

# 74LVC1G14

## Single Schmitt-trigger inverter

Rev. 12 — 6 August 2012

Product data sheet

### 1. General description

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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

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- 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).
- $\pm 24$  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
- Input accepts voltages up to 5 V
- Multiple package options
- ESD protection:
  - ◆ HBM JESD22-A114F 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

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- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator



## 4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
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 × 1.45 × 0.5 mm	SOT886
74LVC1G14GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891
74LVC1G14GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC1G14GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74LVC1G14GX	-40 °C to +125 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.35 mm	SOT1226

## 5. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74LVC1G14GW	VF
74LVC1G14GV	V14
74LVC1G14GM	VF
74LVC1G14GF	VF
74LVC1G14GN	VF
74LVC1G14GS	VF
74LVC1G14GX	VF

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

## 6. Functional diagram

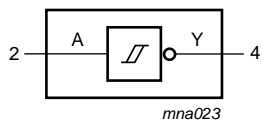


Fig 1. Logic symbol

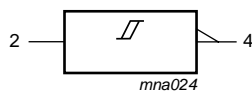


Fig 2. IEC logic symbol

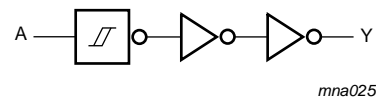


Fig 3. Logic diagram

## 7. Pinning information

### 7.1 Pinning

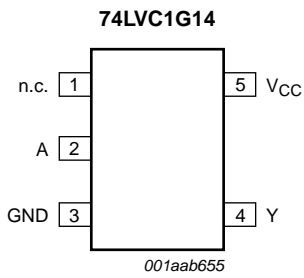


Fig 4. Pin configuration SOT353-1 and SOT753

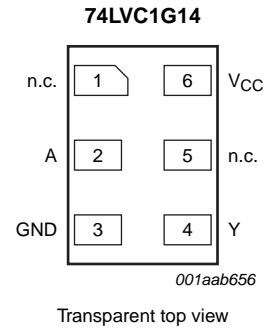


Fig 5. Pin configuration SOT886

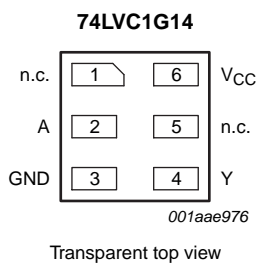


Fig 6. Pin configuration SOT891, SOT1115 and SOT1202

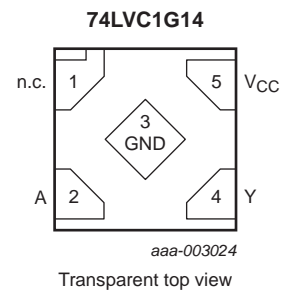


Fig 7. Pin configuration SOT1226 (X2SON5)

### 7.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	TSSOP5 and X2SON5	XSON6	
n.c.	1	1	not connected
A	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V <sub>CC</sub>	5	6	supply voltage

## 8. Functional description

Table 4. Function table<sup>[1]</sup>

Input	Output
A	Y
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
$V_I$	input voltage		<sup>[1]</sup> -0.5	+6.5	V
$V_O$	output voltage	Active mode	<sup>[1][2]</sup> -0.5	$V_{CC} + 0.5$	V
		Power-down mode	<sup>[1][2]</sup> -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	-	$\pm 50$	mA
$I_O$	output current	$V_O = 0$ V to $V_{CC}$	-	$\pm 50$	mA
$I_{CC}$	supply current		-	+100	mA
$I_{GND}$	ground current		-100	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
$P_{tot}$	total power dissipation	$T_{amb} = -40$ °C to +125 °C	<sup>[3]</sup> -	250	mW

[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 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.

