

74AXP1G11

Low-power 3-input AND gate

Rev. 1 — 5 October 2015

Product data sheet

1. General description

The 74AXP1G11 is a single 3-input AND gate.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device ensures very low static and dynamic power consumption across the entire V_{CC} range from 0.7 V to 2.75 V. It is fully specified for partial power down applications using I_{OFF} . The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 0.7 V to 2.75 V
- Low input capacitance; $C_I = 0.5$ pF (typical)
- Low output capacitance; $C_O = 1.0$ pF (typical)
- Low dynamic power consumption; $C_{PD} = 2.6$ pF at $V_{CC} = 1.2$ V (typical)
- Low static power consumption; $I_{CC} = 0.6$ μ A (85 °C maximum)
- High noise immunity
- Complies with JEDEC standard:
 - ◆ JESD8-12A.01 (1.1 V to 1.3 V)
 - ◆ JESD8-11A.01 (1.4 V to 1.6 V)
 - ◆ JESD8-7A (1.65 V to 1.95 V)
 - ◆ JESD8-5A.01 (2.3 V to 2.7 V)
- ESD protection:
 - ◆ HBM ANSI/ESDA/JEDEC JS-001 Class 2 exceeds 2 kV
 - ◆ CDM JESD22-C101E exceeds 1000 V
- Latch-up performance exceeds 100 mA per JESD 78 Class II
- Inputs accept voltages up to 2.75 V
- Low noise overshoot and undershoot < 10 % of V_{CC}
- I_{OFF} circuitry provides partial Power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C

3. Ordering information

Table 1. Ordering information

| Type number | Package | | | Version |
|-------------|-------------------|-------|---|---------|
| | Temperature range | Name | Description | |
| 74AXP1G11GM | -40 °C to +85 °C | XSON6 | plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm | SOT886 |
| 74AXP1G11GN | -40 °C to +85 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm | SOT1115 |
| 74AXP1G11GS | -40 °C to +85 °C | XSON6 | extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm | SOT1202 |

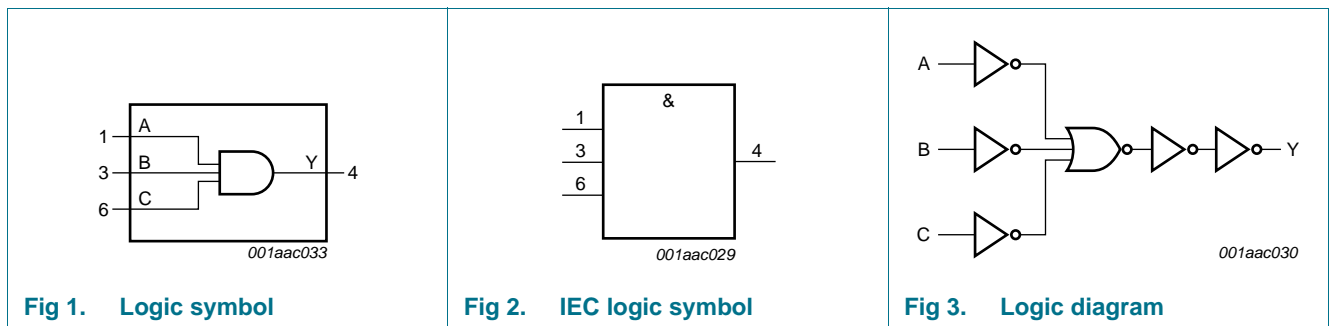
4. Marking

Table 2. Marking

| Type number | Marking code ^[1] |
|-------------|-----------------------------|
| 74AXP1G11GM | rU |
| 74AXP1G11GN | rU |
| 74AXP1G11GS | rU |

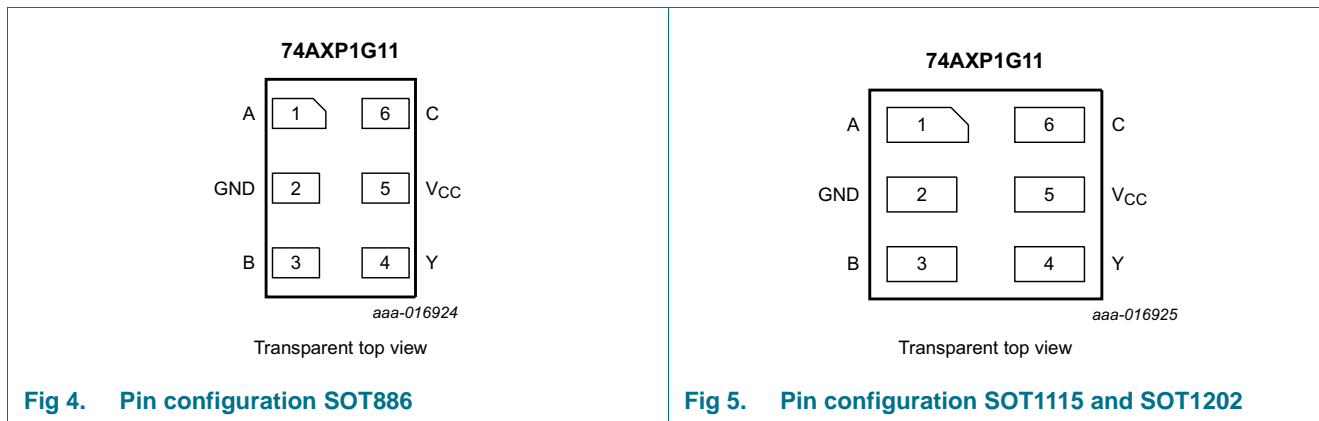
[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram



