

74LVC1G14

Single Schmitt-trigger inverter

Rev. 12 — 6 August 2012

Product data sheet

1. 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.

2. 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 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

- 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 ^[1] |
|-------------|-----------------------------|
| 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

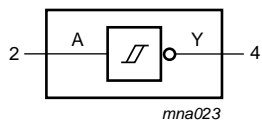


Fig 1. Logic symbol

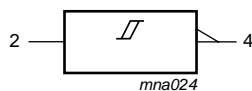


Fig 2. IEC logic symbol

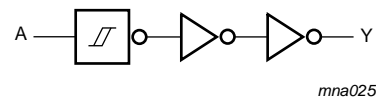


Fig 3. Logic diagram

7. Pinning information

7.1 Pinning

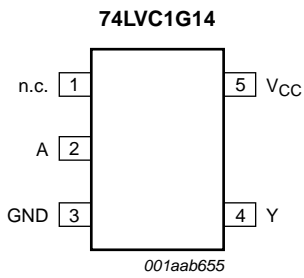


Fig 4. Pin configuration SOT353-1 and SOT753

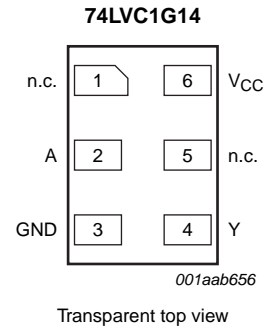


Fig 5. Pin configuration SOT886

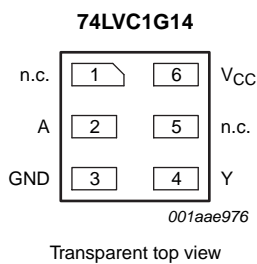


Fig 6. Pin configuration SOT891, SOT1115 and SOT1202

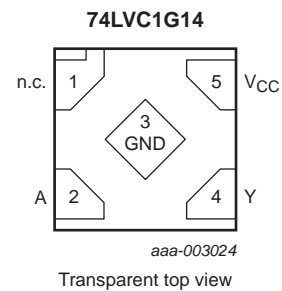


Fig 7. Pin configuration SOT1226 (X2SON5)

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 _{CC} | 5 | 6 | supply voltage |

8. Functional description

Table 4. Function table^[1]

| 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 | | ^[1] -0.5 | +6.5 | V |
| 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_{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 |
| 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 |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +125 °C | ^[3] - | 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 ^[1] | Max | Min | Max | |
| 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 _{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+} 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 |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | ±0.1 | ±5 | - | ±100 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | ±0.1 | ±10 | - | ±200 | 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 | 10 | - | 200 | 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 | - | 5000 | μA |
| C _I | 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 load 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 threshold voltage | see Figure 10 and Figure 11 | | | | | | |
| | | 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 |

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 ^[1] | Max | Min | Max | |
| 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 Figure 10 , Figure 11 and Figure 12 | | | | | | |
| | | 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] All typical values are measured at T_{amb} = 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 ^[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 V; V _I = 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.

[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).

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

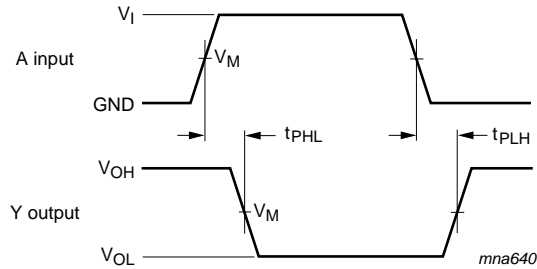
f_i = input frequency in MHz;

f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V.