## 10. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	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	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ <sup>[1]</sup>	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	1.54	-	0.95	-	V
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.9	2.15	-	1.7	-	V
		I <sub>O</sub> = -12 mA; V <sub>CC</sub> = 2.7 V	2.2	2.50	-	1.9	-	V
		I <sub>O</sub> = -24 mA; V <sub>CC</sub> = 3.0 V	2.3	2.62	-	2.0	-	V
		I <sub>O</sub> = -32 mA; V <sub>CC</sub> = 4.5 V	3.8	4.11	-	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	-	-	0.10	-	0.10	V
		I <sub>O</sub> = 4 mA; V <sub>CC</sub> = 1.65 V	-	0.07	0.45	-	0.70	V
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	0.12	0.30	-	0.45	V
		I <sub>O</sub> = 12 mA; V <sub>CC</sub> = 2.7 V	-	0.17	0.40	-	0.60	V
		I <sub>O</sub> = 24 mA; V <sub>CC</sub> = 3.0 V	-	0.33	0.55	-	0.80	V
		I <sub>O</sub> = 32 mA; V <sub>CC</sub> = 4.5 V	-	0.39	0.55	-	0.80	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	-	±100	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	-	±200	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	-	200	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	-	5000	μA
C <sub>I</sub>	input capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = GND to V <sub>CC</sub>	-	5.0	-	-	-	pF

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

**Table 8. Transfer characteristics**

Voltages are referenced to GND (ground = 0 V); for load 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 <sub>T+</sub>	positive-going threshold voltage	see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>						
		V <sub>CC</sub> = 1.8 V	0.82	1.0	1.14	0.79	1.14	V
		V <sub>CC</sub> = 2.3 V	1.03	1.2	1.40	1.00	1.40	V
		V <sub>CC</sub> = 3.0 V	1.29	1.5	1.71	1.26	1.71	V
		V <sub>CC</sub> = 4.5 V	1.84	2.1	2.36	1.81	2.36	V
		V <sub>CC</sub> = 5.5 V	2.19	2.5	2.79	2.16	2.79	V

**Table 8. Transfer characteristics ...continued**

Voltages are referenced to GND (ground = 0 V); for load 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 <sub>T-</sub>	negative-going threshold voltage	see <a href="#">Figure 10</a> and <a href="#">Figure 11</a>						
		V <sub>CC</sub> = 1.8 V	0.46	0.6	0.75	0.46	0.78	V
		V <sub>CC</sub> = 2.3 V	0.65	0.8	0.96	0.65	0.99	V
		V <sub>CC</sub> = 3.0 V	0.88	1.0	1.24	0.88	1.27	V
		V <sub>CC</sub> = 4.5 V	1.32	1.5	1.84	1.32	1.87	V
		V <sub>CC</sub> = 5.5 V	1.58	1.8	2.24	1.58	2.27	V
V <sub>H</sub>	hysteresis voltage	(V <sub>T+</sub> - V <sub>T-</sub> ); see <a href="#">Figure 10</a> , <a href="#">Figure 11</a> and <a href="#">Figure 12</a>						
		V <sub>CC</sub> = 1.8 V	0.26	0.4	0.51	0.19	0.51	V
		V <sub>CC</sub> = 2.3 V	0.28	0.4	0.57	0.22	0.57	V
		V <sub>CC</sub> = 3.0 V	0.31	0.5	0.64	0.25	0.64	V
		V <sub>CC</sub> = 4.5 V	0.40	0.6	0.77	0.34	0.77	V
		V <sub>CC</sub> = 5.5 V	0.47	0.6	0.88	0.41	0.88	V

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

## 12. Dynamic characteristics

**Table 9. Dynamic characteristics**

Voltages are referenced to GND (ground = 0 V); for load 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 <sub>pd</sub>	propagation delay	A to Y; see <a href="#">Figure 8</a> <sup>[2]</sup>						
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.0	4.1	11.0	1.0	14.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7	2.8	6.5	0.7	8.5	ns
		V <sub>CC</sub> = 2.7 V	0.7	3.2	6.5	0.7	8.5	ns
		V <sub>CC</sub> = 3.0 V to 3.6 V	0.7	3.0	5.5	0.7	7.0	ns
		V <sub>CC</sub> = 4.5 V to 5.5 V	0.7	2.2	5.0	0.7	6.5	ns
C <sub>PD</sub>	power dissipation capacitance	V <sub>CC</sub> = 3.3 V; V <sub>I</sub> = GND to V <sub>CC</sub> <sup>[3]</sup>	-	15.4	-	-	-	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).

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

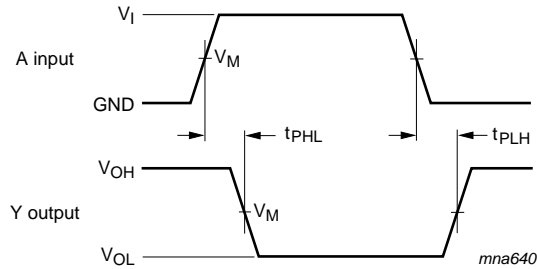
f<sub>i</sub> = input frequency in MHz;

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.