6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table^[1]

| Input | | | Output |
|-------|---|---|--------|
| A | B | C | Y |
| H | H | H | H |
| L | X | X | L |
| X | L | X | L |
| X | X | L | 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 | +3.3 | V |
| I_{IK} | input clamping current | $V_I < 0$ V | -50 | - | mA |
| V_I | input voltage | | -0.5 | +3.3 | V |
| I_{OK} | output clamping current | $V_O < 0$ V | -50 | - | mA |
| V_O | output voltage | | -0.5 | +3.3 | V |
| I_O | output current | $V_O = 0$ V to V_{CC} | - | ± 20 | mA |
| I_{CC} | supply current | | - | 50 | mA |
| I_{GND} | ground current | | -50 | - | mA |
| T_{stg} | storage temperature | | -65 | +150 | °C |
| P_{tot} | total power dissipation | $T_{amb} = -40$ °C to +85 °C | - | 250 | mW |

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Voltages are referenced to GND (ground = 0 V).

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---------------------|-------------------------------------|---------------------------------|-----|----------|------|
| V_{CC} | supply voltage | | 0.7 | 2.75 | V |
| V_I | input voltage | | 0 | 2.75 | V |
| V_O | output voltage | Active mode | 0 | V_{CC} | V |
| | | Power-down mode; $V_{CC} = 0$ V | 0 | 2.75 | V |
| T_{amb} | ambient temperature | | -40 | +85 | °C |
| $\Delta t/\Delta V$ | input transition rise and fall rate | $V_{CC} = 0.7$ V to 2.75 V | 0 | 200 | ns/V |

10. Static characteristics

Table 7. Static characteristics

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

| Symbol | Parameter | Conditions | $T_{amb} = -40\text{ °C to }+85\text{ °C}$ | | | | Unit | |
|------------------|--------------------------------------|--|--|-----------|----------------------|----------------------|-----------|---------------|
| | | | Min | Typ 25 °C | Max 25 °C | Max 85 °C | | |
| V_{IH} | HIGH-level input voltage | $V_{CC} = 0.75\text{ V to }0.85\text{ V}$ | $0.75 \times V_{CC}$ | - | - | - | V | |
| | | $V_{CC} = 1.1\text{ V to }1.95\text{ V}$ | $0.65 \times V_{CC}$ | - | - | - | V | |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | 1.6 | - | - | - | V | |
| V_{IL} | LOW-level input voltage | $V_{CC} = 0.75\text{ V to }0.85\text{ V}$ | - | - | $0.25 \times V_{CC}$ | $0.25 \times V_{CC}$ | V | |
| | | $V_{CC} = 1.1\text{ V to }1.95\text{ V}$ | - | - | $0.35 \times V_{CC}$ | $0.35 \times V_{CC}$ | V | |
| | | $V_{CC} = 2.3\text{ V to }2.7\text{ V}$ | - | - | 0.7 | 0.7 | V | |
| V_{OH} | HIGH-level output voltage | $I_O = -20\text{ }\mu\text{A}; V_{CC} = 0.7\text{ V}$ | - | 0.69 | - | - | V | |
| | | $I_O = -100\text{ }\mu\text{A}; V_{CC} = 0.75\text{ V}$ | 0.65 | - | - | - | V | |
| | | $I_O = -2\text{ mA}; V_{CC} = 1.1\text{ V}$ | 0.825 | - | - | - | V | |
| | | $I_O = -3\text{ mA}; V_{CC} = 1.4\text{ V}$ | 1.05 | - | - | - | V | |
| | | $I_O = -4.5\text{ mA}; V_{CC} = 1.65\text{ V}$ | 1.2 | - | - | - | V | |
| | | $I_O = -8\text{ mA}; V_{CC} = 2.3\text{ V}$ | 1.7 | - | - | - | V | |
| V_{OL} | LOW-level output voltage | $I_O = 20\text{ }\mu\text{A}; V_{CC} = 0.7\text{ V}$ | - | 0.01 | - | - | V | |
| | | $I_O = 100\text{ }\mu\text{A}; V_{CC} = 0.75\text{ V}$ | - | - | 0.1 | 0.1 | V | |
| | | $I_O = 2\text{ mA}; V_{CC} = 1.1\text{ V}$ | - | - | 0.275 | 0.275 | V | |
| | | $I_O = 3\text{ mA}; V_{CC} = 1.4\text{ V}$ | - | - | 0.35 | 0.35 | V | |
| | | $I_O = 4.5\text{ mA}; V_{CC} = 1.65\text{ V}$ | - | - | 0.45 | 0.45 | V | |
| | | $I_O = 8\text{ mA}; V_{CC} = 2.3\text{ V}$ | - | - | 0.7 | 0.7 | V | |
| I_I | input leakage current | $V_I = 0\text{ V to }2.75\text{ V};$ $V_{CC} = 0\text{ V to }2.75\text{ V}$ | [1] | - | 0.001 | ± 0.1 | ± 0.5 | μA |
| I_{OFF} | power-off leakage current | V_I or $V_O = 0\text{ V to }2.75\text{ V};$ $V_{CC} = 0\text{ V}$ | [1] | - | 0.01 | ± 0.1 | ± 0.5 | μA |
| ΔI_{OFF} | additional power-off leakage current | V_I or $V_O = 0\text{ V or }2.75\text{ V};$ $V_{CC} = 0\text{ V to }0.1\text{ V}$ | [1] | - | 0.02 | ± 0.1 | ± 0.5 | μA |
| I_{CC} | supply current | $V_I = 0\text{ V or }V_{CC}; I_O = 0\text{ A}$ | [1] | - | 0.01 | 0.3 | 0.6 | μA |
| ΔI_{CC} | additional supply current | $V_I = V_{CC} - 0.5\text{ V}; I_O = 0\text{ A};$ $V_{CC} = 2.5\text{ V}$ | - | - | 2 | 100 | 150 | μA |