13. Waveforms

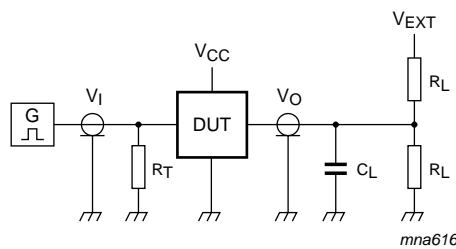


Measurement points are given in [Table 10](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

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 _{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} | ≤ 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 |

14. Waveforms transfer characteristics

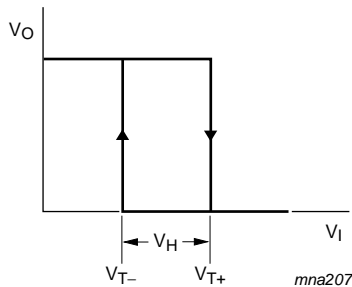
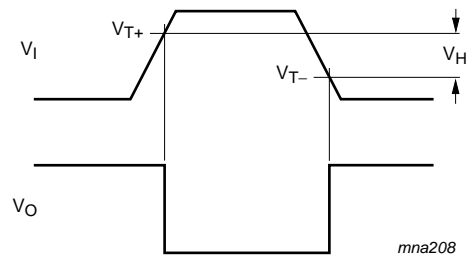
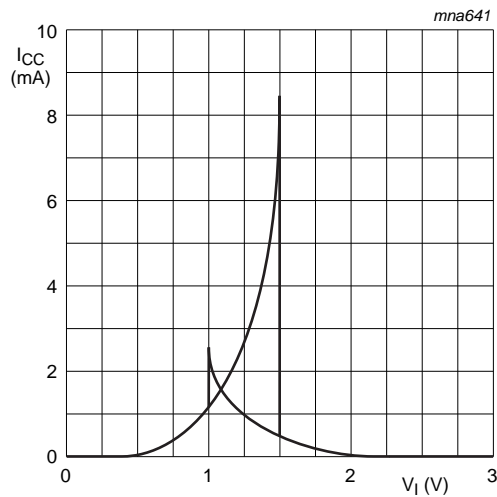


Fig 10. Transfer characteristic



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 (μW);

f_i = input frequency (MHz);

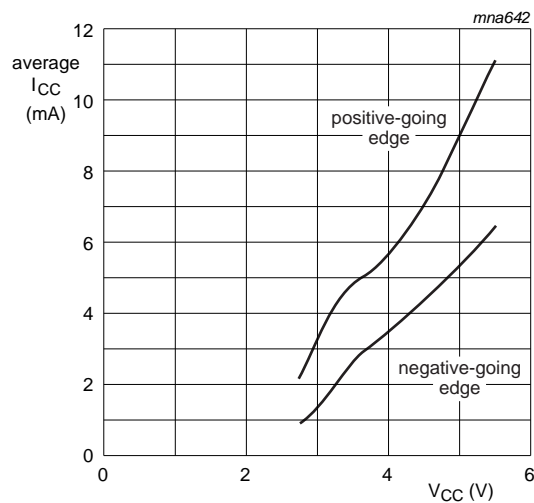
t_r = input rise time (ns); 10 % to 90 %;

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](#).

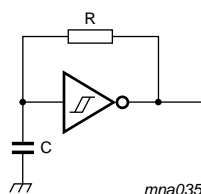
An example of a relaxation circuit using the 74LVC1G14 is shown in [Figure 14](#).



Linear change of V_i between 0.8 V to 2.0 V.

All values given are typical unless otherwise specified.

