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74LVC2G14

Dual inverting Schmitt trigger with 5 V tolerant input

Rev. 10 — 15 December 2016

Product data sheet

1. General description

The 74LVC2G14 provides two 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

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant inputs for interfacing with 5 V logic
- 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)
 - ◆ JESD8B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 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
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C.

3. Applications

- Wave and pulse shaper
- Astable multivibrator
- Monostable multivibrator

4. Ordering information

Table 1. Ordering information

Type number	Package			Version
	Temperature range	Name	Description	
74LVC2G14GW	-40 °C to +125 °C	SC-88	plastic surface-mounted package; 6 leads	SOT363
74LVC2G14GV	-40 °C to +125 °C	TSOP6	plastic surface-mounted package (TSOP6); 6 leads	SOT457
74LVC2G14GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC2G14GF	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1 × 0.5 mm	SOT891
74LVC2G14GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC2G14GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202

5. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74LVC2G14GW	VK
74LVC2G14GV	V14
74LVC2G14GM	VK
74LVC2G14GF	VK
74LVC2G14GN	VK
74LVC2G14GS	VK

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

6. Functional diagram

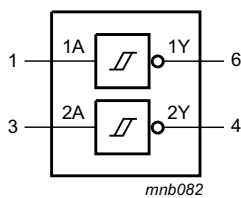


Fig 1. Logic symbol

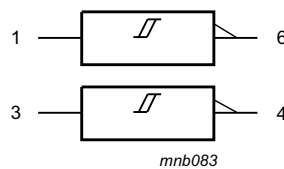


Fig 2. IEC logic symbol

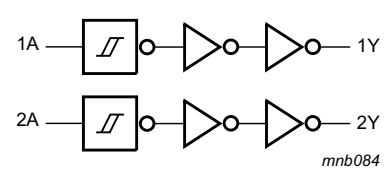
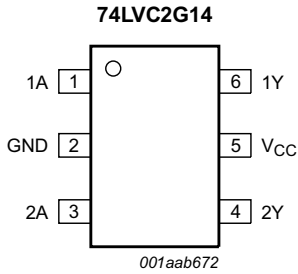
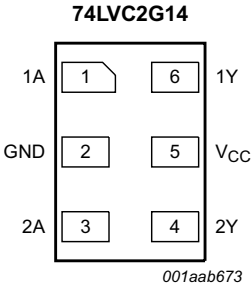
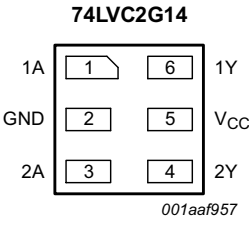


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

 <p>74LVC2G14</p> <p>001aab672</p> <p>Fig 4. Pin configuration SOT363 and SOT457</p>	 <p>74LVC2G14</p> <p>001aab673</p> <p>Transparent top view</p> <p>Fig 5. Pin configuration SOT886</p>	 <p>74LVC2G14</p> <p>001aaf957</p> <p>Transparent top view</p> <p>Fig 6. Pin configuration SOT891, SOT1115 and SOT1202</p>
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7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
1A	1	data input
GND	2	ground (0 V)
2A	3	data input
2Y	4	data output
V _{CC}	5	supply voltage
1Y	6	data input

8. Functional description

Table 4. Function table^[1]

Input	Output
nA	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		-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	-0.5	$V_{CC} + 0.5$	V
		Power-down mode	-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	-	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 SC-88 and TSOP6 packages: above 87.5 °C the value of P_{tot} derates linearly with 4.0 mW/K.
For XSON6 packages: 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	Min	Typ ^[1]	Max	Unit		
T_{amb} = -40 °C to +85 °C								
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}						
		I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V		
		I _O = -4 mA; V _{CC} = 1.65 V	1.2	-	-	V		
		I _O = -8 mA; V _{CC} = 2.3 V	1.9	-	-	V		
		I _O = -12 mA; V _{CC} = 2.7 V	2.2	-	-	V		
		I _O = -24 mA; V _{CC} = 3.0 V	2.3	-	-	V		
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}						
		I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V		
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.45	V		
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.3	V		
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.4	V		
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.55	V		
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	μA		
		I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	±0.1	±2	μA
		I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	0.1	4	μA
		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	μA
		C _I	input capacitance	V _{CC} = 3.3 V; V _I = GND to V _{CC}	-	3.5	-	pF
		T_{amb} = -40 °C to +125 °C						
V _{OH}	HIGH-level output voltage	V _I = V _{T+} or V _{T-}						
		I _O = -100 μA; V _{CC} = 1.65 V to 5.5 V	V _{CC} - 0.1	-	-	V		
		I _O = -4 mA; V _{CC} = 1.65 V	0.95	-	-	V		
		I _O = -8 mA; V _{CC} = 2.3 V	1.7	-	-	V		
		I _O = -12 mA; V _{CC} = 2.7 V	1.9	-	-	V		
		I _O = -24 mA; V _{CC} = 3.0 V	2.0	-	-	V		
V _{OL}	LOW-level output voltage	V _I = V _{T+} or V _{T-}						
		I _O = 100 μA; V _{CC} = 1.65 V to 5.5 V	-	-	0.1	V		
		I _O = 4 mA; V _{CC} = 1.65 V	-	-	0.7	V		
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.45	V		
		I _O = 12 mA; V _{CC} = 2.7 V	-	-	0.6	V		
		I _O = 24 mA; V _{CC} = 3.0 V	-	-	0.8	V		
I _I	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	±0.1	±1	μA		
		I _{OFF}	power-off leakage current	V _I or V _O = 5.5 V; V _{CC} = 0 V	-	±0.1	±2	μA
		I _{CC}	supply current	V _I = 5.5 V or GND; V _{CC} = 1.65 V to 5.5 V; I _O = 0 A	-	0.1	4	μA
		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	μA
		C _I	input capacitance	V _{CC} = 3.3 V; V _I = GND to V _{CC}	-	3.5	-	pF

