

74LVC1G86

2-input EXCLUSIVE-OR gate

Rev. 13 — 7 January 2022

Product data sheet

1. General description

The 74LVC1G86 provides the 2-input EXCLUSIVE-OR function.

Inputs can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices 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 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
- Overvoltage tolerant inputs to 5.5 V
- Complies with JEDEC standard:
 - JESD8-7 (1.65 V to 1.95 V)
 - JESD8-5 (2.3 V to 2.7 V)
 - JESD8C (2.7 V to 3.6 V)
 - JESD36 (4.5 V to 5.5 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 dissipation
- Latch-up performance exceeds 250 mA
- I_{OFF} circuitry provides partial Power-down mode operation
- Direct interface with TTL levels
- 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 | | | Version |
|-------------|-------------------|--------|--|-----------|
| | Temperature range | Name | Description | |
| 74LVC1G86GW | -40 °C to +125 °C | TSSOP5 | plastic thin shrink small outline package; 5 leads; body width 1.25 mm | SOT353-1 |
| 74LVC1G86GV | -40 °C to +125 °C | SC-74A | plastic surface-mounted package; 5 leads | SOT753 |
| 74LVC1G86GM | -40 °C to +125 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74LVC1G86GN | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm | SOT1115 |
| 74LVC1G86GS | -40 °C to +125 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm | SOT1202 |
| 74LVC1G86GX | -40 °C to +125 °C | X2SON5 | plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm | SOT1226-3 |

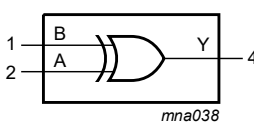
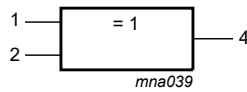
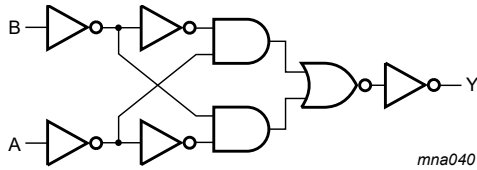
4. Marking

Table 2. Marking codes

| Type number | Marking ^[1] |
|-------------|------------------------|
| 74LVC1G86GW | VH |
| 74LVC1G86GV | V86 |
| 74LVC1G86GM | VH |
| 74LVC1G86GN | VH |
| 74LVC1G86GS | VH |
| 74LVC1G86GX | VH |

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

5. Functional diagram

| | | |
|--|--|--|
|  <p>Fig. 1. Logic symbol</p> |  <p>Fig. 2. IEC logic symbol</p> |  <p>Fig. 3. Logic diagram</p> |
|--|--|--|

6. Pinning information

6.1. Pinning

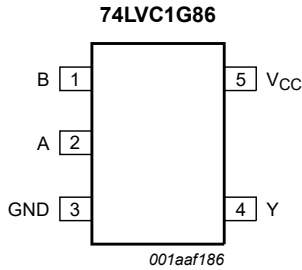


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)

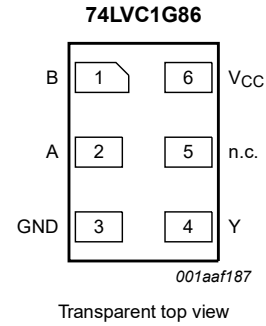


Fig. 5. Pin configuration SOT886 (XSON6)

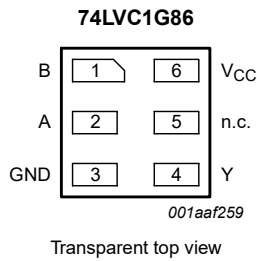


Fig. 6. Pin configuration SOT1115 and SOT1202 (XSON6)

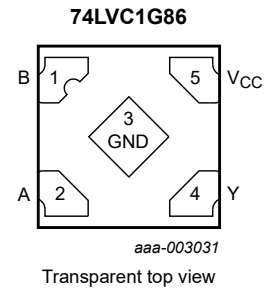


Fig. 7. Pin configuration SOT1226-3 (X2SON5)

6.2. Pin description

Table 3. Pin description

| Symbol | Pin | | Description |
|-----------------|-------------------|-------|----------------|
| | TSSOP5 and X2SON5 | XSON6 | |
| B | 1 | 1 | data input |
| 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 |

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level

| Input | | Output |
|-------|---|--------|
| A | B | Y |
| L | L | L |
| L | H | H |
| H | L | H |
| H | H | L |

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 |
| 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 | - | ± 50 | mA |
| V_O | output voltage | Active mode | [1] | $V_{CC} + 0.5$ | V |
| | | Power-down mode; $V_{CC} = 0$ V | [1] | +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 | [2] | 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] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.

For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.

For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.

