

74LVC2G02

Dual 2-input NOR gate

Rev. 8 — 20 October 2010

Product data sheet

1. General description

The 74LVC2G02 provides a 2-input NOR gate function.

Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in a mixed 3.3 V and 5 V environment.

This device is fully specified for partial power-down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing a 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 outputs for interfacing with 5 V logic
- High noise immunity
- ± 24 mA output drive ($V_{CC} = 3.0$ V)
- CMOS low power consumption
- 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)
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- ESD protection:
 - ◆ HBM JESD22-A114F exceeds 2000 V
 - ◆ MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to $+85$ °C and -40 °C to $+125$ °C



3. Ordering information

Table 1. Ordering information

| Type number | Package | | | |
|-------------|-------------------|--------|--|----------|
| | Temperature range | Name | Description | Version |
| 74LVC2G02DP | -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 |
| 74LVC2G02DC | -40 °C to +125 °C | VSSOP8 | plastic very thin shrink small outline package; 8 leads; body width 2.3 mm | SOT765-1 |
| 74LVC2G02GT | -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 |
| 74LVC2G02GF | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1 × 0.5 mm | SOT1089 |
| 74LVC2G02GD | -40 °C to +125 °C | XSON8U | plastic extremely thin small outline package; no leads; 8 terminals; UTLP based; body 3 × 2 × 0.5 mm | SOT996-2 |
| 74LVC2G02GM | -40 °C to +125 °C | XQFN8U | plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 × 1.6 × 0.5 mm | SOT902-1 |
| 74LVC2G02GN | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.2 × 1.0 × 0.35 mm | SOT1116 |
| 74LVC2G02GS | -40 °C to +125 °C | XSON8 | extremely thin small outline package; no leads; 8 terminals; body 1.35 × 1.0 × 0.35 mm | SOT1203 |

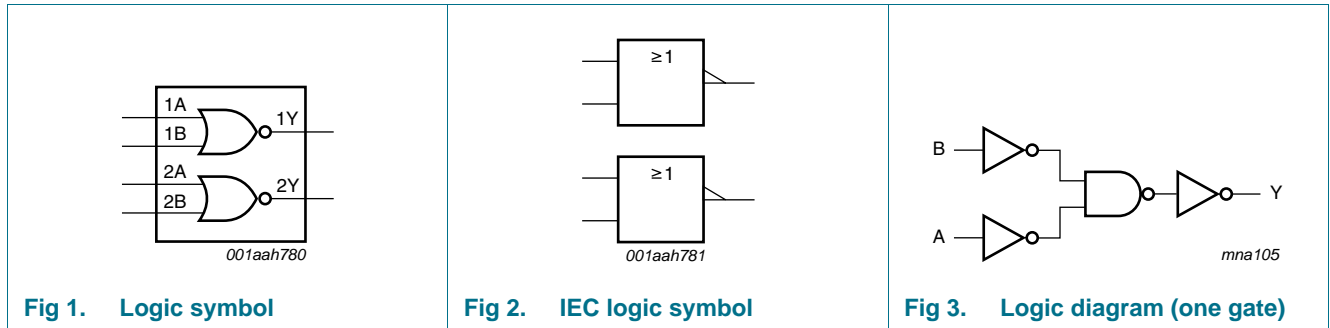
4. Marking

Table 2. Marking codes

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| 74LVC2G02DP | V02 |
| 74LVC2G02DC | V02 |
| 74LVC2G02GT | V02 |
| 74LVC2G02GF | VB |
| 74LVC2G02GD | V02 |
| 74LVC2G02GM | V02 |
| 74LVC2G02GN | VB |
| 74LVC2G02GS | VB |

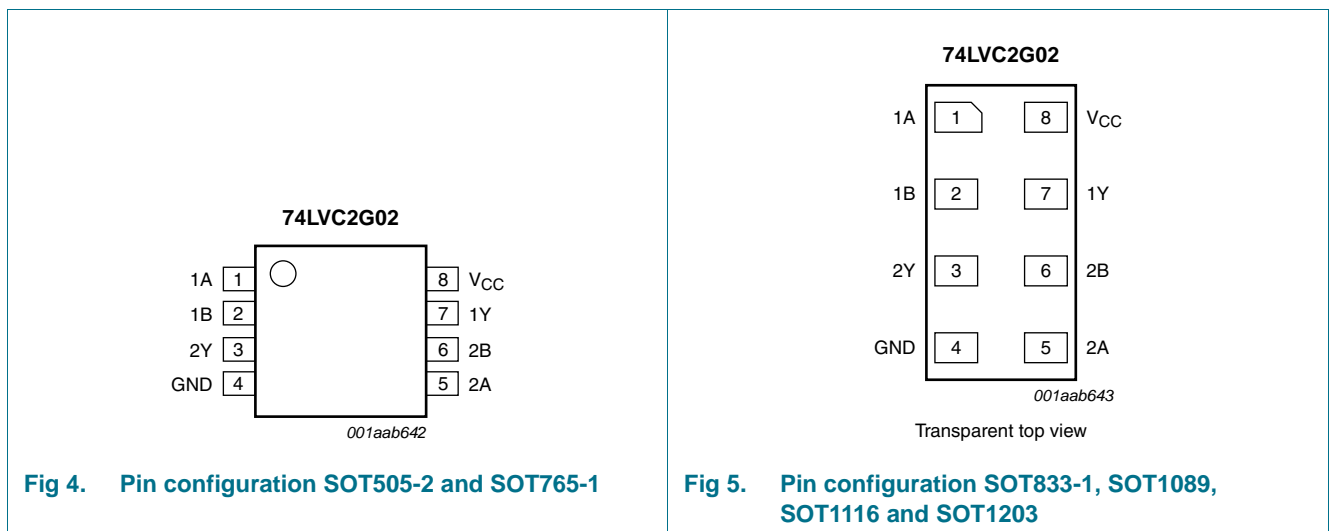
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