Table 7. Static characteristics ...continued

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

Symbol	Parameter	Conditions	Min	Typ [1]	Max	Unit
I_I	input leakage current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 0 \text{ V}$ to 5.5 V	-	-	± 1	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 5.5 \text{ V}$; $V_{CC} = 0 \text{ V}$	-	-	± 2	μA
I_{CC}	supply current	$V_I = 5.5 \text{ V}$ or GND; $V_{CC} = 1.65 \text{ V}$ to 5.5 V ; $I_O = 0 \text{ A}$	-	-	4	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.6 \text{ V}$; $I_O = 0 \text{ A}$; $V_{CC} = 2.3 \text{ V}$ to 5.5 V	-	-	500	μA

[1] All typical values are measured at maximum V_{CC} and $T_{amb} = 25 \text{ }^\circ\text{C}$.**Table 8. Transfer characteristics**Voltages are referenced to GND (ground = 0 V; for test circuit see [Figure 8](#))

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ [1]	Max	Min	Max	
V_{T+}	positive-going threshold voltage	see Figure 9 and Figure 10						
		$V_{CC} = 1.8 \text{ V}$	0.70	1.10	1.50	0.70	1.70	V
		$V_{CC} = 2.3 \text{ V}$	1.00	1.40	1.80	1.00	2.00	V
		$V_{CC} = 3.0 \text{ V}$	1.30	1.76	2.20	1.30	2.40	V
		$V_{CC} = 4.5 \text{ V}$	1.90	2.47	3.10	1.90	3.30	V
V_{T-}	negative-going threshold voltage	see Figure 9 and Figure 10						
		$V_{CC} = 1.8 \text{ V}$	0.25	0.61	0.90	0.25	1.10	V
		$V_{CC} = 2.3 \text{ V}$	0.40	0.80	1.15	0.40	1.35	V
		$V_{CC} = 3.0 \text{ V}$	0.60	1.04	1.50	0.60	1.70	V
		$V_{CC} = 4.5 \text{ V}$	1.00	1.55	2.00	1.00	2.20	V
V_H	hysteresis voltage	$(V_{T+} - V_{T-})$; see Figure 9 , Figure 10 and Figure 11						
		$V_{CC} = 1.8 \text{ V}$	0.15	0.49	1.00	0.15	1.20	V
		$V_{CC} = 2.3 \text{ V}$	0.25	0.60	1.10	0.25	1.30	V
		$V_{CC} = 3.0 \text{ V}$	0.40	0.73	1.20	0.40	1.40	V
		$V_{CC} = 4.5 \text{ V}$	0.60	0.92	1.50	0.60	1.70	V
	$V_{CC} = 5.5 \text{ V}$	0.70	1.02	1.70	0.70	1.90	V	

[1] All typical values are measured at $T_{amb} = 25 \text{ }^\circ\text{C}$

12. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see [Figure 8](#).

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{pd}	propagation delay	nA to nY; see Figure 7 ^[2]						
		V _{CC} = 1.65 V to 1.95 V	1.0	5.6	11.0	1.0	12.0	ns
		V _{CC} = 2.3 V to 2.7 V	0.5	3.7	6.5	0.5	7.2	ns
		V _{CC} = 2.7 V	0.5	4.1	7.0	0.5	7.7	ns
		V _{CC} = 3.0 V to 3.6 V	0.5	3.9	6.0	0.5	6.7	ns
		V _{CC} = 4.5 V to 5.5 V	0.5	2.7	4.3	0.5	4.7	ns
C _{PD}	power dissipation capacitance	V _I = GND to V _{CC} ; V _{CC} = 3.3 V ^[3]	-	18.1	-	-	-	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 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_i = input frequency in MHz;

f_o = output frequency in MHz;

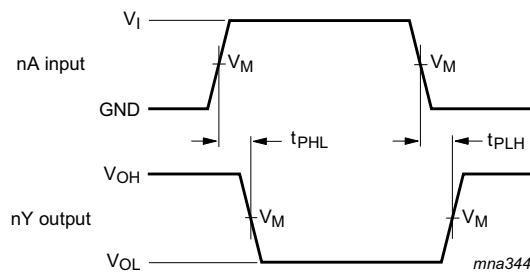
C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching;

∑(C_L × V_{CC}² × f_o) = sum of outputs.