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

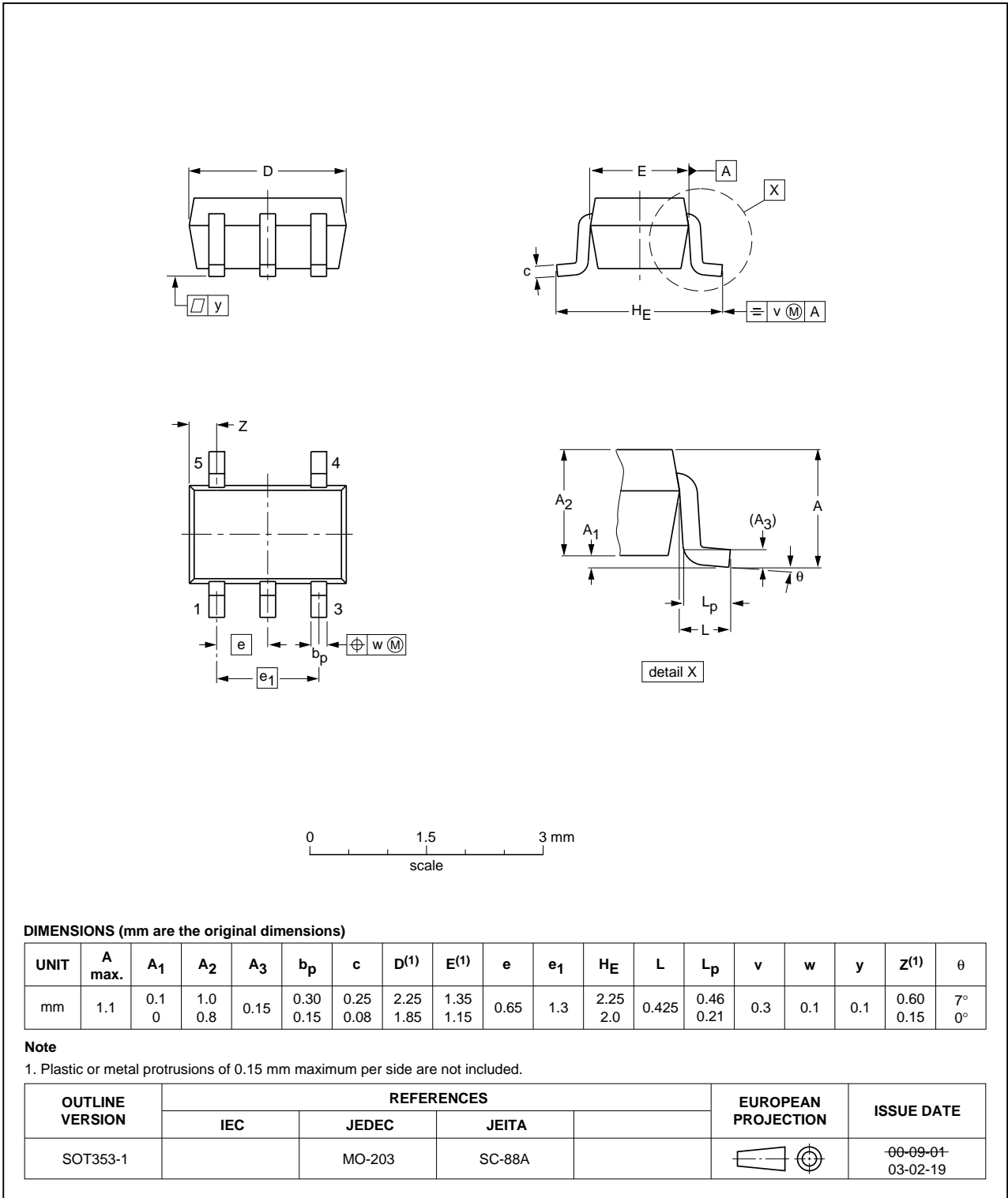


Fig 15. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

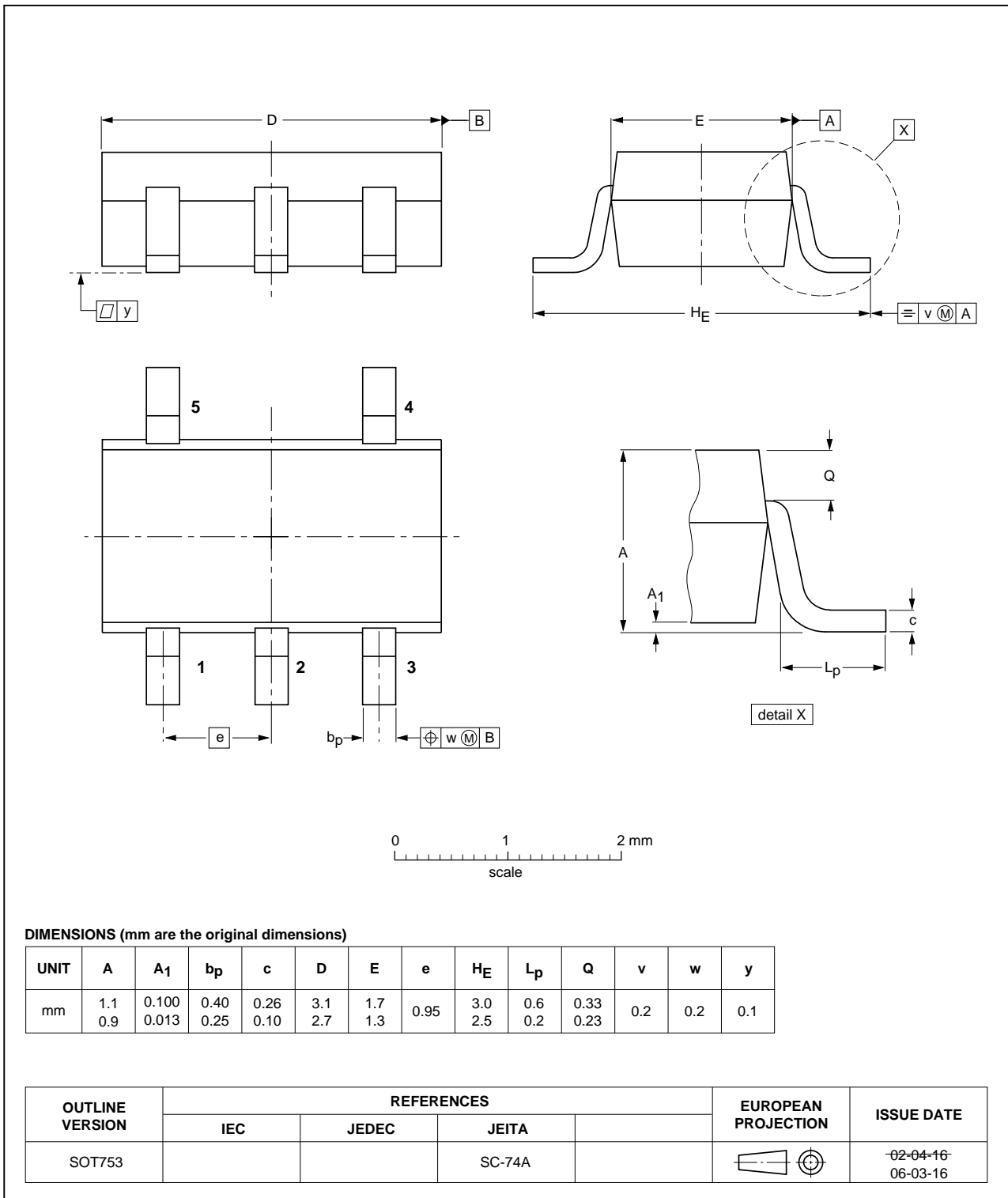


Fig 16. Package outline SOT753 (SC-74A)