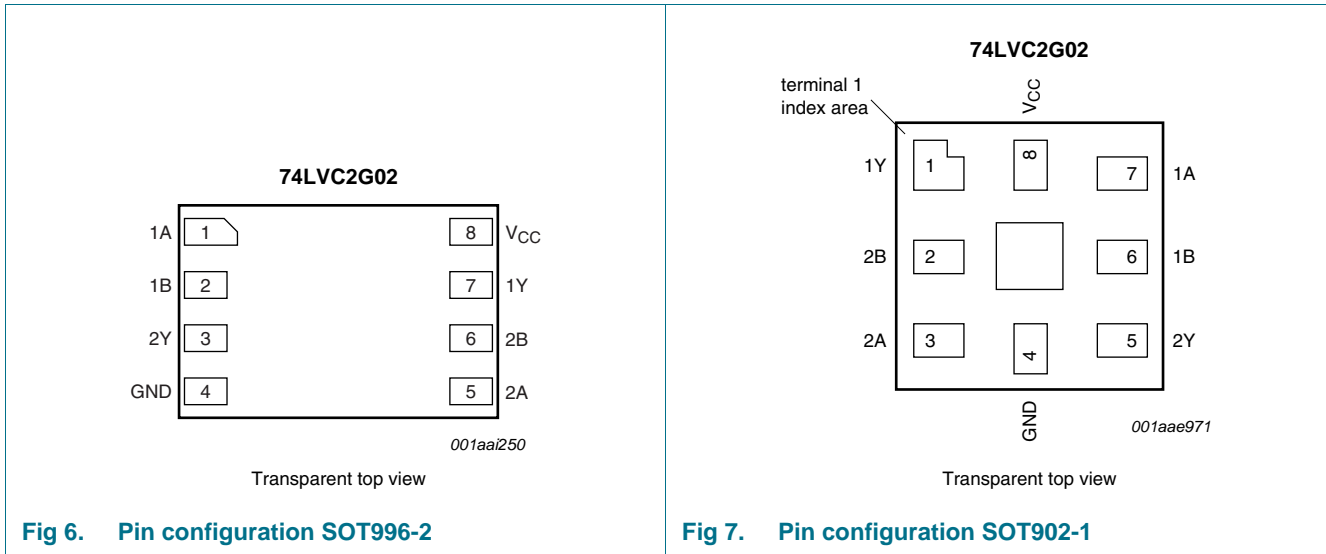
5. Functional diagram



6. Pinning information

6.1 Pinning





6.2 Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|--|----------|----------------|
| | SOT505-2, SOT765-1, SOT833-1, SOT1089, SOT996-2, SOT1116 and SOT1203 | SOT902-1 | |
| 1A, 2A | 1, 5 | 7, 3 | data input |
| 1B, 2B | 2, 6 | 6, 2 | data input |
| GND | 4 | 4 | ground (0 V) |
| 1Y, 2Y | 7, 3 | 1, 5 | data output |
| V _{CC} | 8 | 8 | supply voltage |

7. Functional description

Table 4. Function table^[1]

| Input | | Output |
|-------|----|--------|
| nA | nB | nY |
| L | L | H |
| X | H | L |
| H | X | L |

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care.

8. 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] -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 | $V_O < 0$ V or $V_O > V_{CC}$ | - | ± 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] - | 300 | 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 condition.

[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, XSON8U and XQFN8U packages: above 118 °C the value of P_{tot} derates linearly with 7.8 mW/K.

9. 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 | 0 | 5.5 | V |
| T_{amb} | ambient temperature | | -40 | +125 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 1.65$ V to 2.7 V | - | 20 | ns/V |
| | | $V_{CC} = 2.7$ V to 5.5 V | - | 10 | ns/V |

10. 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_{IH} | HIGH-level input voltage | $V_{CC} = 1.65$ V to 1.95 V | $0.65 \times V_{CC}$ | - | - | V |
| | | $V_{CC} = 2.3$ V to 2.7 V | 1.7 | - | - | V |
| | | $V_{CC} = 2.7$ V to 3.6 V | 2.0 | - | - | V |
| | | $V_{CC} = 4.5$ V to 5.5 V | $0.7 \times V_{CC}$ | - | - | V |

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 |
|--|---------------------------|--|------------------------|--------------------|------------------------|------|
| V _{IL} | LOW-level input voltage | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3 × V _{CC} | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | 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 | 1.53 | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | 1.9 | 2.13 | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | 2.2 | 2.50 | - | V |
| | | I _O = -24 mA; V _{CC} = 3.0 V | 2.3 | 2.60 | - | V |
| | | I _O = -32 mA; V _{CC} = 4.5 V | 3.8 | 4.10 | - | V |
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | 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 | - | 0.08 | 0.45 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | 0.14 | 0.3 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | 0.19 | 0.4 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | 0.37 | 0.55 | V |
| | | I _O = 32 mA; V _{CC} = 4.5 V | - | 0.43 | 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 | ±5 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | ±0.1 | ±10 | 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 | 10 | μA |
| ΔI _{CC} | additional supply current | per pin; 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 | | - | 2.5 | - | pF |
| T_{amb} = -40 °C to +125 °C | | | | | | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.65 × V _{CC} | - | - | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | V |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7 × V _{CC} | - | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35 × V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | V |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3 × V _{CC} | V |
| V _{OH} | HIGH-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | 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 |
| | | I _O = -32 mA; V _{CC} = 4.5 V | 3.4 | - | - | V |

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 |
|------------------|---------------------------|--|-----|--------------------|------|------|
| V _{OL} | LOW-level output voltage | V _I = V _{IH} or V _{IL} | | | | |
| | | 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 | - | - | 0.70 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.45 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.60 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.80 | V |
| | | I _O = 32 mA; V _{CC} = 4.5 V | - | - | 0.80 | V |
| I _I | input leakage current | V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V | - | - | ±20 | μA |
| I _{OFF} | power-off leakage current | V _I or V _O = 5.5 V; V _{CC} = 0 V | - | - | ±20 | 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 | - | - | 40 | μA |
| ΔI _{CC} | additional supply current | per pin; V _I = V _{CC} - 0.6 V; I _O = 0 A; V _{CC} = 2.3 V to 5.5 V | - | - | 5000 | μA |

[1] All typical values are measured at T_{amb} = 25 °C.