For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

9. 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 |
| | | $V_{CC} = 0$ 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 | -40 °C to +85 °C | | | -40 °C to +125 °C | | Unit |
|------------------|---------------------------|---|-----------------------|--------|---------------------|-----------------------|---------------------|------|
| | | | Min | Typ[1] | Max | Min | Max | |
| V _{IH} | HIGH-level input voltage | V _{CC} = 1.65 V to 1.95 V | 0.65V _{CC} | - | - | 0.65V _{CC} | - | V |
| | | V _{CC} = 2.3 V to 2.7 V | 1.7 | - | - | 1.7 | - | V |
| | | V _{CC} = 2.7 V to 3.6 V | 2.0 | - | - | 2.0 | - | V |
| | | V _{CC} = 4.5 V to 5.5 V | 0.7V _{CC} | - | - | 0.7V _{CC} | - | V |
| V _{IL} | LOW-level input voltage | V _{CC} = 1.65 V to 1.95 V | - | - | 0.35V _{CC} | - | 0.35V _{CC} | V |
| | | V _{CC} = 2.3 V to 2.7 V | - | - | 0.7 | - | 0.7 | V |
| | | V _{CC} = 2.7 V to 3.6 V | - | - | 0.8 | - | 0.8 | V |
| | | V _{CC} = 4.5 V to 5.5 V | - | - | 0.3V _{CC} | - | 0.3V _{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 _{CC} - 0.1 | - | V |
| | | I _O = -4 mA; V _{CC} = 1.65 V | 1.2 | - | - | 0.95 | - | V |
| | | I _O = -8 mA; V _{CC} = 2.3 V | 1.9 | - | - | 1.7 | - | V |
| | | I _O = -12 mA; V _{CC} = 2.7 V | 2.2 | - | - | 1.9 | - | V |
| | | I _O = -24 mA; V _{CC} = 3.0 V | 2.3 | - | - | 2.0 | - | V |
| | | I _O = -32 mA; V _{CC} = 4.5 V | 3.8 | - | - | 3.4 | - | 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 | - | - | 0.10 | - | 0.10 | V |
| | | I _O = 4 mA; V _{CC} = 1.65 V | - | - | 0.45 | - | 0.70 | V |
| | | I _O = 8 mA; V _{CC} = 2.3 V | - | - | 0.30 | - | 0.45 | V |
| | | I _O = 12 mA; V _{CC} = 2.7 V | - | - | 0.40 | - | 0.60 | V |
| | | I _O = 24 mA; V _{CC} = 3.0 V | - | - | 0.55 | - | 0.80 | V |
| | | I _O = 32 mA; V _{CC} = 4.5 V | - | - | 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 | ±1 | - | ±1 | µA |
| I _{OFF} | power-off leakage current | V _{CC} = 0 V; V _I or V _O = 5.5 V | - | ±0.1 | ±2 | - | ±2 | 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 | 4 | - | 4 | µA |
| ΔI _{CC} | additional supply current | per pin; V _{CC} = 2.3 V to 5.5 V; V _I = V _{CC} - 0.6 V; I _O = 0 A | - | 5 | 500 | - | 500 | µA |
| C _I | input capacitance | V _{CC} = 3.3 V; V _I = GND to V _{CC} | - | 5 | - | - | - | pF |

[1] All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Fig. 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, B to Y; see Fig. 8 [2] | | | | | | |
| | | V _{CC} = 1.65 V to 1.95 V | 1.0 | 3.7 | 9.9 | 1.0 | 13.0 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 0.5 | 2.5 | 5.5 | 0.5 | 7.0 | ns |
| | | V _{CC} = 2.7 V | 0.5 | 2.8 | 5.8 | 0.5 | 7.5 | ns |
| | | V _{CC} = 3.0 V to 3.6 V | 0.5 | 2.3 | 5.0 | 0.5 | 6.5 | ns |
| | | V _{CC} = 4.5 V to 5.5 V | 0.5 | 1.9 | 4.0 | 0.5 | 5.5 | ns |
| C _{PD} | power dissipation capacitance | V _I = GND to V _{CC} [3] | | | | | | |
| | | V _{CC} = 3.3 V | - | 25 | - | - | - | pF |

- [1] All typical values are measured at nominal V_{CC}.
- [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;
 Σ(C_L × V_{CC}² × f_o) = sum of the outputs.