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

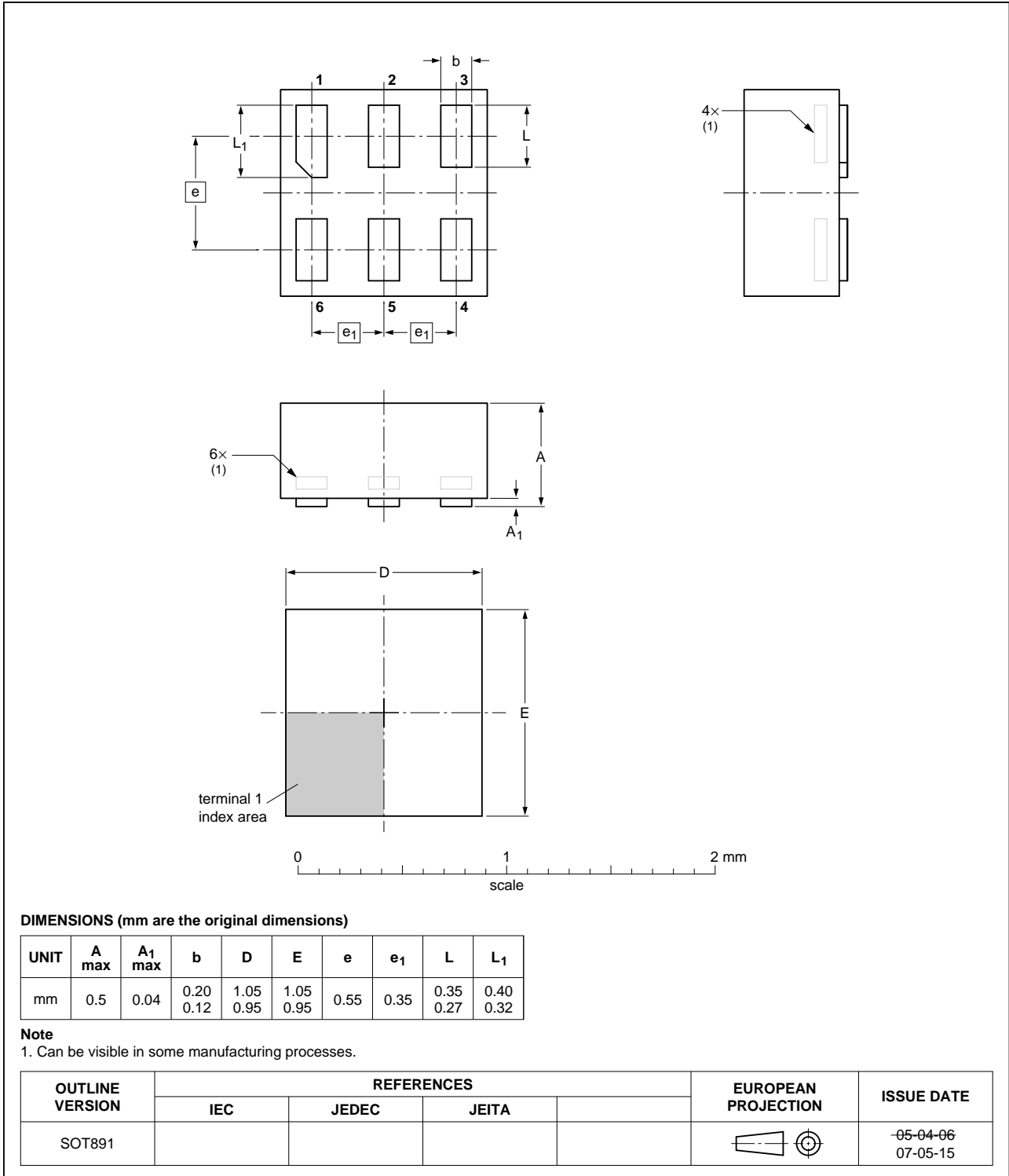


Fig 18. Package outline SOT891 (XSON6)