11. Dynamic characteristics

Table 8. 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 ^[1] | Max | Min | Max | |
| t _{pd} | propagation delay | nA, nB to nY; see Figure 8 ^[2] | | | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.2 | 3.8 | 8.9 | 1.2 | 11.2 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.8 | 2.4 | 5.4 | 0.8 | 6.8 | ns |
| | | V _{CC} = 2.7 V | 0.8 | 3.2 | 6.0 | 0.8 | 7.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.6 | 2.4 | 4.9 | 0.6 | 6.2 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.6 | 1.8 | 4.3 | 0.6 | 5.5 | ns |

Table 8. Dynamic characteristics ...continued
 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 ^[1] | Max | Min | Max | |
| C _{PD} | power dissipation capacitance | per gate; V _I = GND to V _{CC} | - | 14 | - | - | - | pF |

- [1] Typical values are measured at nominal V_{CC} and at T_{amb} = 25 °C.
- [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).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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.

12. Waveforms

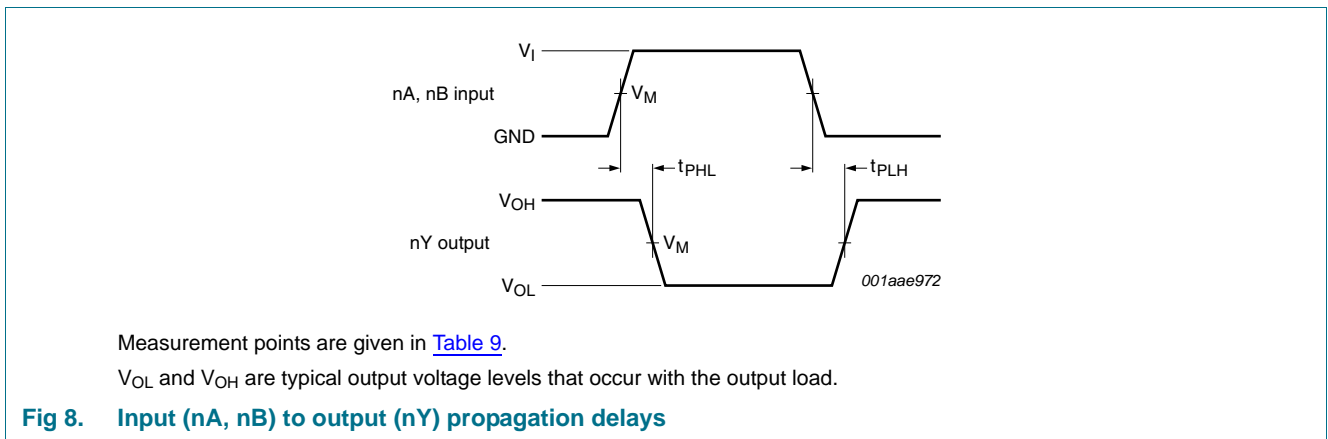
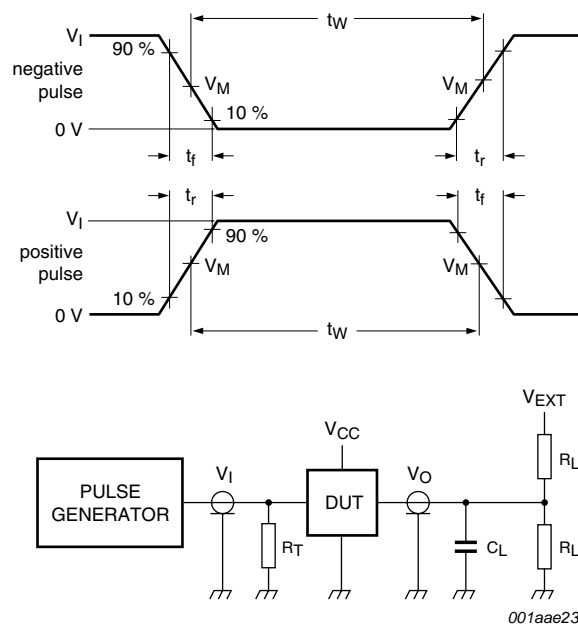


Table 9. Measurement points

| Supply voltage | Input | Output |
|------------------|--------------------|--------------------|
| V _{CC} | V _M | V _M |
| 1.65 V to 1.95 V | 0.5V _{CC} | 0.5V _{CC} |
| 2.3 V to 2.7 V | 0.5V _{CC} | 0.5V _{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 | 0.5V _{CC} | 0.5V _{CC} |



Test data is given in [Table 10](#).

Definitions for test circuit:

R_L = Load resistor.

C_L = Load capacitance including jig and probe capacitance.

R_T = Termination resistance should be equal to output impedance Z_o of the pulse generator.

V_{EXT} = Test voltage for switching times.

Fig 9. Load circuitry for switching times

Table 10. 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 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 |