11.1. Waveforms and test circuit

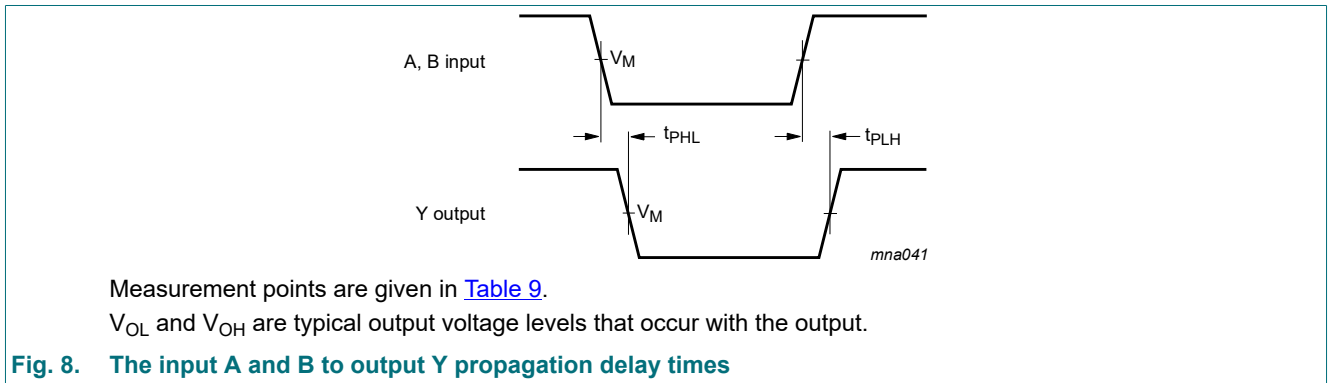
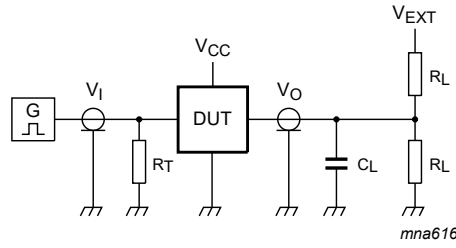


Table 9. Measurement points

| 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 test circuit:

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

C_L = Load capacitance including jig and probe capacitance;

R_L = Load resistance;

V_{EXT} = External voltage for measuring switching times.

Fig. 9. Test circuit for measuring 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 |