13. Waveforms

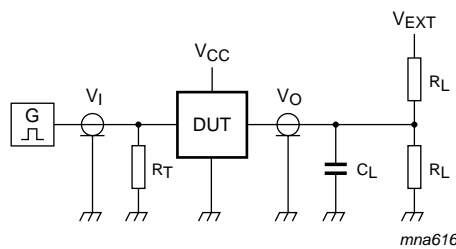


Measurement points are given in [Table 10](#).  
 $V_{OL}$  and  $V_{OH}$  are typical output voltage levels that occur with the output load.

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

**Table 10. Measurement points**

Supply voltage	Input	Output
$V_{CC}$	$V_M$	$V_M$
1.65 V to 1.95 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
2.3 V to 2.7 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$
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	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$



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.

**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

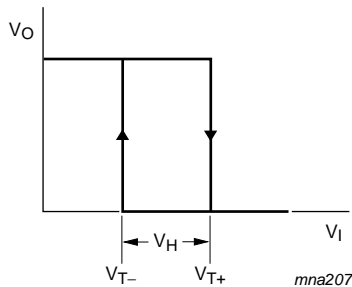
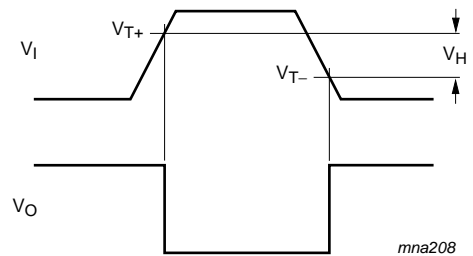
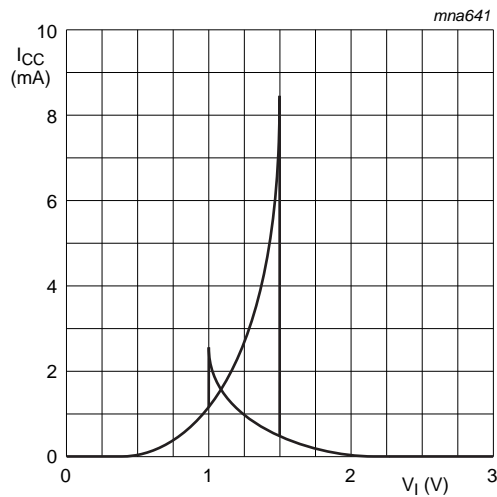


Fig 10. Transfer characteristic



$V_{T+}$  and  $V_{T-}$  limits at 70 % and 20 %.

Fig 11. Definition of  $V_{T+}$ ,  $V_{T-}$  and  $V_H$



$V_{CC} = 3.0$  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:

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

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

$f_i$  = input frequency (MHz);

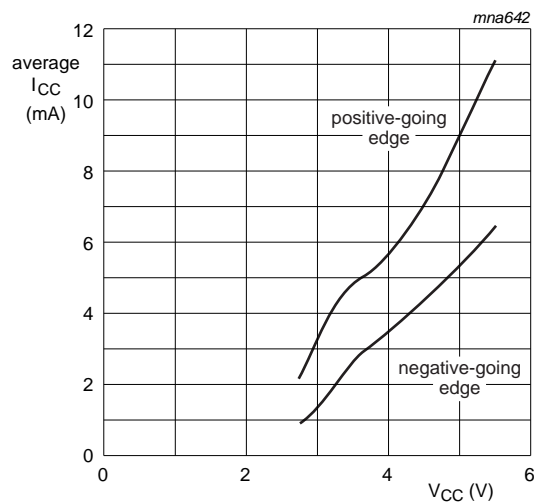
$t_r$  = input rise time (ns); 10 % to 90 %;

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

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

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

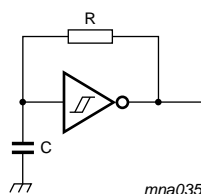
An example of a relaxation circuit using the 74LVC1G14 is shown in [Figure 14](#).



Linear change of  $V_i$  between 0.8 V to 2.0 V.

All values given are typical unless otherwise specified.