13. Package outline

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

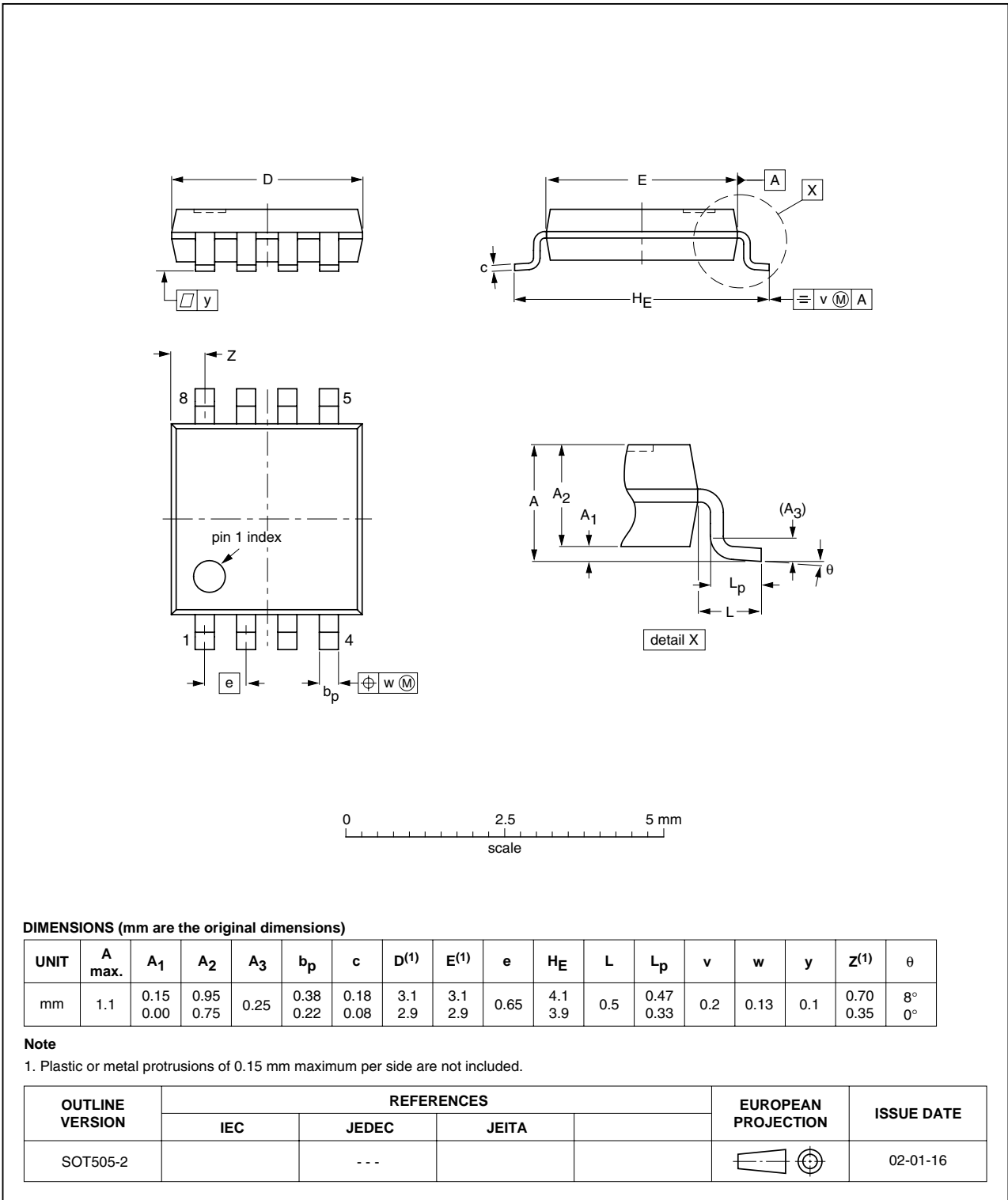


Fig 10. Package outline SOT505-2 (TSSOP8)

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

SOT765-1

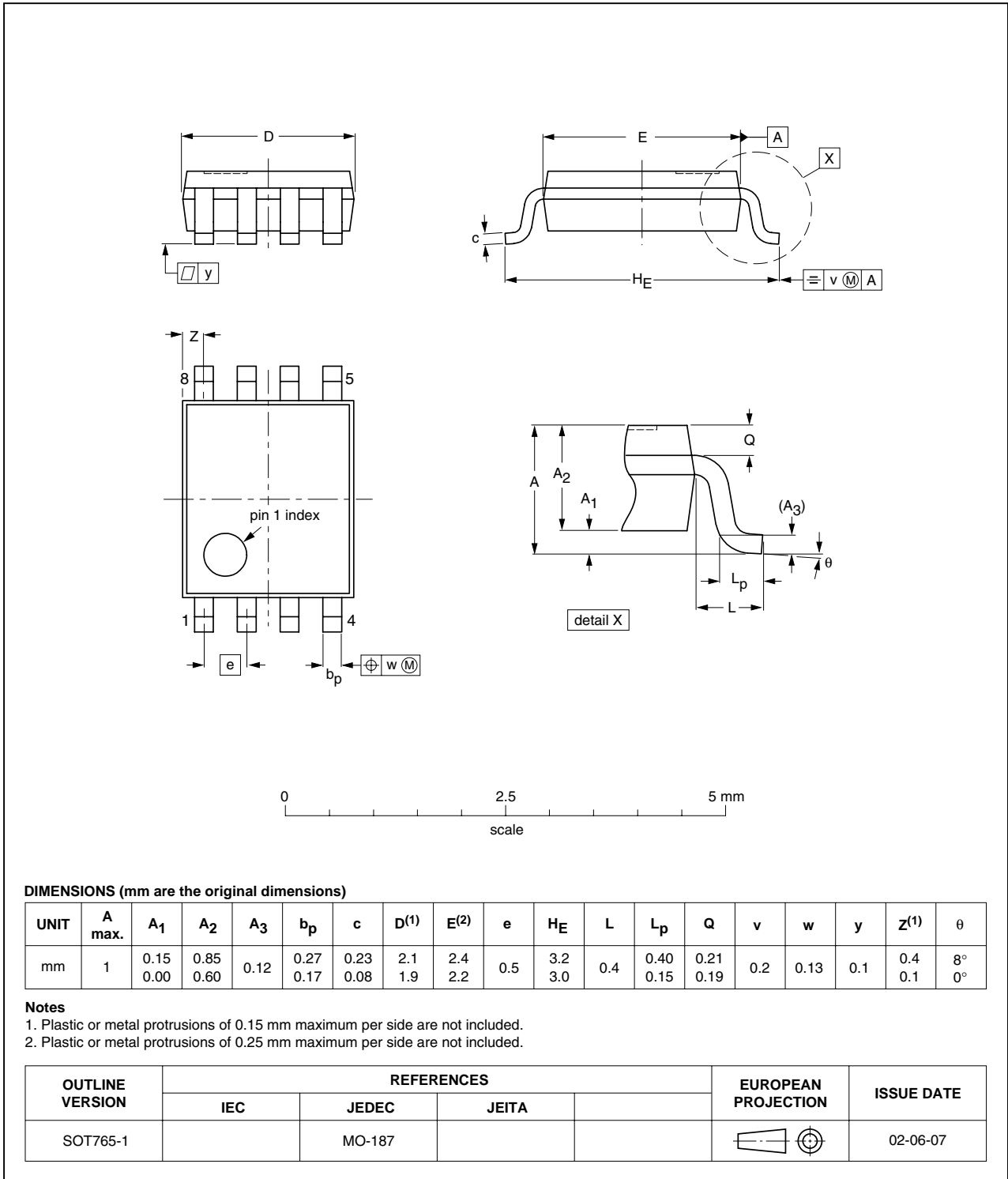


Fig 11. Package outline SOT765-1 (VSSOP8)