13. Waveforms



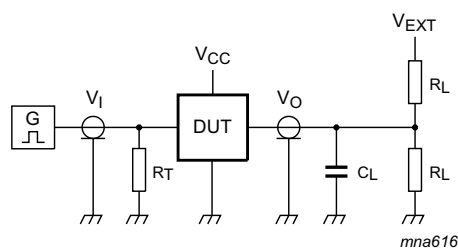
Measurement points are given in [Table 10](#).

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

Fig 7. The data input (nA) to output (nY) 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 8. Test circuit for measuring switching times

Table 11. Test data

Supply voltage	Input		Load		V_{EXT}
	V_I	$t_r = t_f$	C_L	R_L	t_{PLH}, t_{PHL}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 k Ω	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

14. Waveforms transfer characteristics

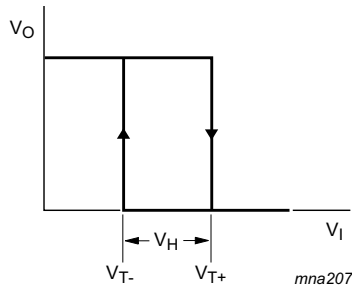
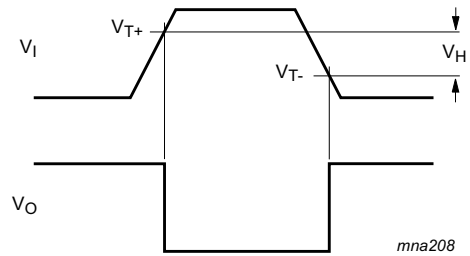
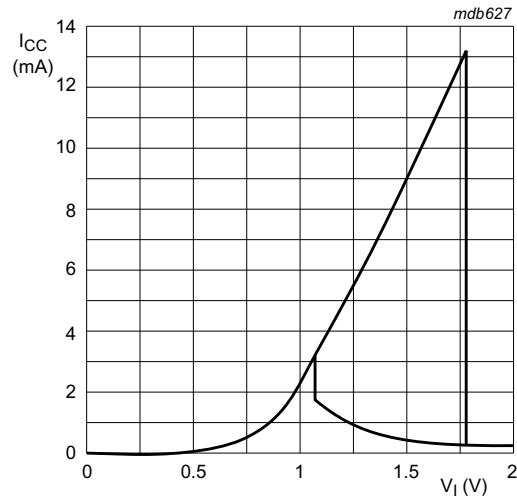


Fig 9. Transfer characteristic



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

Fig 10. Definition of V_{T+} , V_{T-} and V_H



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

Fig 11. Typical transfer characteristics

15. Application information

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

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

P_{add} = additional power dissipation (μW);

f_i = input frequency (MHz);

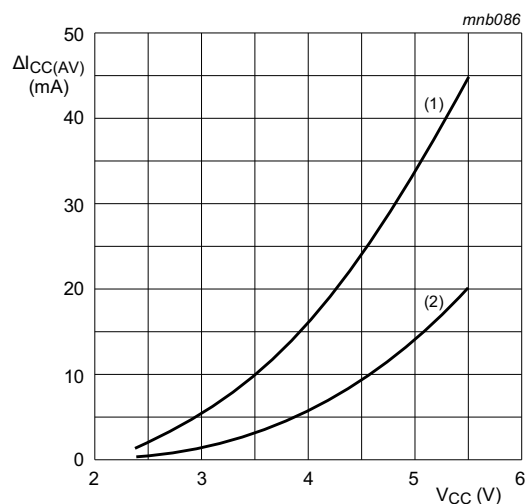
t_r = input rise time (ns); 10 % to 90 %;

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

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

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

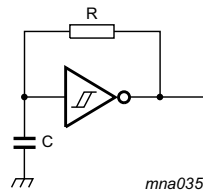
An example of a relaxation circuit using the 74LVC2G14 is shown in [Figure 13](#).



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 12. Average I_{CC} as a function of V_{CC}



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

For K-factor, see [Figure 14](#)