12. Package outline

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

SOT353-1

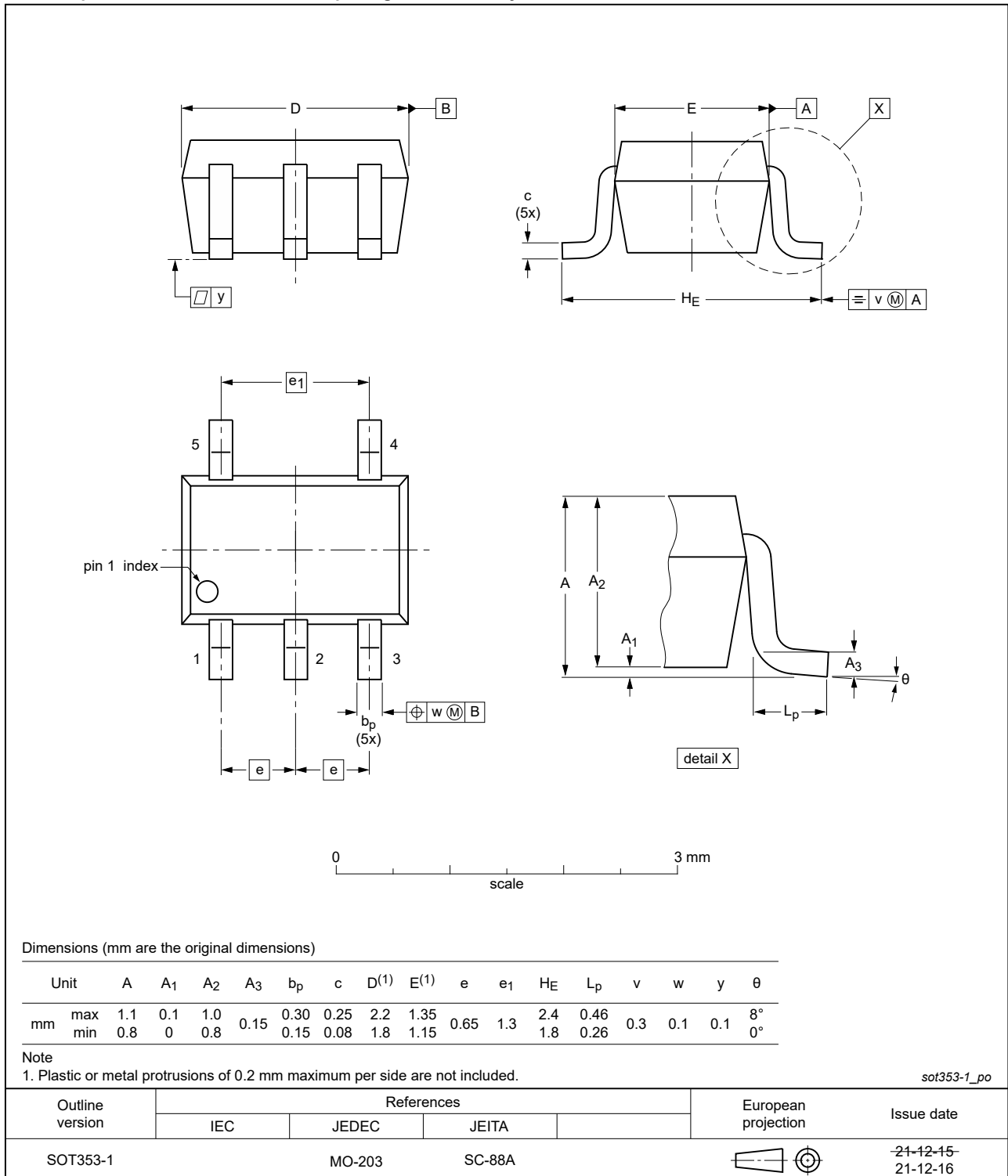


Fig. 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads

SOT753

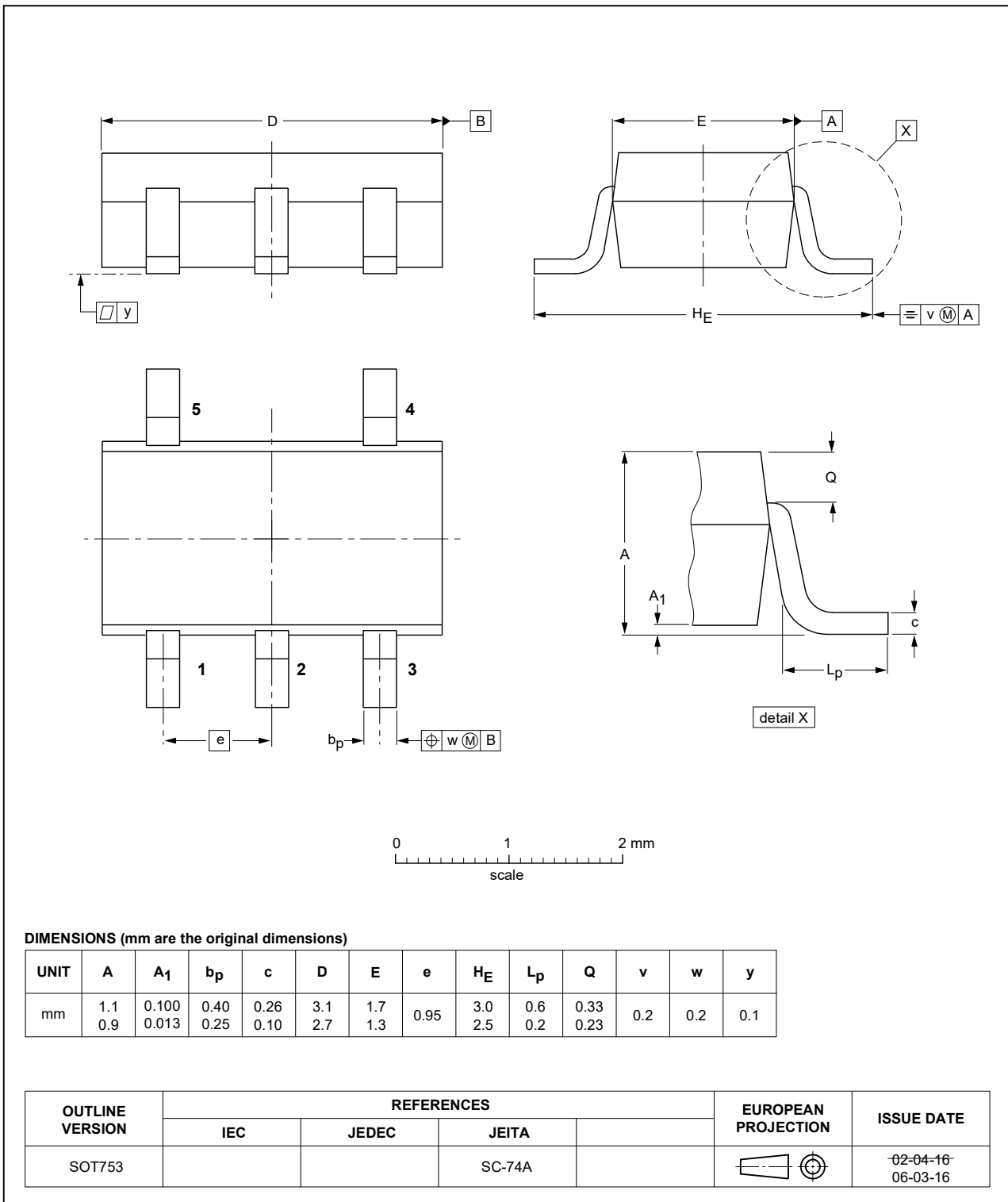


Fig. 11. Package outline SOT753 (SC-74A)