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

SOT1115

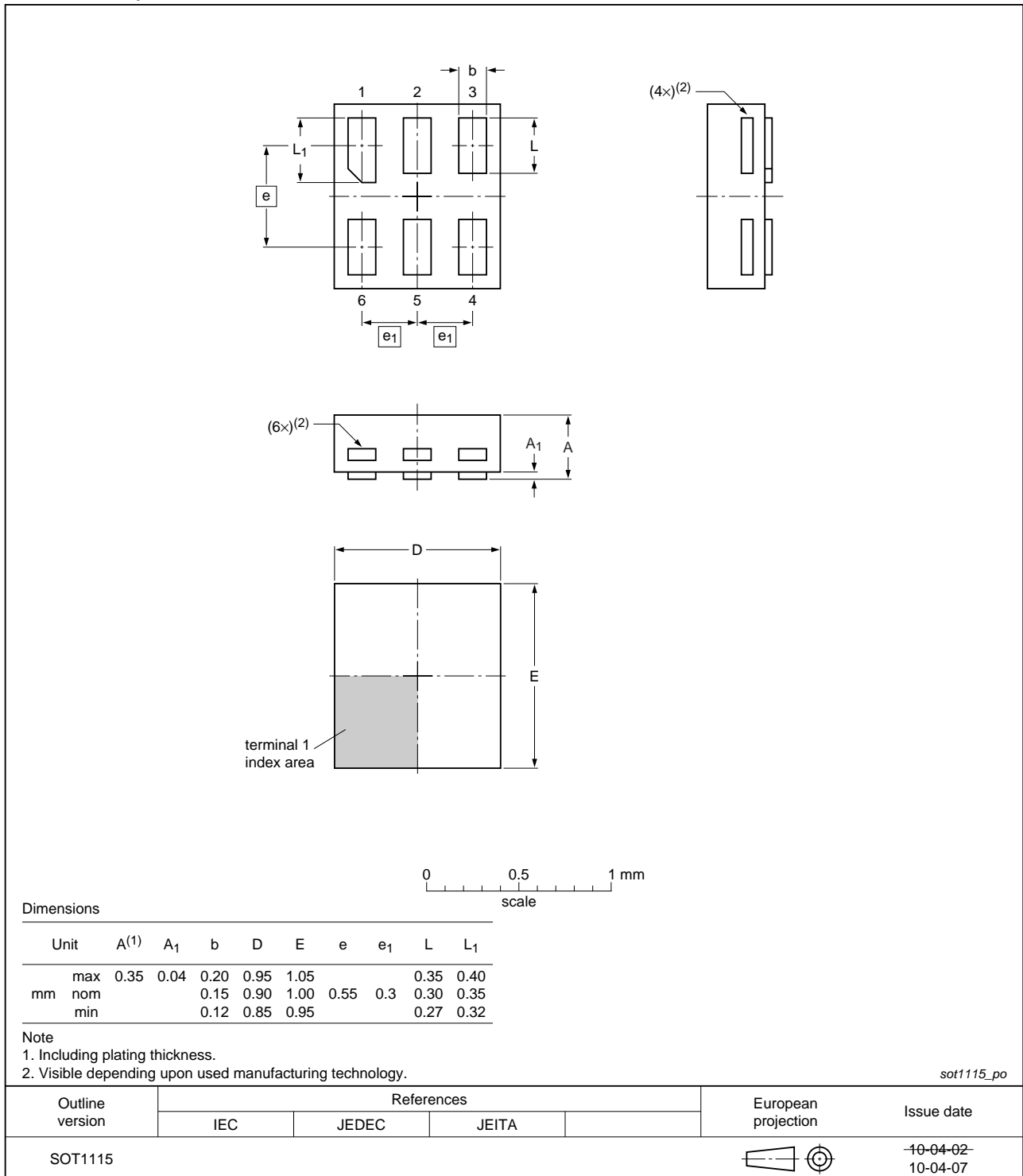


Fig 19. Package outline SOT1115 (XSON6)