Fig 13. Relaxation oscillator

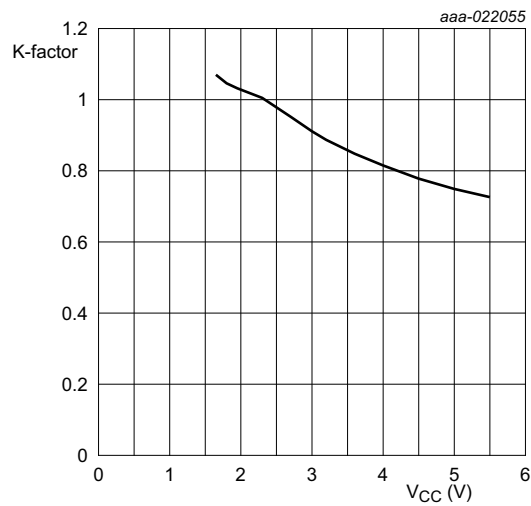


Fig 14. Typical K-factor for relaxation oscillator

16. Package outline

Plastic surface-mounted package; 6 leads

SOT363

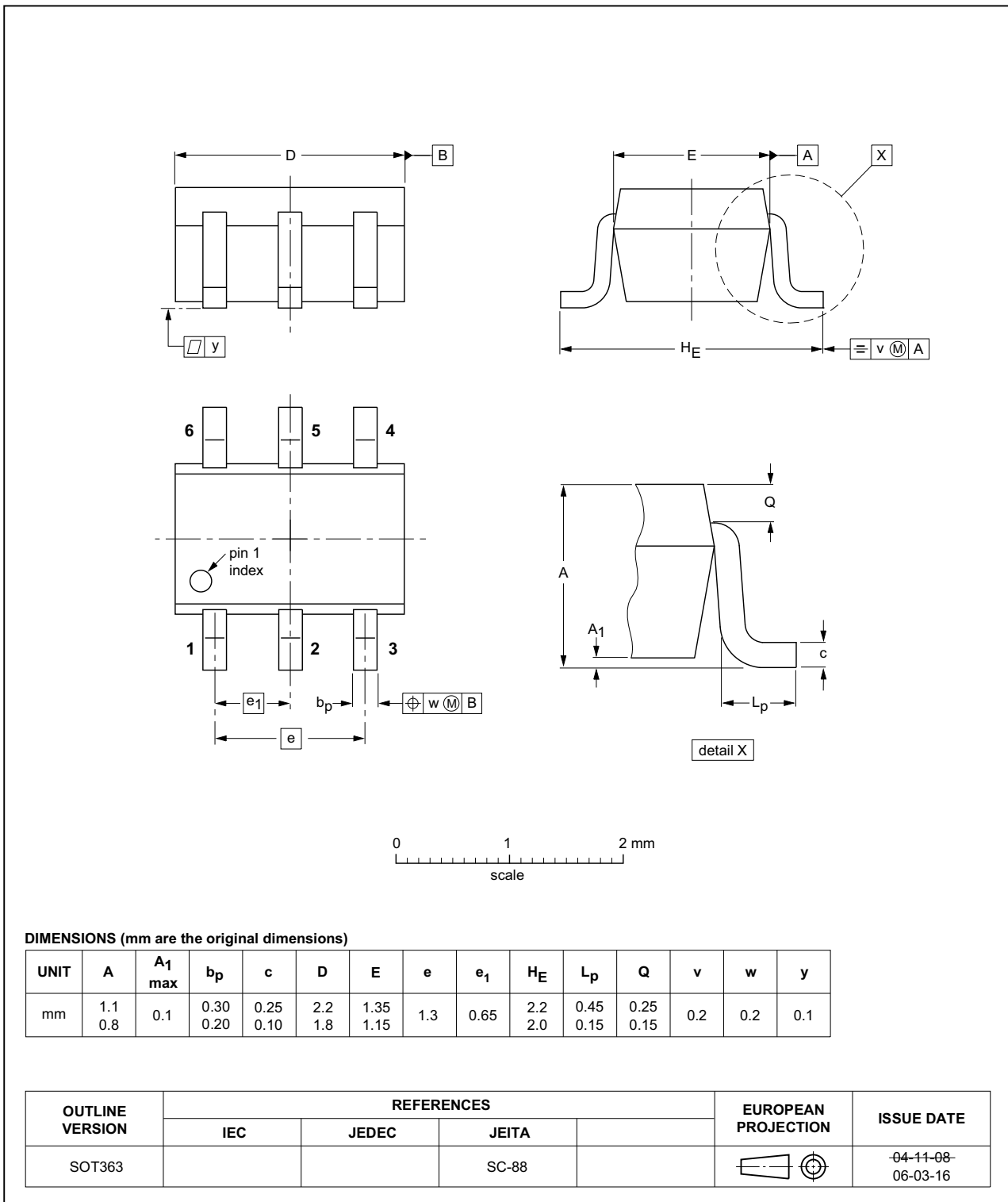


Fig 15. Package outline SOT363 (SC-88)