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

SOT833-1

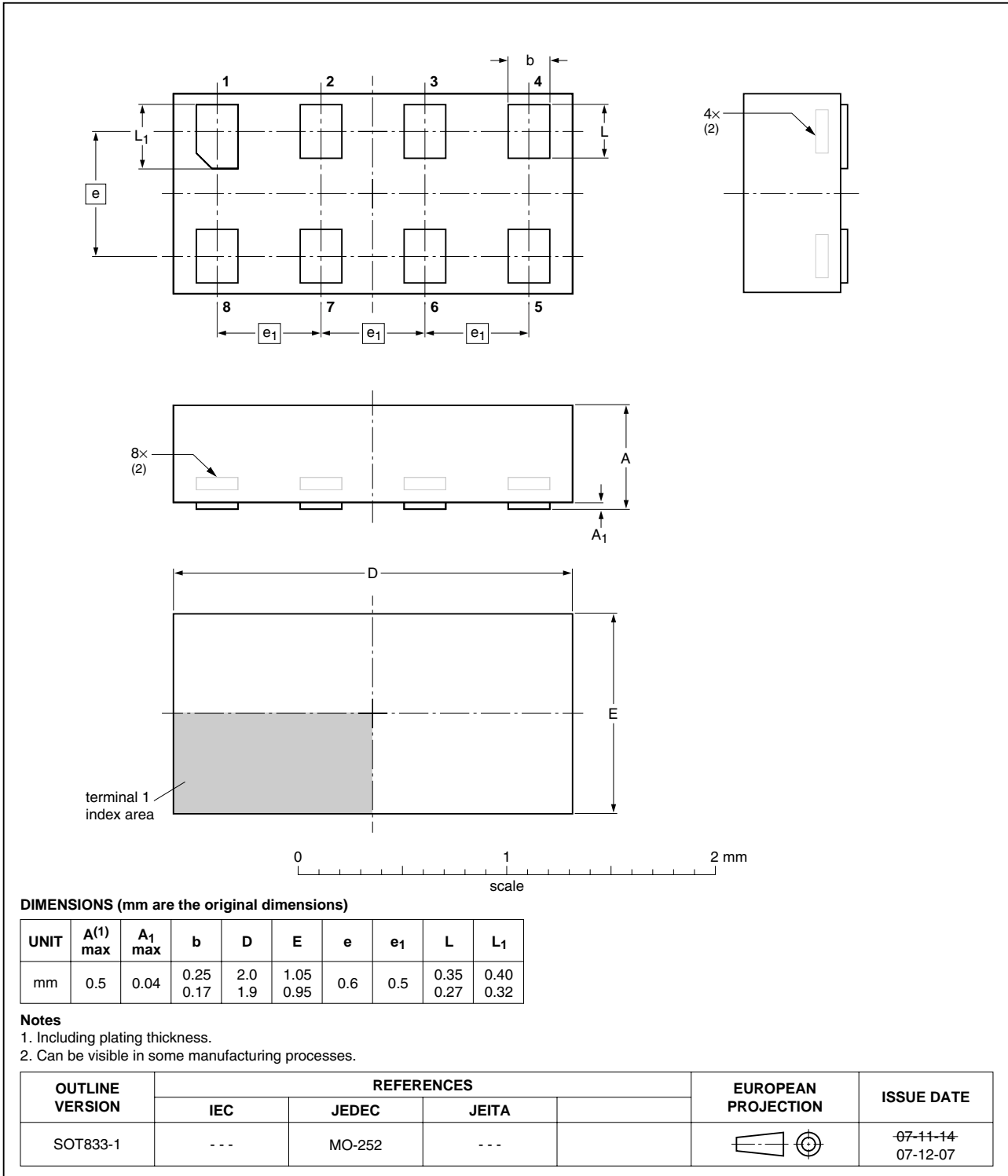


Fig 12. Package outline SOT833-1 (XSON8)