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

SOT886

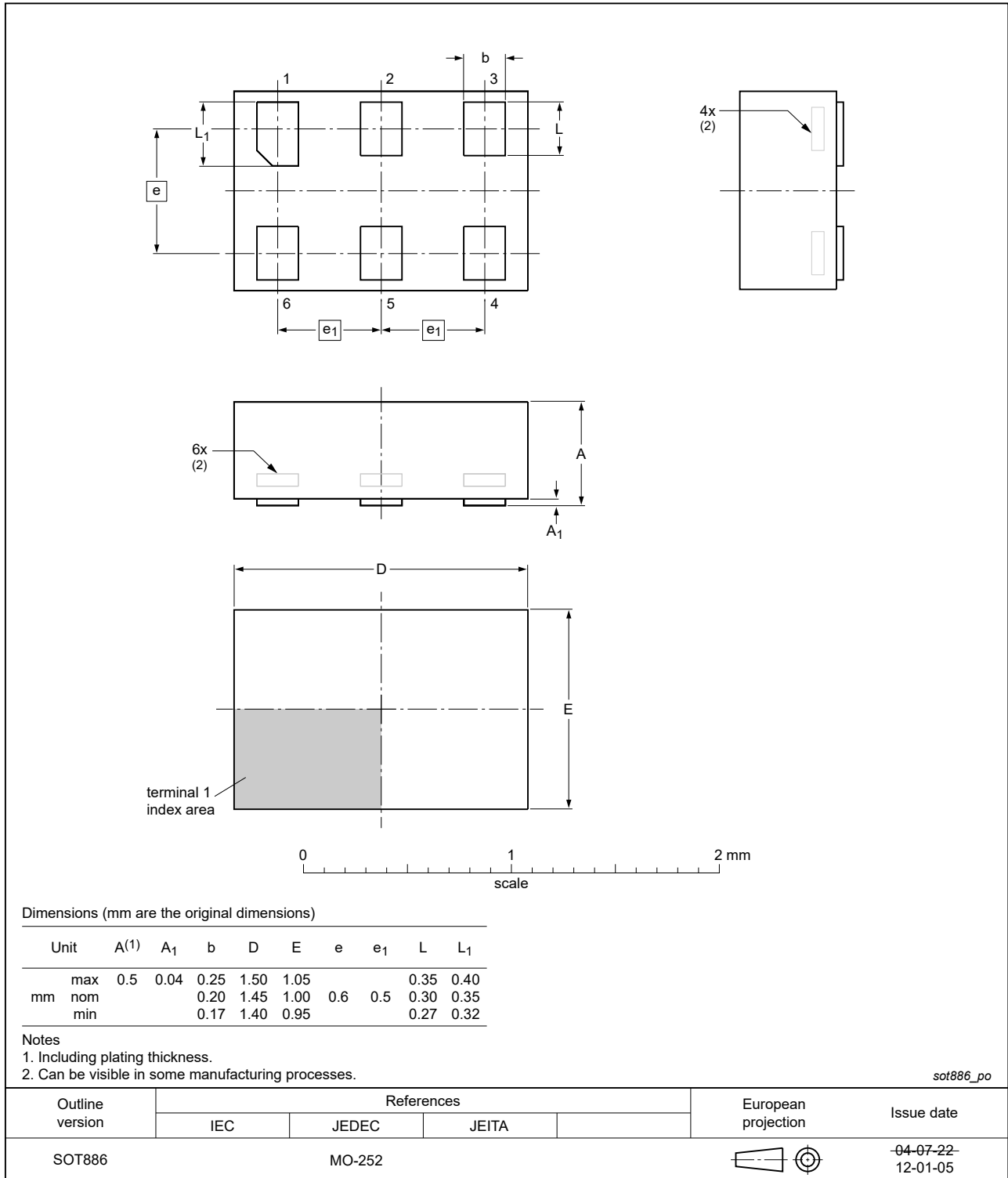


Fig. 12. Package outline SOT886 (XSON6)

