2</b>
<b>5</b>	<b>Marking</b> .....	<b>2</b>
<b>6</b>	<b>Functional diagram</b> .....	<b>3</b>
<b>7</b>	<b>Pinning information</b> .....	<b>3</b>
7.1	Pinning .....	3
7.2	Pin description .....	4
<b>8</b>	<b>Functional description</b> .....	<b>4</b>
<b>9</b>	<b>Limiting values</b> .....	<b>5</b>
<b>10</b>	<b>Recommended operating conditions</b> .....	<b>5</b>
<b>11</b>	<b>Static characteristics</b> .....	<b>6</b>
<b>12</b>	<b>Dynamic characteristics</b> .....	<b>8</b>
<b>13</b>	<b>Waveforms</b> .....	<b>8</b>
<b>14</b>	<b>Waveforms transfer characteristics</b> .....	<b>9</b>
<b>15</b>	<b>Application information</b> .....	<b>10</b>
<b>16</b>	<b>Package outline</b> .....	<b>12</b>
<b>17</b>	<b>Abbreviations</b> .....	<b>20</b>
<b>18</b>	<b>Revision history</b> .....	<b>20</b>
<b>19</b>	<b>Legal information</b> .....	<b>21</b>
19.1	Data sheet status .....	21
19.2	Definitions .....	21
19.3	Disclaimers .....	21
19.4	Trademarks .....	22
<b>20</b>	<b>Contact information</b> .....	<b>22</b>
<b>21</b>	<b>Contents</b> .....	<b>23</b>

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