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

SOT1089

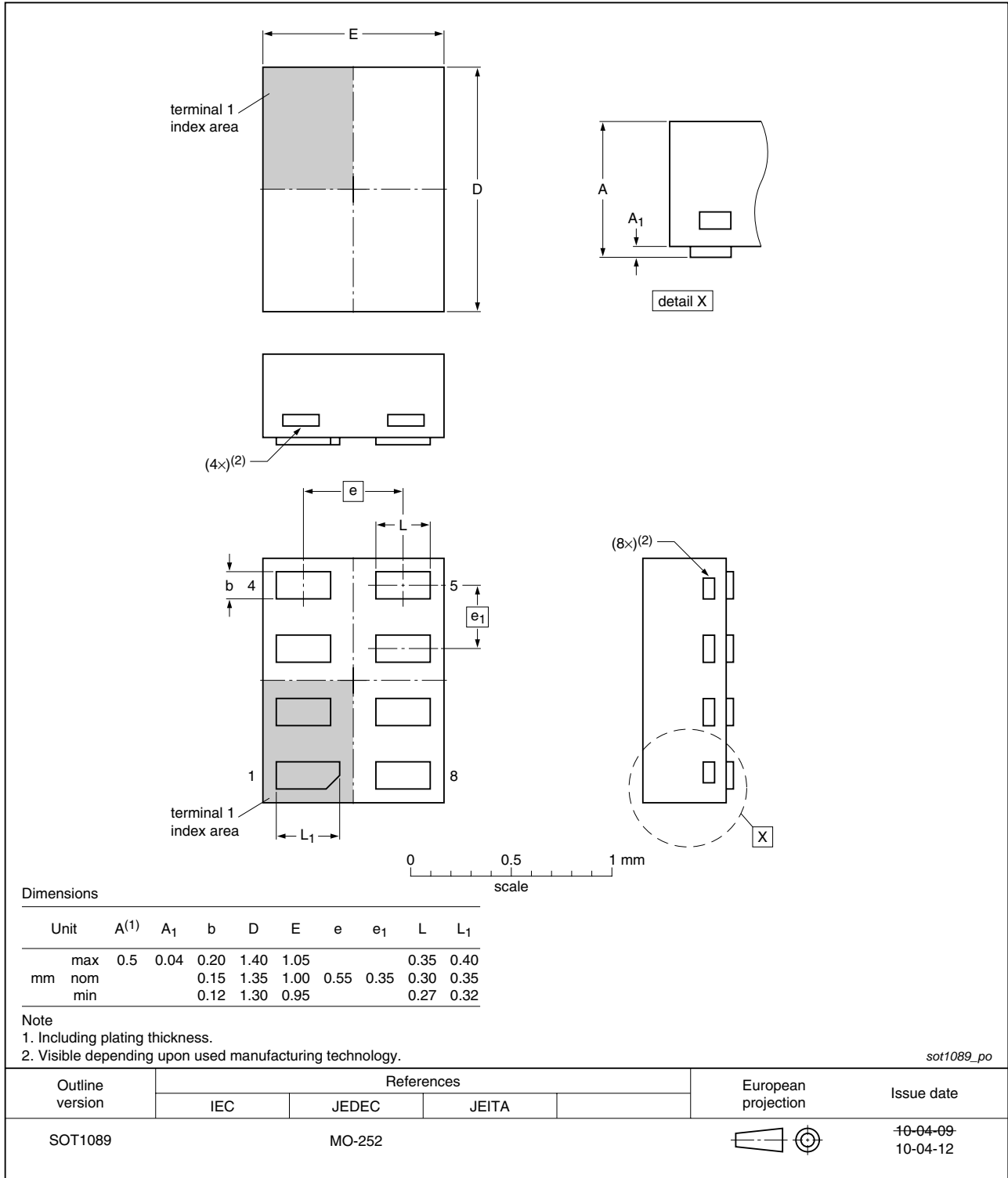


Fig 13. Package outline SOT1089 (XSON8)

XSON8U: plastic extremely thin small outline package; no leads;
8 terminals; UTLP based; body 3 x 2 x 0.5 mm

SOT996-2

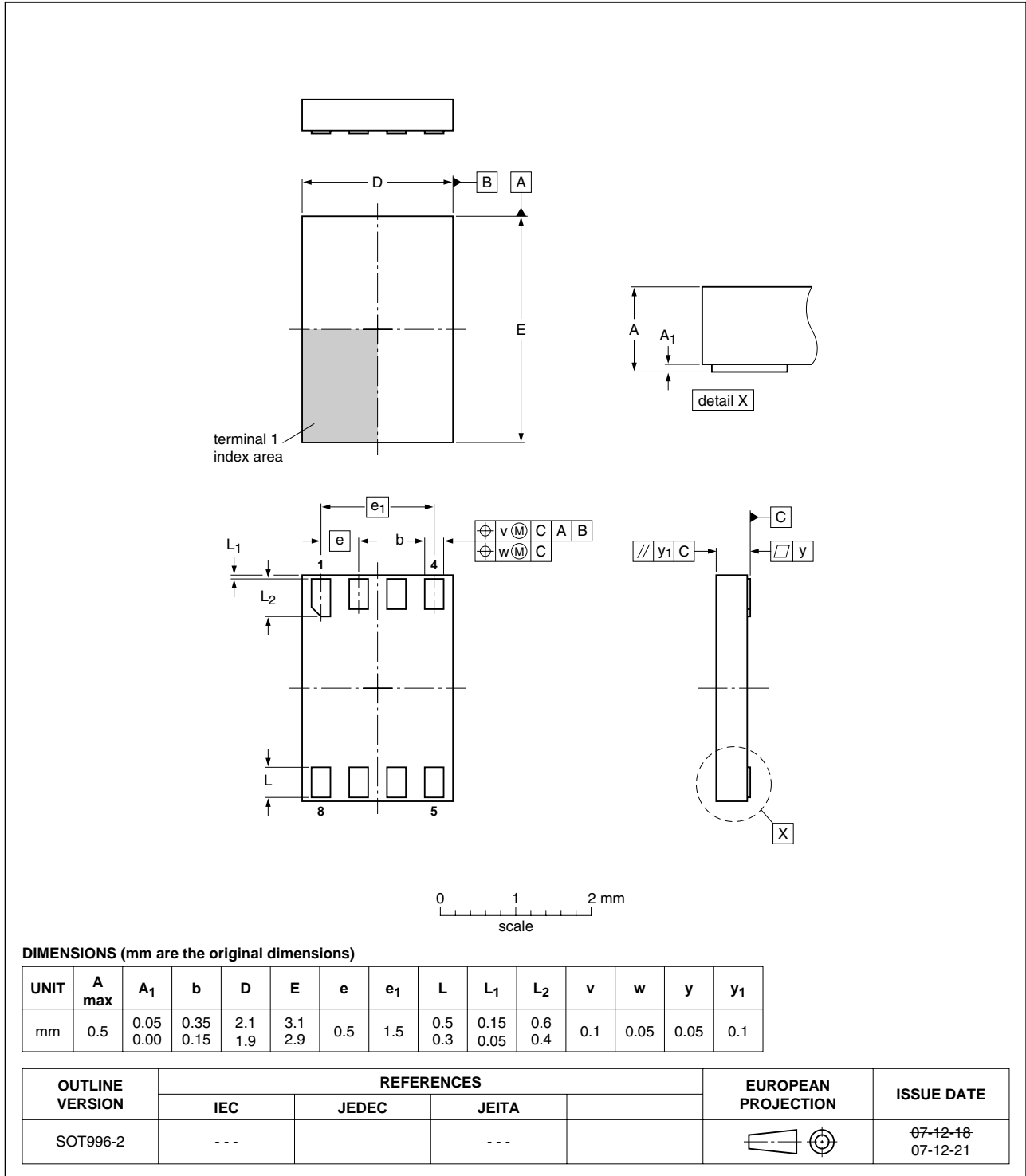


Fig 14. Package outline SOT996-2 (XSON8U)

XQFN8U: plastic extremely thin quad flat package; no leads; 8 terminals; UTLP based; body 1.6 x 1.6 x 0.5 mm