Plastic surface-mounted package (TSOP6); 6 leads

SOT457

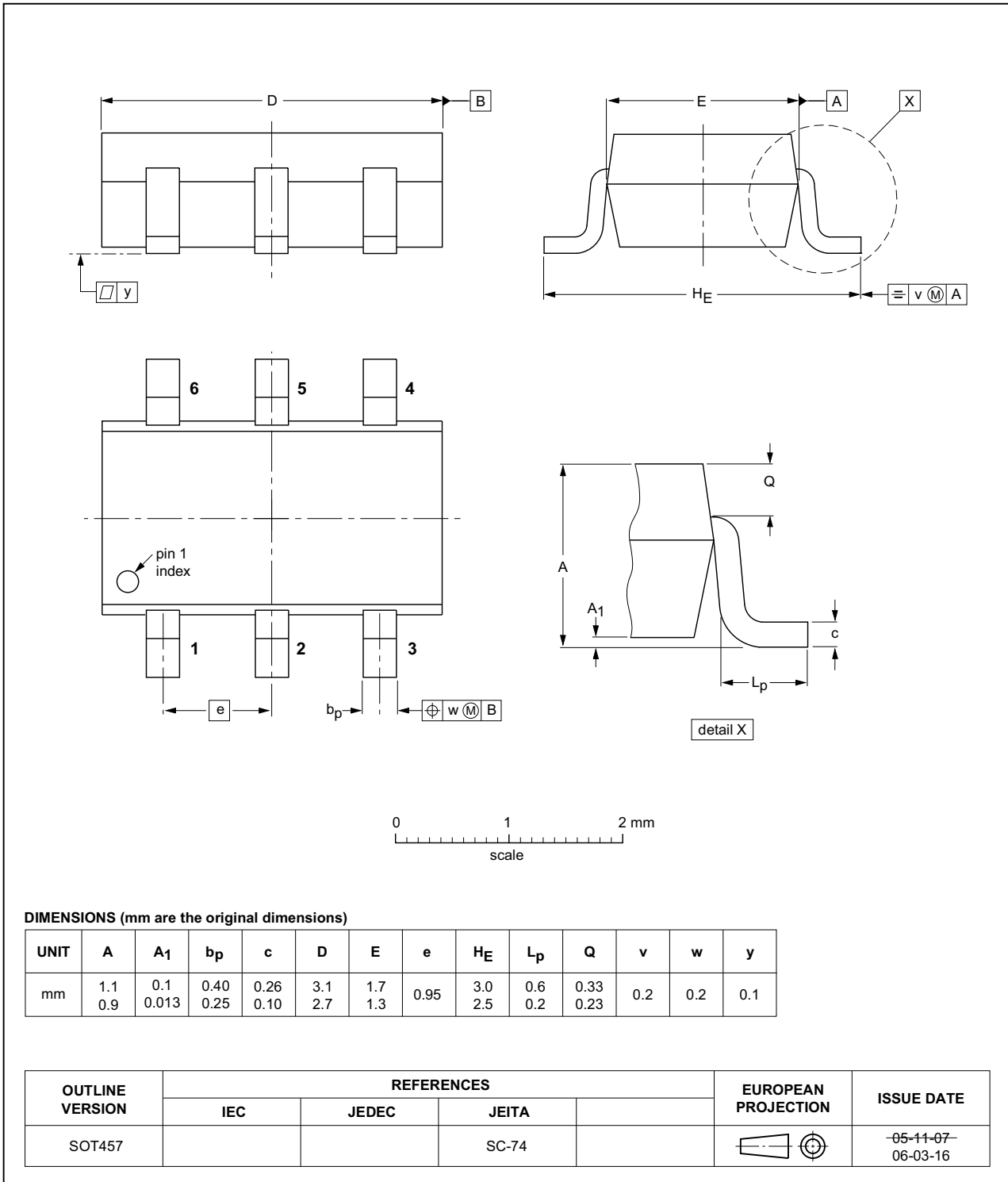


Fig 16. Package outline SOT457 (SC-74)