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

SOT1115

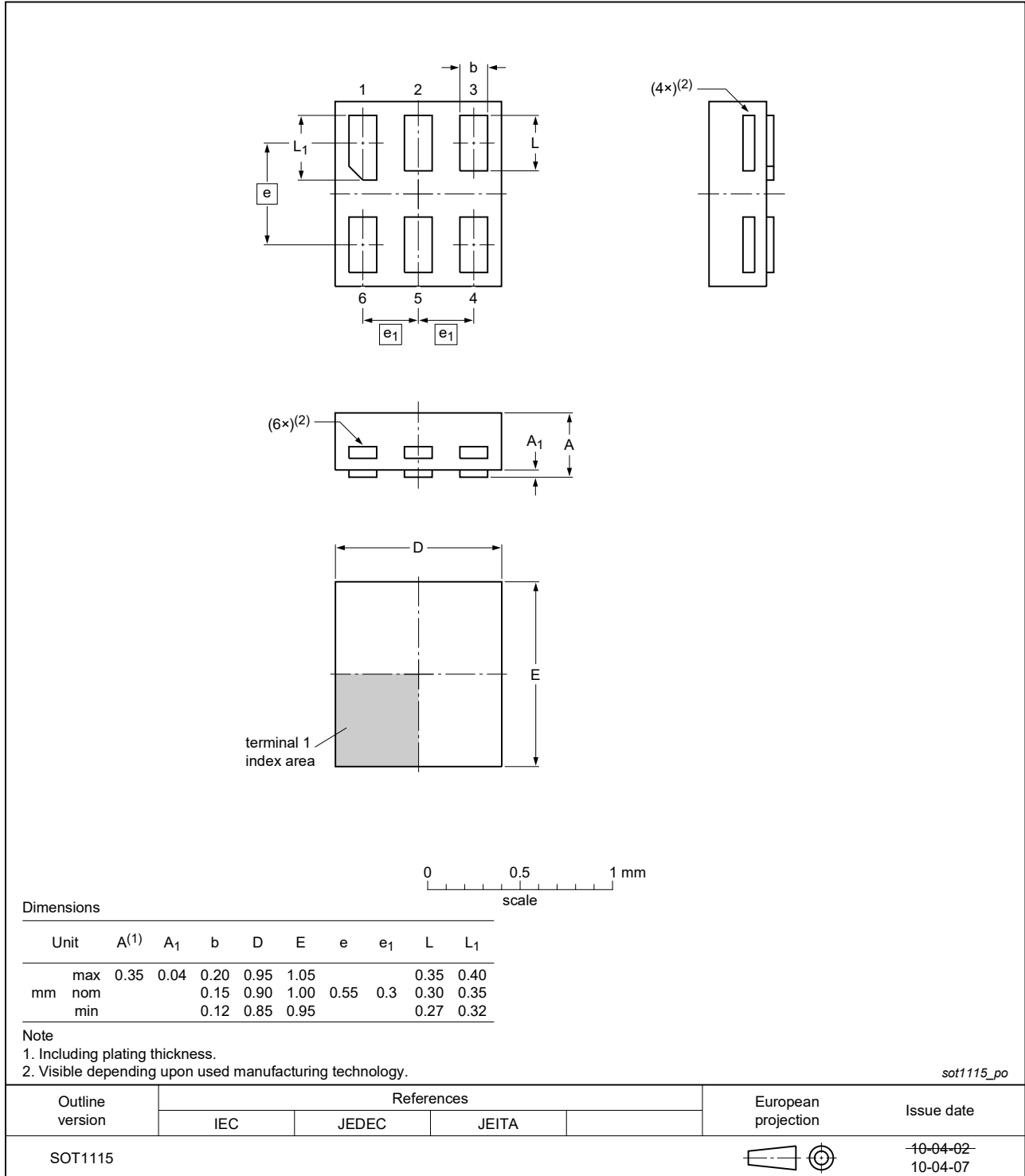


Fig. 13. Package outline SOT1115 (XSON6)