**Fig 13. Average additional supply current as a function of supply voltage**



$$f = \frac{1}{T} \approx \frac{1}{0.5 \times RC}$$

**Fig 14. Relaxation oscillator**

16. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm

SOT353-1

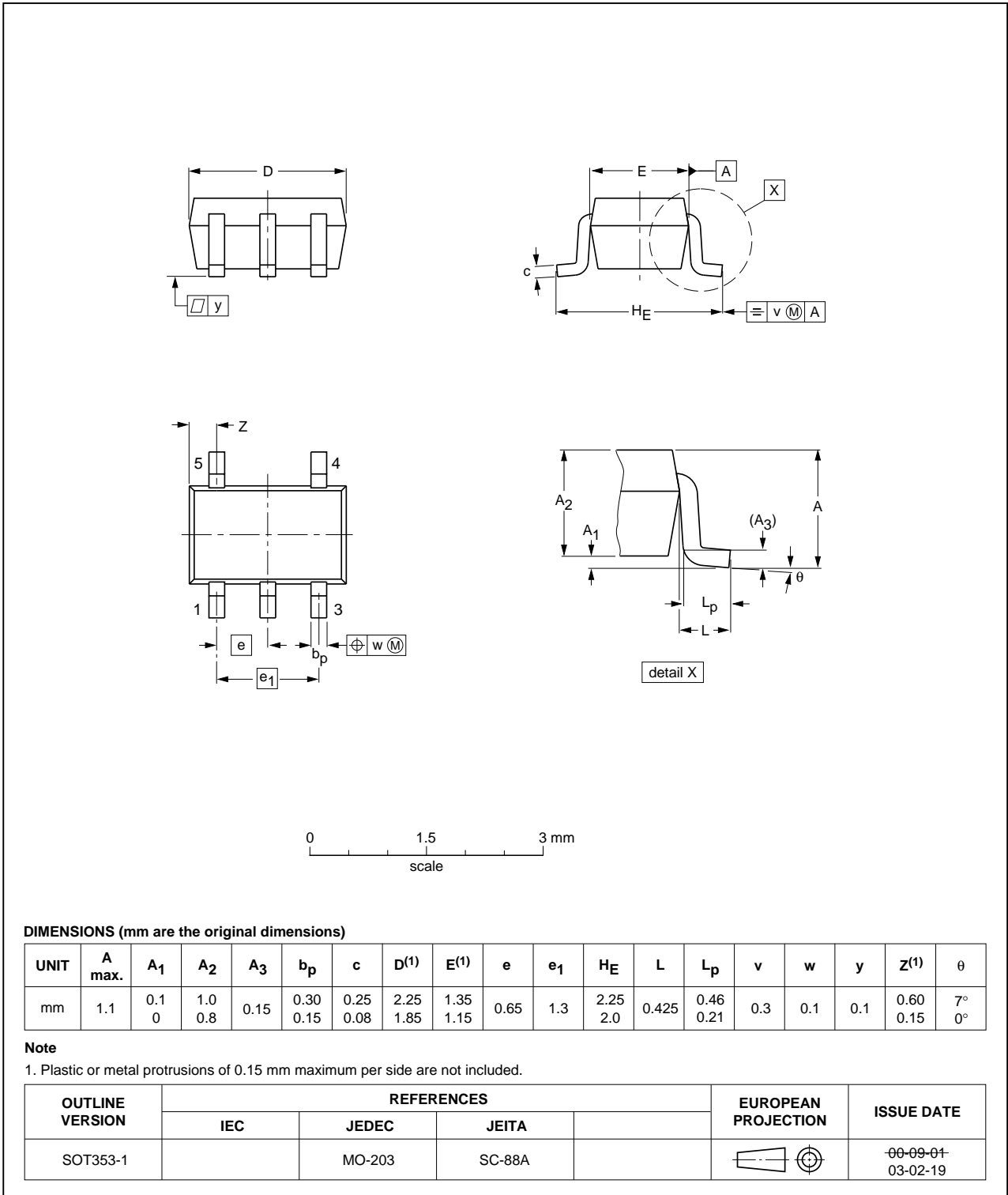