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

SOT886

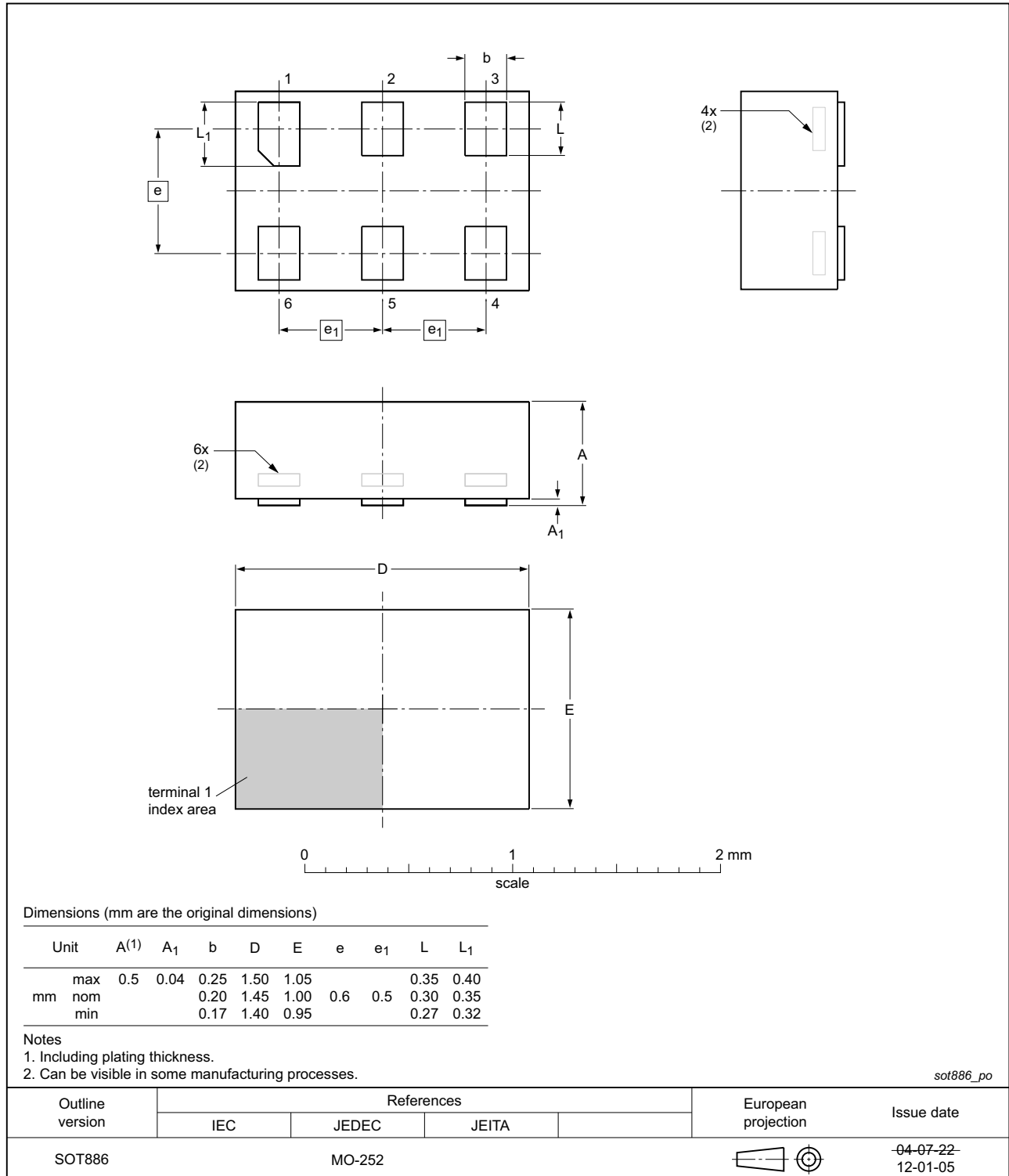


Fig 17. Package outline SOT886 (XSON6)