SOT902-1

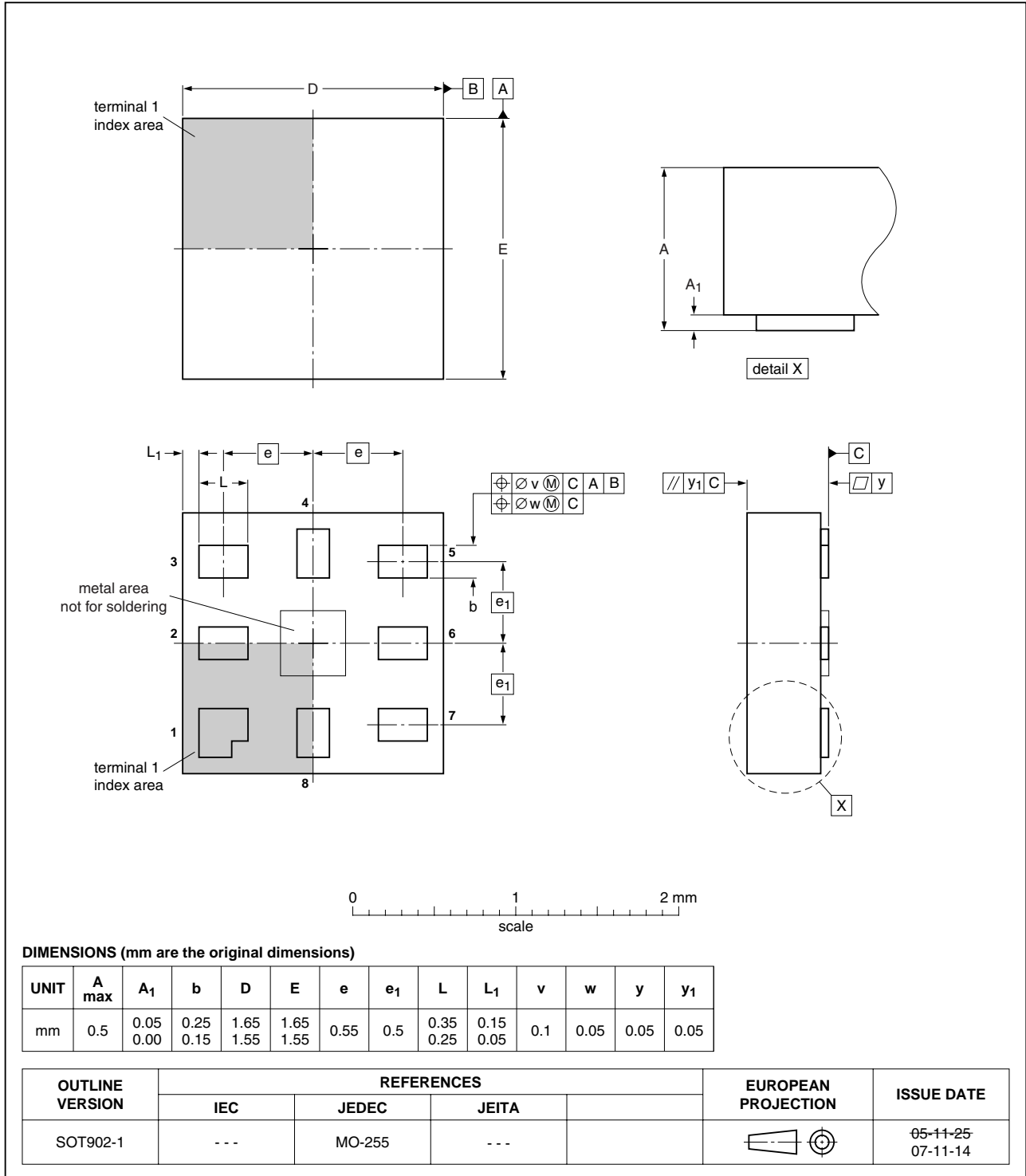


Fig 15. Package outline SOT902-1 (XQFN8U)