Fig 15. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

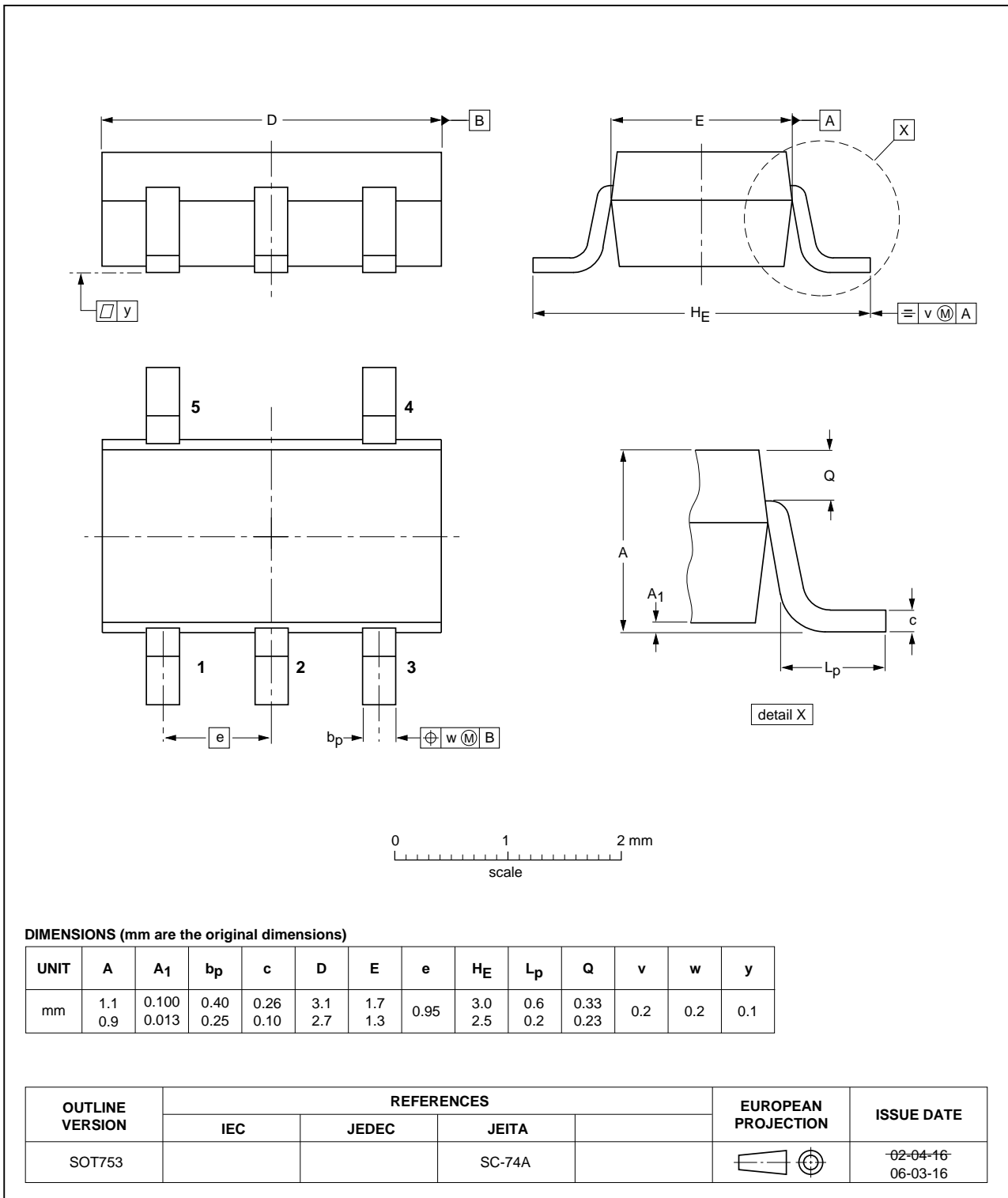


Fig 16. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

SOT886



Fig 17. Package outline SOT886 (XSON6)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