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

SOT1202

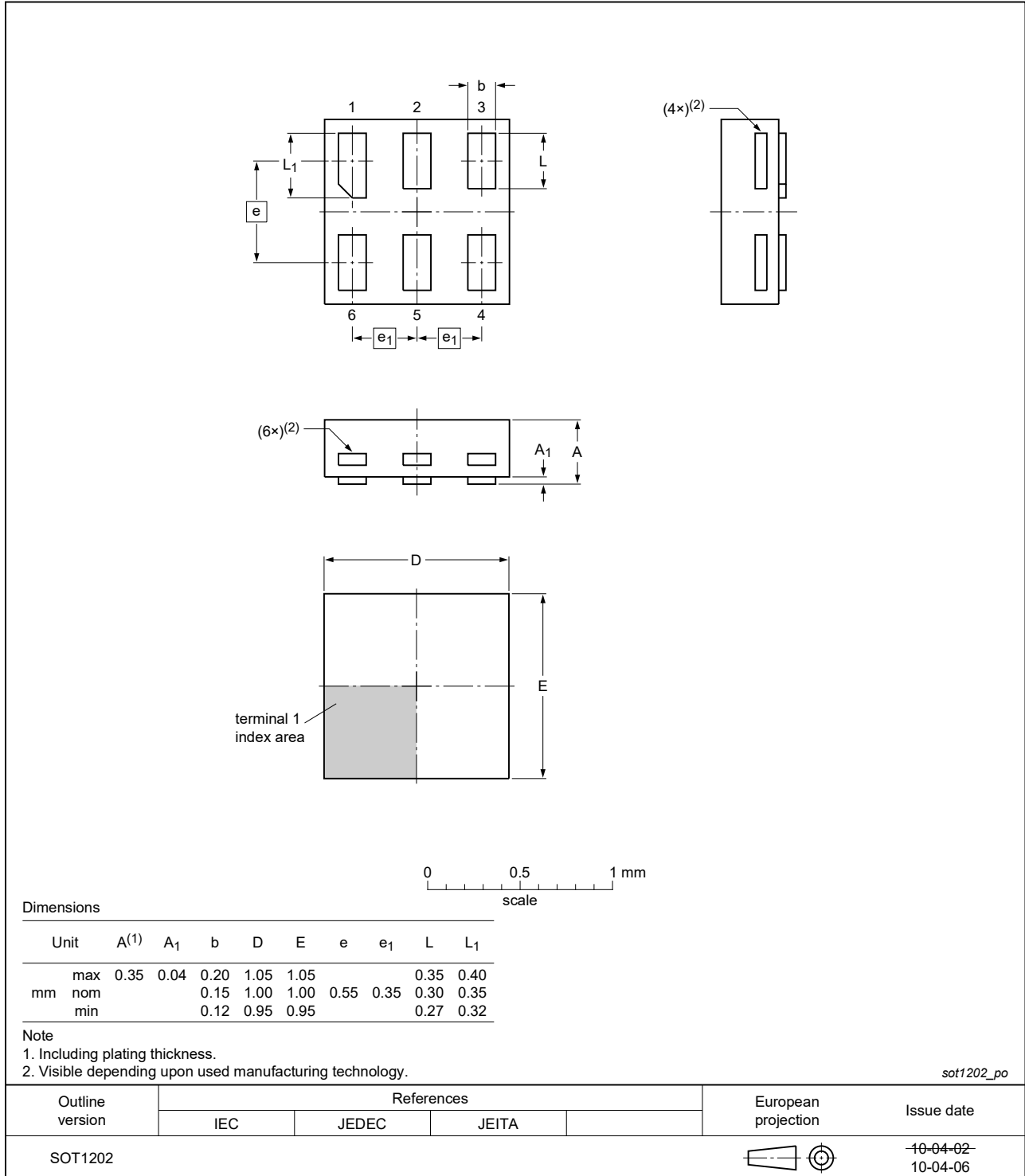


Fig. 14. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;
5 terminals; body 0.8 x 0.8 x 0.32 mm