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

SOT1116

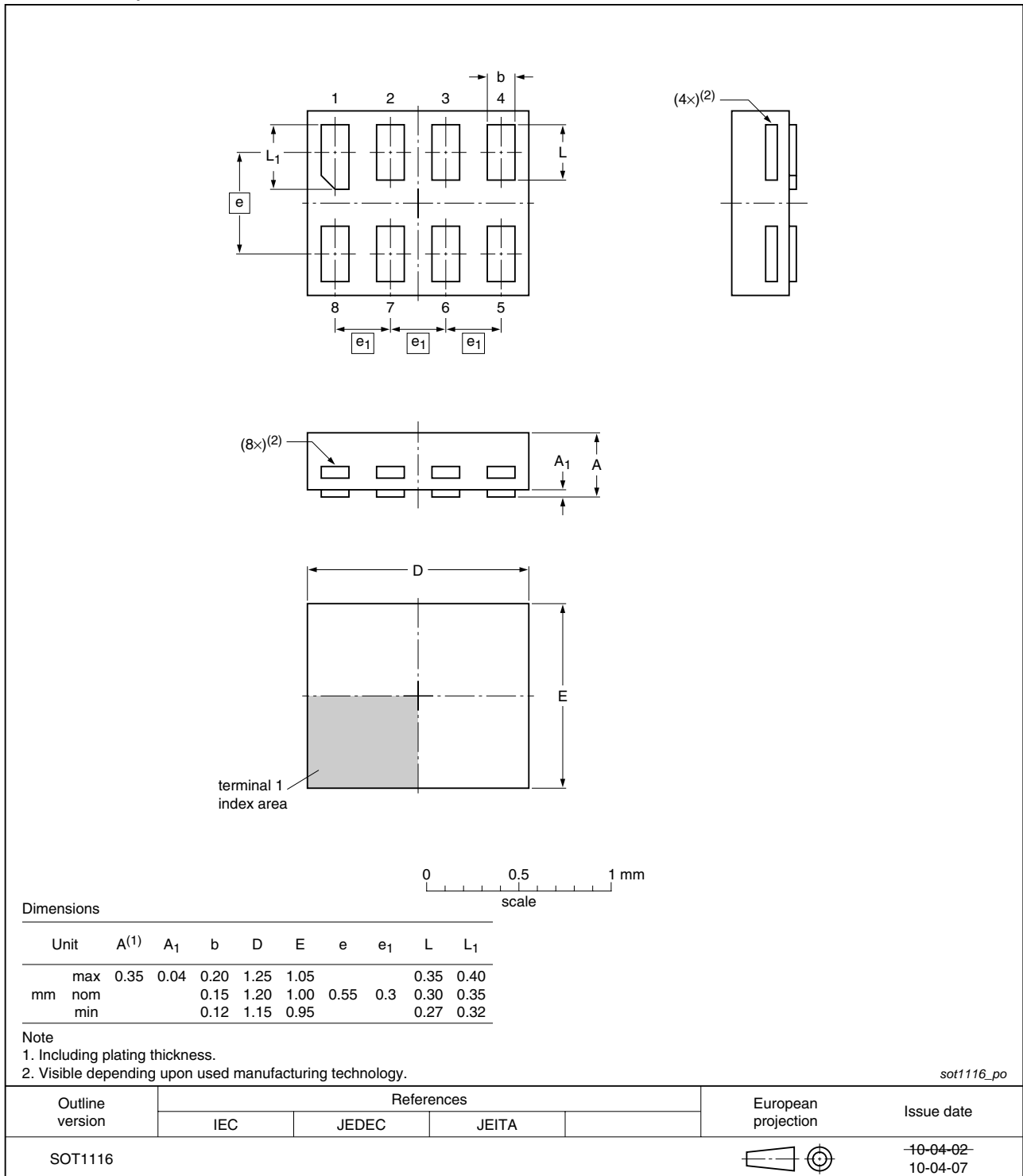


Fig 16. Package outline SOT1116 (XSON8)

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

SOT1203

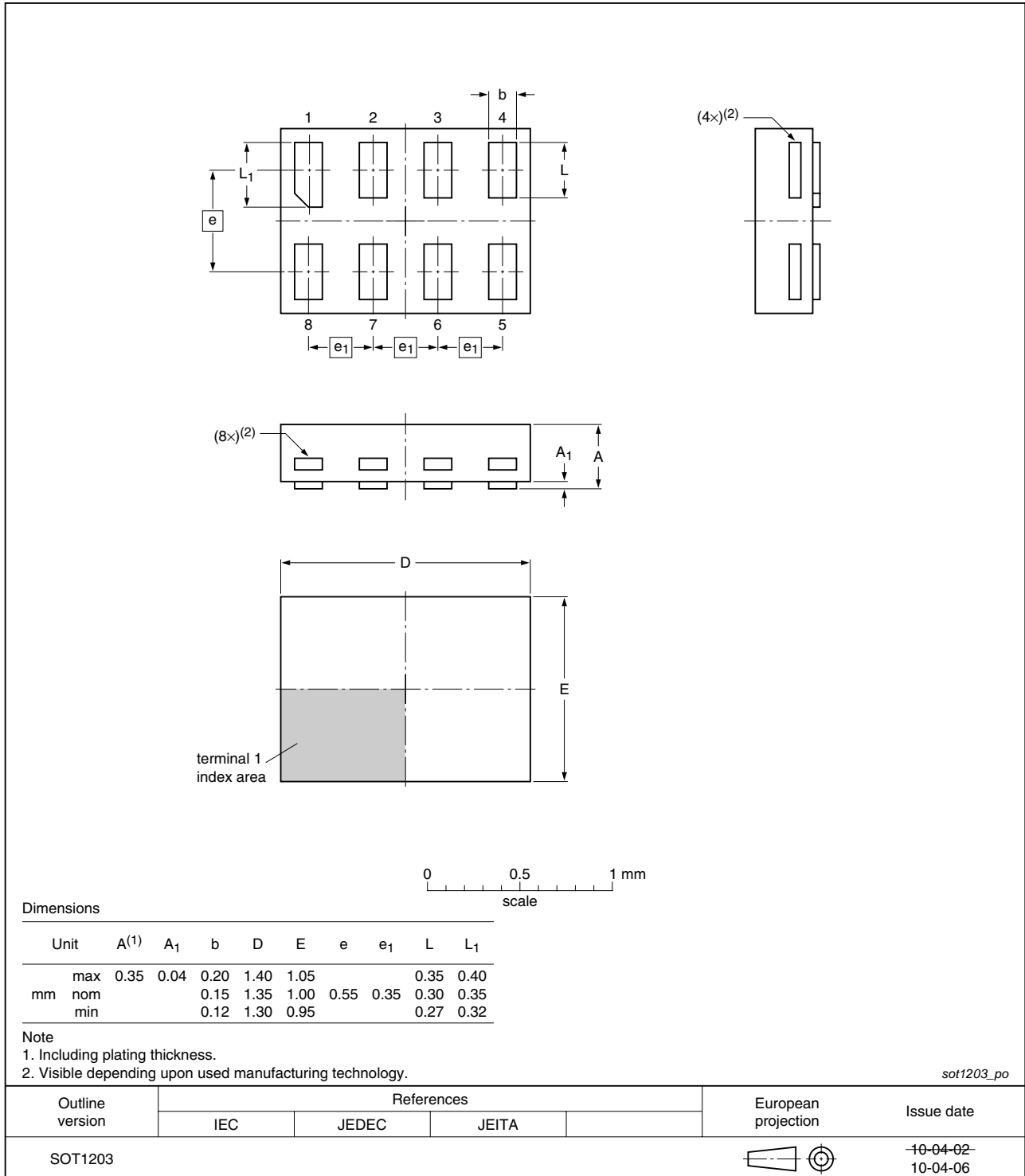


Fig 17. Package outline SOT1203 (XSON8)

14. Abbreviations

Table 11. 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 |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|-----------------------|---------------|---------------|
| 74LVC2G02 v.8 | 20101020 | Product data sheet | - | 74LVC2G02 v.7 |
| Modifications: | <ul style="list-style-type: none"> Added type number 74LVC2G02GF (SOT1089/XSON8 package) Added type number 74LVC2G020GN (SOT1116/XSON8 package). Added type number 74LVC2G02GS (SOT1203/XSON8 package). | | | |
| 74LVC2G02 v.7 | 20080606 | Product data sheet | - | 74LVC2G02 v.6 |
| 74LVC2G02 v.6 | 20080222 | Product data sheet | - | 74LVC2G02 v.5 |
| 74LVC2G02 v.5 | 20070904 | Product data sheet | - | 74LVC2G02 v.4 |
| 74LVC2G02 v.4 | 20060515 | Product data sheet | - | 74LVC2G02 v.3 |
| 74LVC2G02 v.3 | 20050201 | Product specification | - | 74LVC2G02 v.2 |
| 74LVC2G02 v.2 | 20040915 | Product specification | - | 74LVC2G02 v.1 |
| 74LVC2G02 v.1 | 20031015 | Product specification | - | - |

16. Legal information

16.1 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".

[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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