SOT891

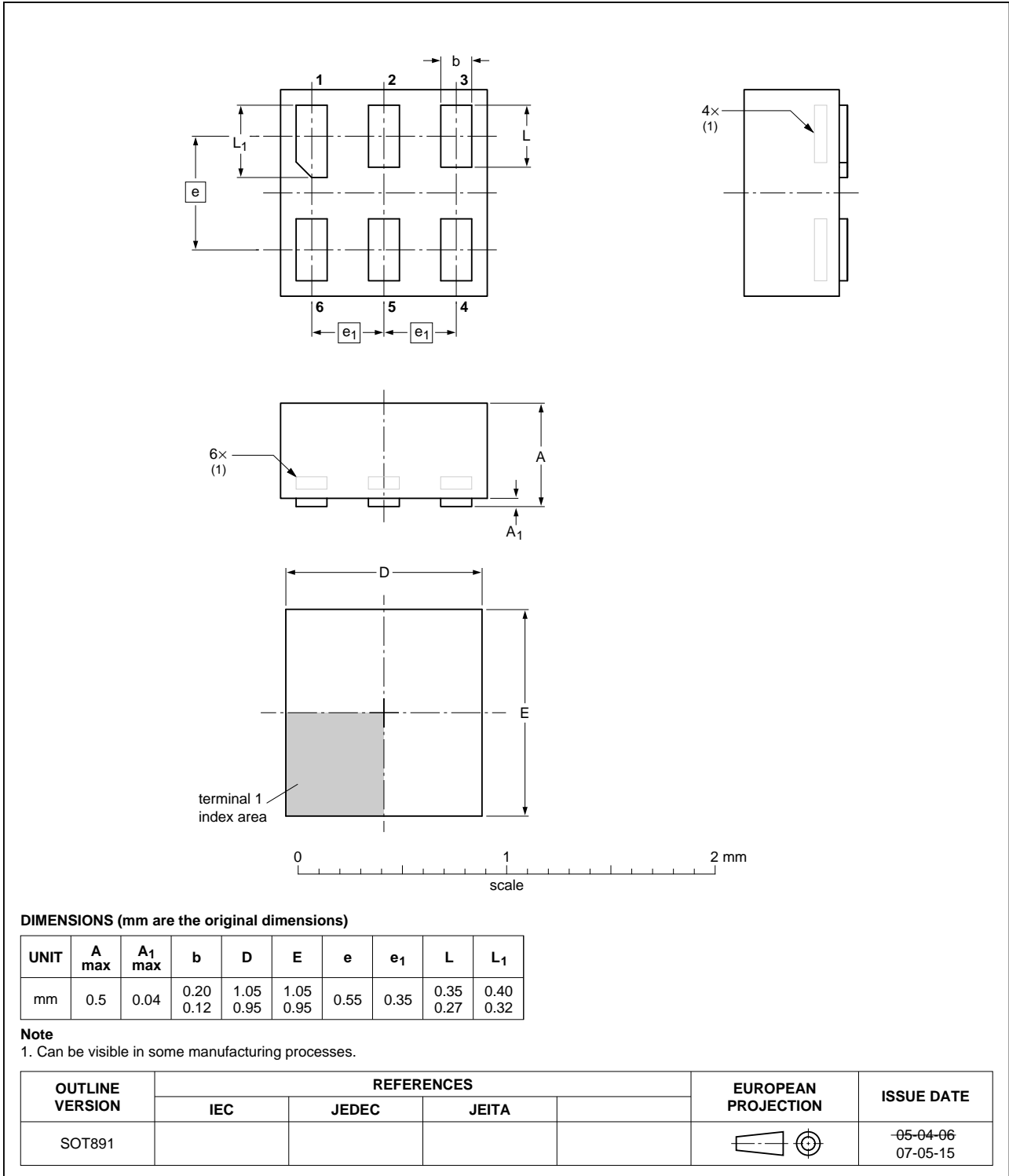


Fig 18. Package outline SOT891 (XSON6)

**XSON6: extremely thin small outline package; no leads;  
6 terminals; body 0.9 x 1.0 x 0.35 mm**

SOT1115



Fig 19. Package outline SOT1115 (XSON6)

**XSON6: extremely thin small outline package; no leads;  
6 terminals; body 1.0 x 1.0 x 0.35 mm**

**SOT1202**



**Fig 20. Package outline SOT1202 (XSON6)**

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;  
5 terminals; body 0.8 x 0.8 x 0.35 mm