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

SOT1202

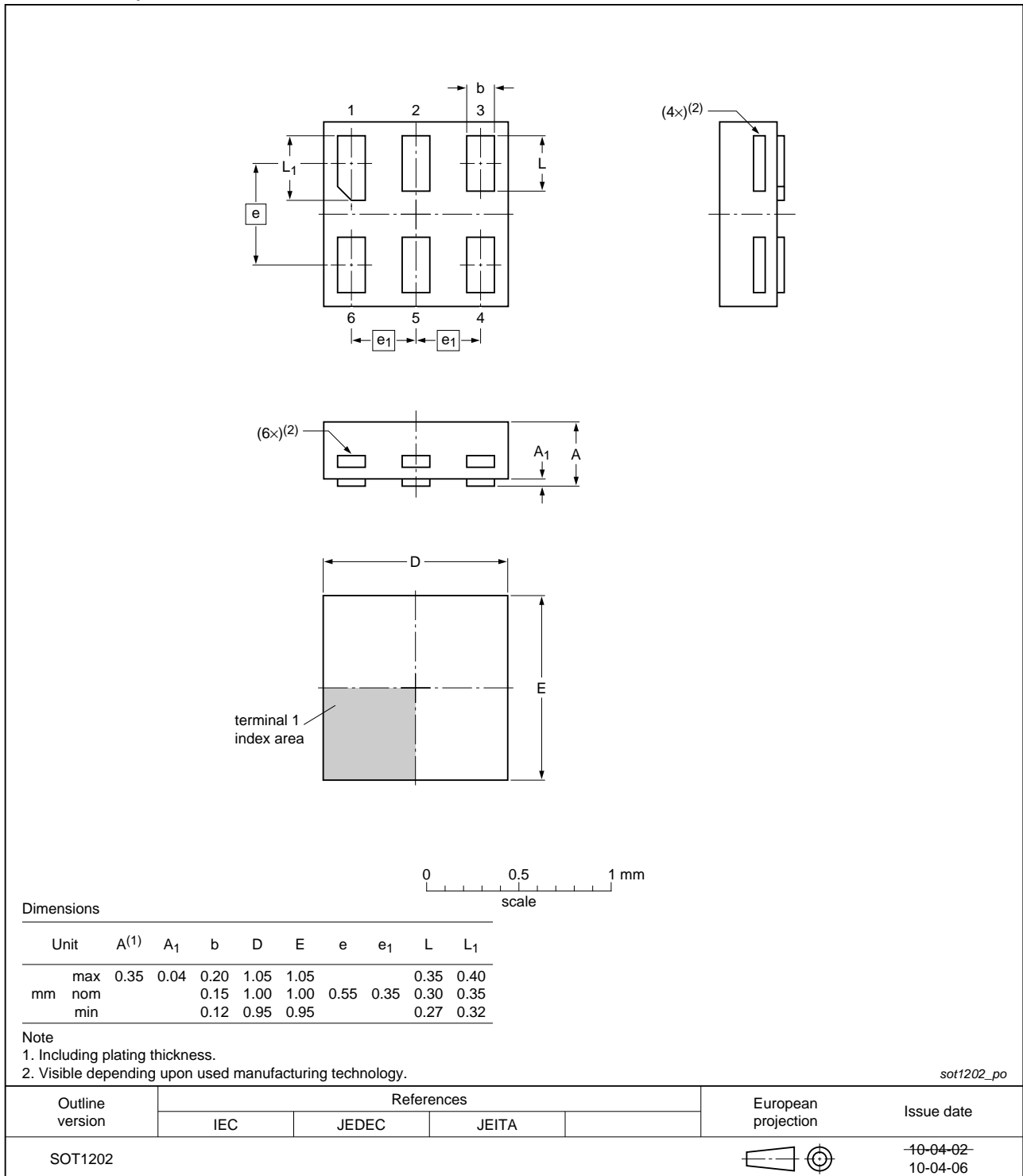


Fig 20. Package outline SOT1202 (XSON6)