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

SOT891

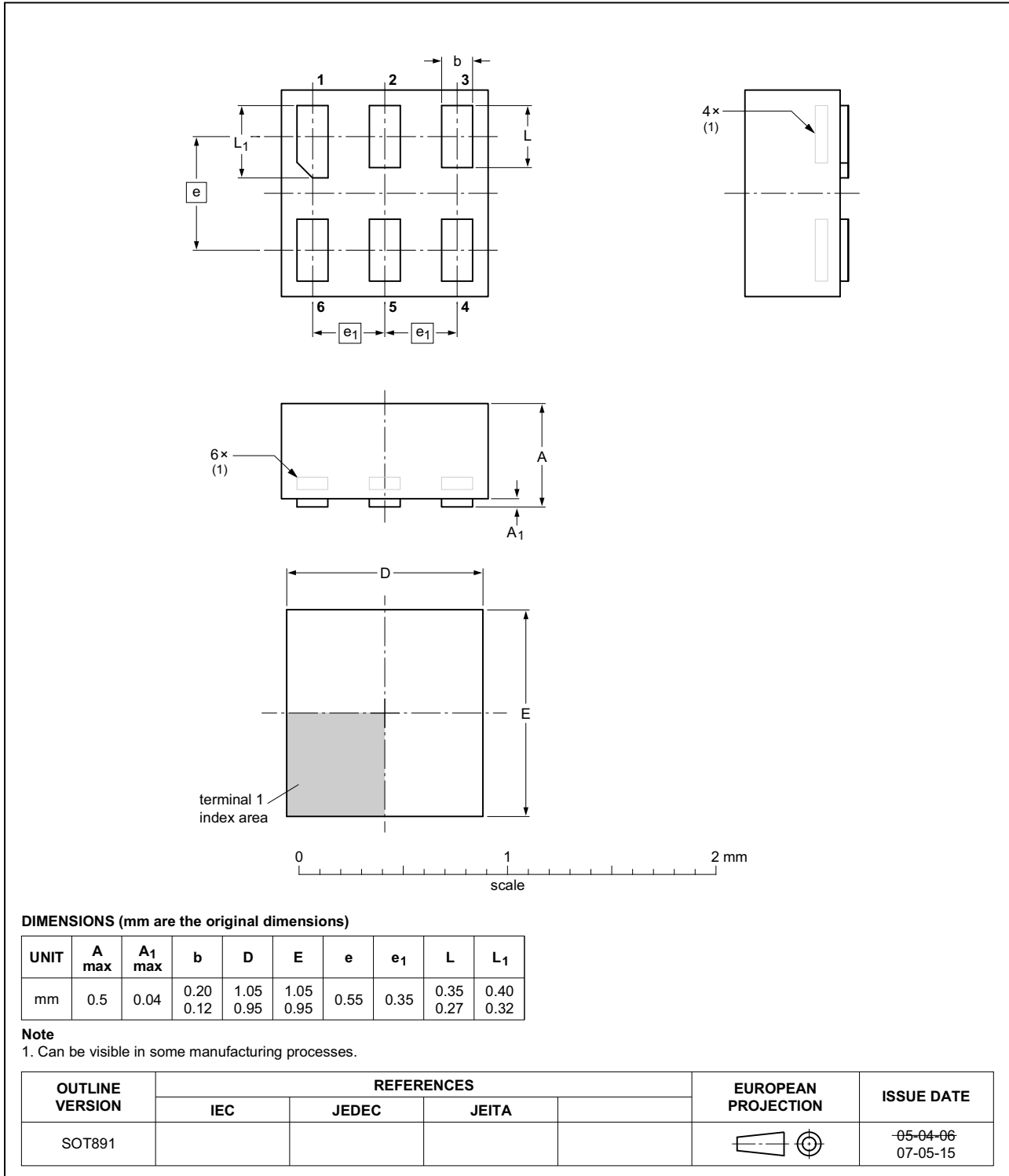


Fig 18. Package outline SOT891 (XSON6)

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

SOT1115

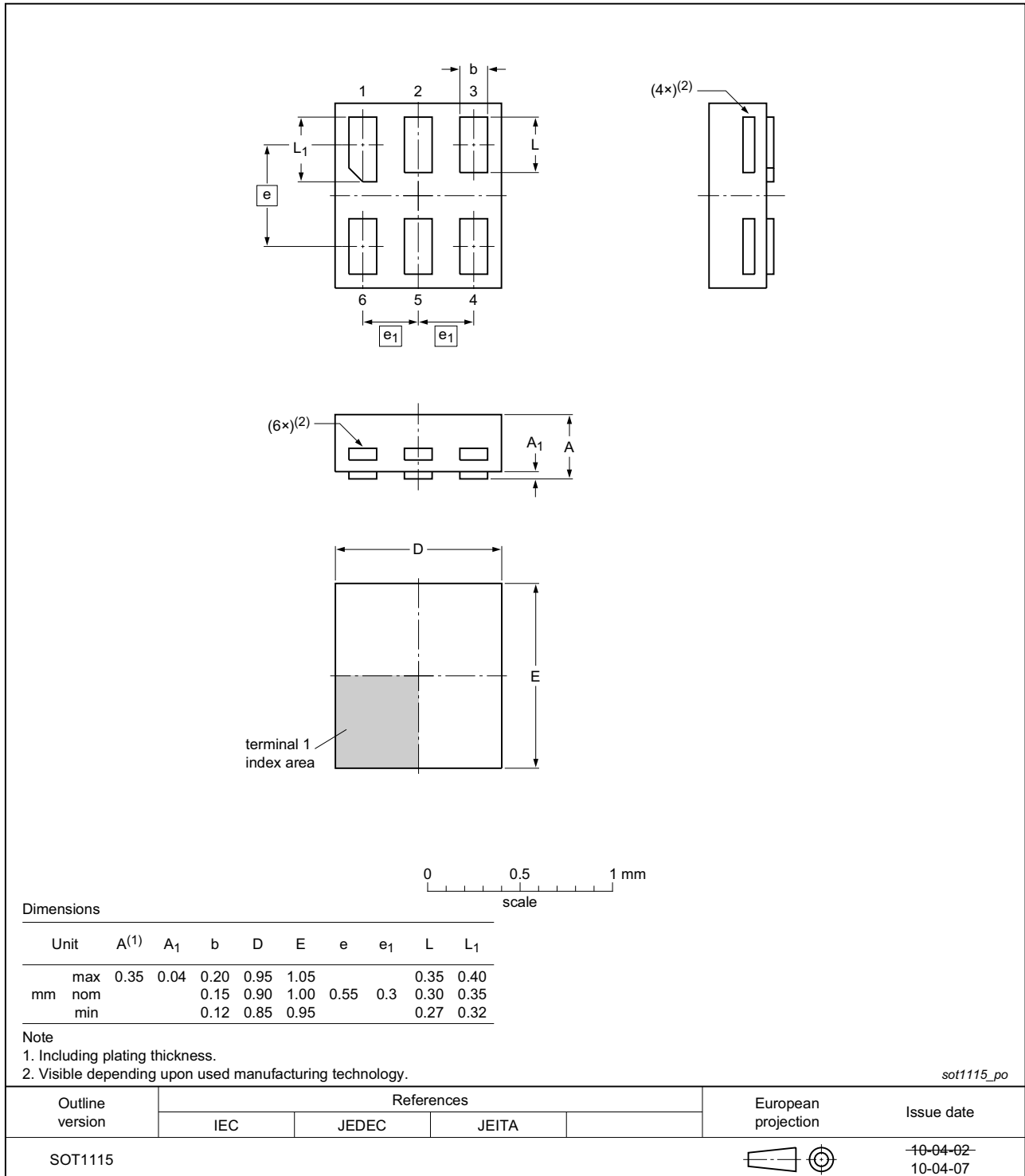


Fig 19. Package outline SOT1115 (XSON6)