SOT1226

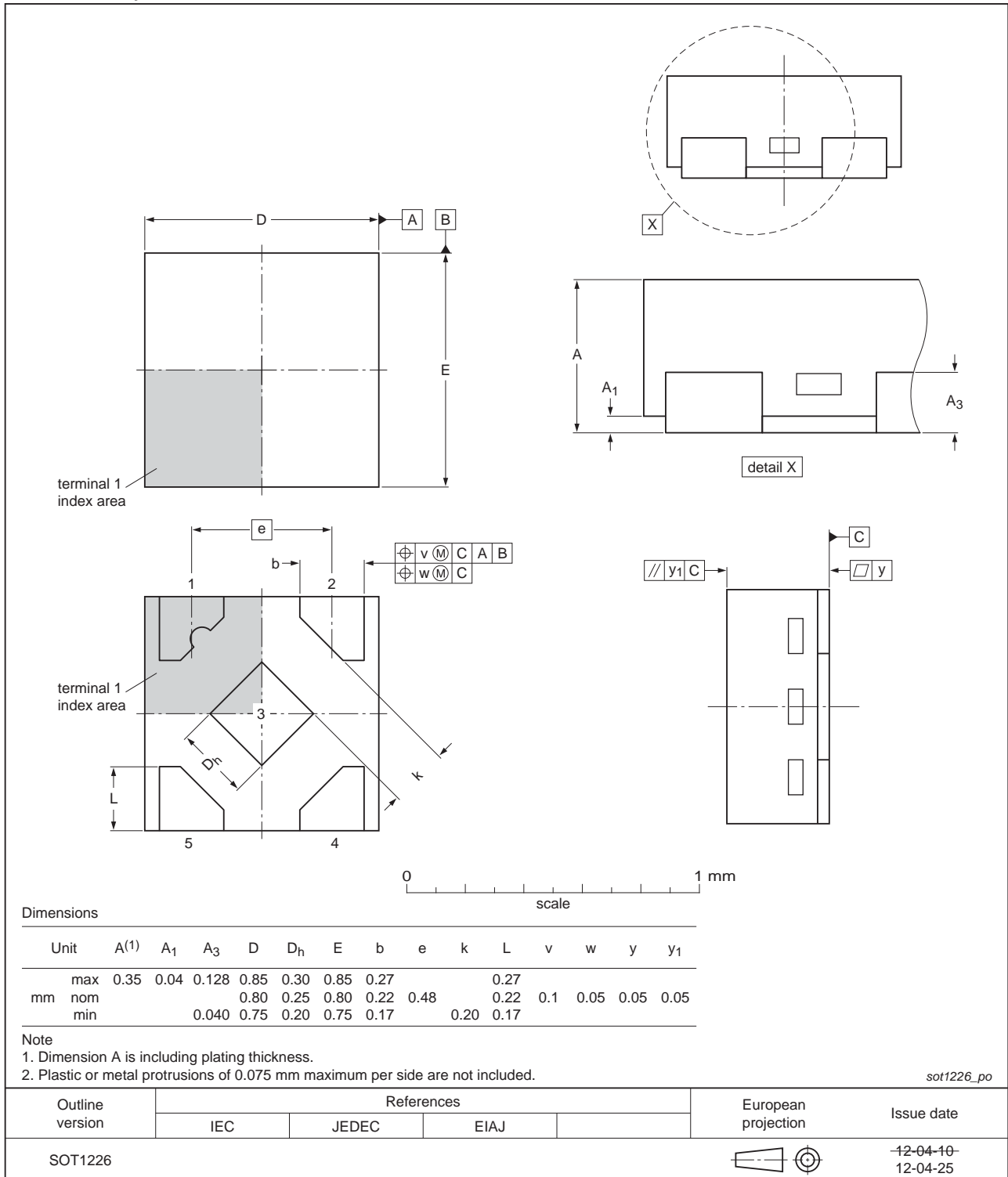


Fig 21. Package outline SOT1226 (X2SON5)



## 17. Abbreviations

Table 12. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
TTL	Transistor-Transistor Logic
HBM	Human Body Model
ESD	ElectroStatic Discharge
MM	Machine Model
DUT	Device Under Test

## 18. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G14 v.12	20120806	Product data sheet	-	74LVC1G14 v.11
Modifications:	<ul style="list-style-type: none"> <li>Package outline drawing of SOT1226 (<a href="#">Figure 21</a>) modified.</li> </ul>			
74LVC1G14 v.11	20120412	Product data sheet	-	74LVC1G14 v.10
Modifications:	<ul style="list-style-type: none"> <li>Added type number 74LVC1G14GX (SOT1226)</li> <li>Package outline drawing of SOT886 (<a href="#">Figure 17</a>) modified.</li> </ul>			
74LVC1G14 v.10	20111206	Product data sheet	-	74LVC1G14 v.9
Modifications:	<ul style="list-style-type: none"> <li>Legal pages updated.</li> </ul>			
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
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## 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".

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