SOT1226-3

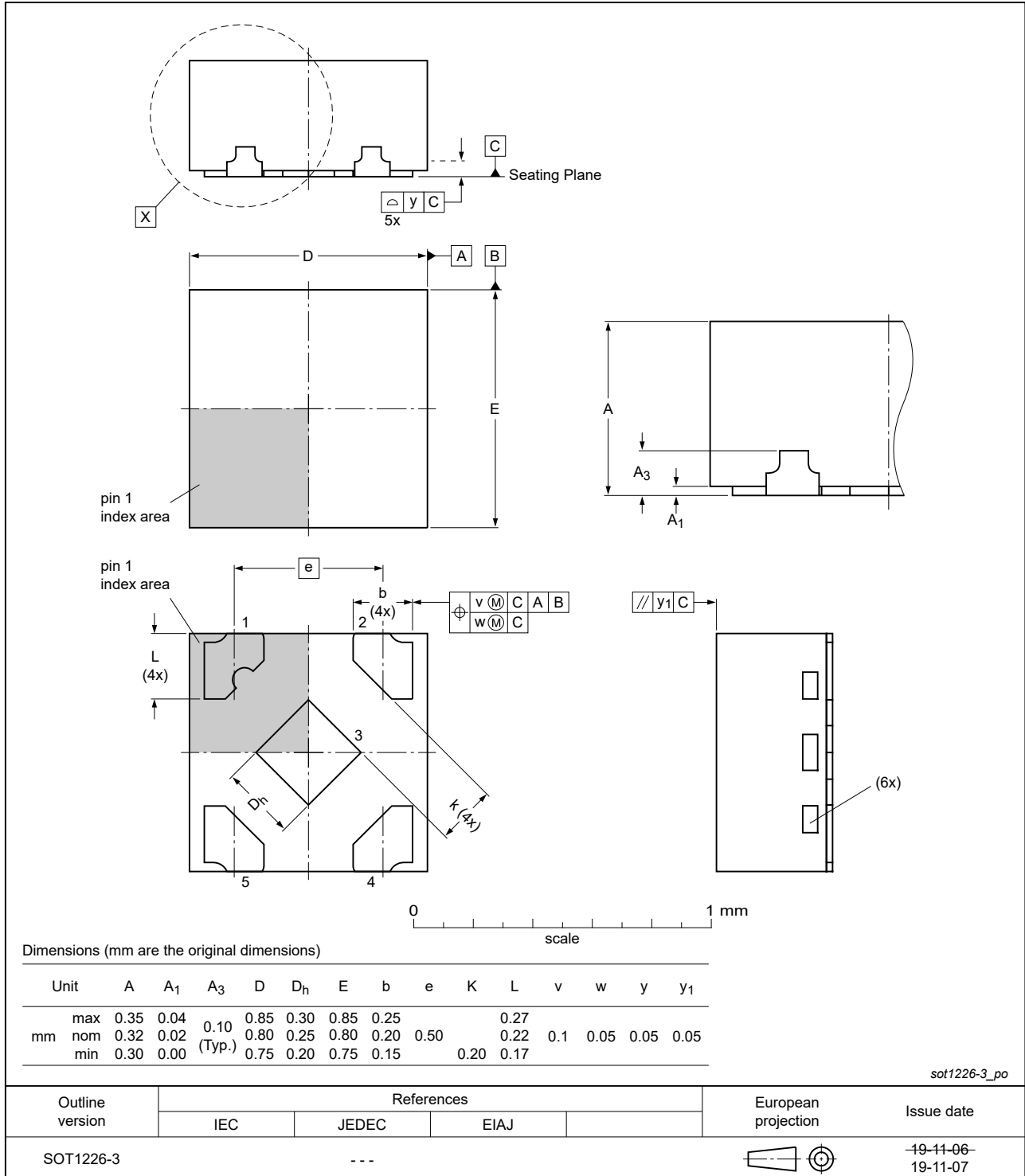


Fig. 15. Package outline SOT1226-3 (X2SON5)

13. 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 |

14. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|----------------|--|---------------------------|---------------|----------------|
| 74LVC1G86 v.13 | 20220107 | Product data sheet | - | 74LVC1G86 v.12 |
| Modifications: | <ul style="list-style-type: none"> Type number 74LVC1G86GF removed. SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. Fig. 10: Package outline drawing for SOT353-1 (TSSOP5) has changed. Table 5: Derating values for P_{tot} total power dissipation updated. Section 2 updated. | | | |
| 74LVC1G86 v.12 | 20170309 | Product data sheet | - | 74LVC1G86 v.11 |
| Modifications: | <ul style="list-style-type: none"> The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia. Legal texts have been adapted to the new company name where appropriate. | | | |
| 74LVC1G86 v.11 | 20161212 | Product data sheet | - | 74LVC1G86 v.10 |
| Modifications: | <ul style="list-style-type: none"> Table 7: The maximum limits for leakage current and supply current have changed. | | | |
| 74LVC1G86 v.10 | 20120702 | Product data sheet | - | 74LVC1G86 v.9 |
| Modifications: | <ul style="list-style-type: none"> Added type number 74LVC1G86GX (SOT1226) | | | |
| 74LVC1G86 v.9 | 20120305 | Product data sheet | - | 74LVC1G86 v.8 |
| Modifications: | <ul style="list-style-type: none"> Package outline drawing of SOT886 (Fig. 12) modified. | | | |
| 74LVC1G86 v.8 | 20111201 | Product data sheet | - | 74LVC1G86 v.7 |
| Modifications: | <ul style="list-style-type: none"> Legal pages updated. | | | |
| 74LVC1G86 v.7 | 20100914 | Product data sheet | - | 74LVC1G86 v.6 |
| 74LVC1G86 v.6 | 20070718 | Product data sheet | - | 74LVC1G86 v.5 |
| 74LVC1G86 v.5 | 20060913 | Product data sheet | - | 74LVC1G86 v.4 |
| 74LVC1G86 v.4 | 20040908 | Product specification | - | 74LVC1G86 v.3 |
| 74LVC1G86 v.3 | 20021115 | Product specification | - | 74LVC1G86 v.2 |
| 74LVC1G86 v.2 | 20010406 | Preliminary specification | - | 74LVC1G86 v.1 |
| 74LVC1G86 v.1 | 20001222 | Preliminary specification | - | - |

15. Legal information

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. |
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| 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 <https://www.nexperia.com>.

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