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

SOT1226

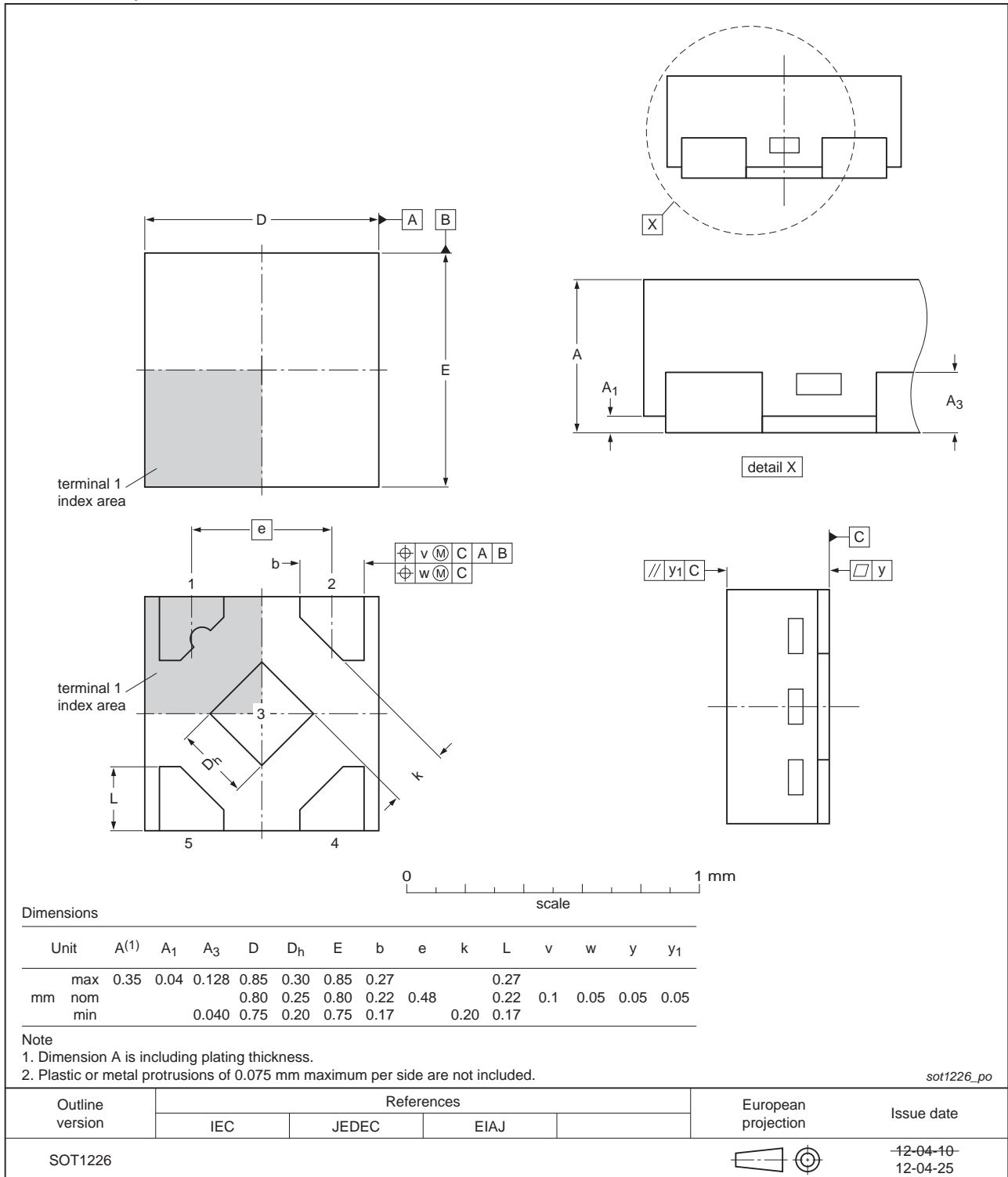


Fig 21. Package outline SOT1226 (X2SON5)

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"> Package outline drawing of SOT1226 (Figure 21) modified. | | | |
| 74LVC1G14 v.11 | 20120412 | Product data sheet | - | 74LVC1G14 v.10 |
| Modifications: | <ul style="list-style-type: none"> Added type number 74LVC1G14GX (SOT1226) Package outline drawing of SOT886 (Figure 17) modified. | | | |
| 74LVC1G14 v.10 | 20111206 | Product data sheet | - | 74LVC1G14 v.9 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 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 | - | - |

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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For sales office addresses, please send an email to: salesaddresses@nxp.com

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