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

SOT1202

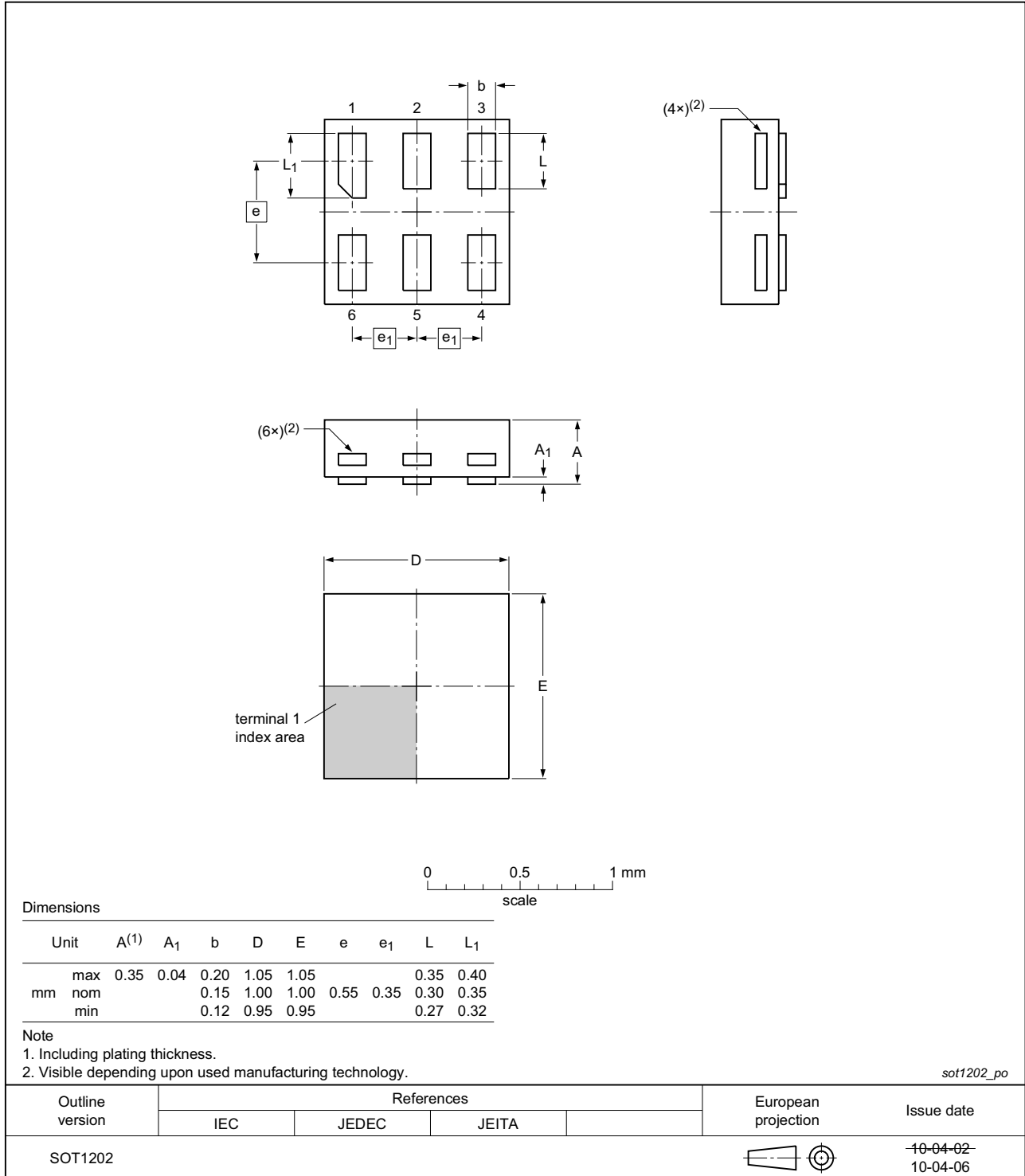


Fig 20. Package outline SOT1202 (XSON6)

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

18. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC2G14 v.10	20161215	Product data sheet	-	74LVC2G14 v.9
Modifications:	<ul style="list-style-type: none"> Table 7: The maximum limits for leakage current and supply current have changed. 			
74LVC2G14 v.9	20160315	Product data sheet	-	74LVC2G14 v.8
Modifications:	<ul style="list-style-type: none"> Figure 14 added (typical K-factor for relaxation oscillator). 			
74LVC2G14 v.8	20140910	Product data sheet		74LVC2G14 v.7
Modifications:	<ul style="list-style-type: none"> Package outline drawing of SOT886 (Figure 17) modified. 			
74LVC2G14 v.7	20111130	Product data sheet		74LVC2G14 v.6
74LVC2G14 v.6	20110923	Product data sheet		74LVC2G14 v.5
74LVC2G14 v.5	20101029	Product data sheet		74LVC2G14 v.4
74LVC2G14 v.4	20070904	Product data sheet		74LVC2G14 v.3
74LVC2G14 v.3	20070220	Product data sheet		74LVC2G14 v.2
74LVC2G14 v.2	20040908	Product specification	-	74LVC2G14 v.1
74LVC2G14 v.1	20030731	Product specification		-

19. Legal information

19.1 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.

[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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