[1] Typical values are measured at $V_{CC} = 1.2\text{ V}$.

11. Dynamic characteristics

Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 12](#).

| Symbol | Parameter | Conditions | T _{amb} = 25 °C | | | T _{amb} = -40 °C to +85 °C | | Unit |
|-----------------|-------------------------------|--|--------------------------|--------------------|-----|-------------------------------------|-----|------|
| | | | Min | Typ ^[1] | Max | Min | Max | |
| t _{pd} | propagation delay | A, B, C to Y; see Figure 6 ^{[2][3]} | | | | | | |
| | | V _{CC} = 0.75 V to 0.85 V | 3 | 13 | 51 | 3 | 130 | ns |
| | | V _{CC} = 1.1 V to 1.3 V | 2.0 | 4.6 | 7.7 | 1.9 | 8.0 | ns |
| | | V _{CC} = 1.4 V to 1.6 V | 1.5 | 3.3 | 5.2 | 1.4 | 5.6 | ns |
| | | V _{CC} = 1.65 V to 1.95 V | 1.2 | 2.7 | 4.3 | 1.1 | 4.6 | ns |
| | | V _{CC} = 2.3 V to 2.7 V | 1.0 | 2.1 | 3.2 | 0.9 | 3.4 | ns |
| t _t | transition time | V _{CC} = 2.7 V; see Figure 6 ^[4] | - | - | - | 1.0 | - | ns |
| C _I | input capacitance | V _I = 0 V or V _{CC} ; V _{CC} = 0 V to 2.75 V | - | 0.5 | - | - | - | pF |
| C _O | output capacitance | V _O = 0 V; V _{CC} = 0 V | - | 1.0 | - | - | - | pF |
| C _{PD} | power dissipation capacitance | f _i = 1 MHz; V _I = 0 V to V _{CC} ^[5] | | | | | | |
| | | V _{CC} = 0.75 V to 0.85 V | - | 2.5 | - | - | - | pF |
| | | V _{CC} = 1.1 V to 1.3 V | - | 2.6 | - | - | - | pF |
| | | V _{CC} = 1.4 V to 1.6 V | - | 2.6 | - | - | - | pF |
| | | V _{CC} = 1.65 V to 1.95 V | - | 2.7 | - | - | - | pF |
| | | V _{CC} = 2.3 V to 2.7 V | - | 3.0 | - | - | - | pF |

[1] All typical values are measured at nominal V_{CC}.

[2] t_{pd} is the same as t_{PLH} and t_{PHL}.

[3] For additional propagation delay values at different load capacitances, see [Figure 7](#) to [Figure 11](#).

[4] t_t is the same as t_{THL} and t_{TLH}.

[5] C_{PD} is used to determine the dynamic power dissipation (P_D in μW).

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

f_i = input frequency in MHz;

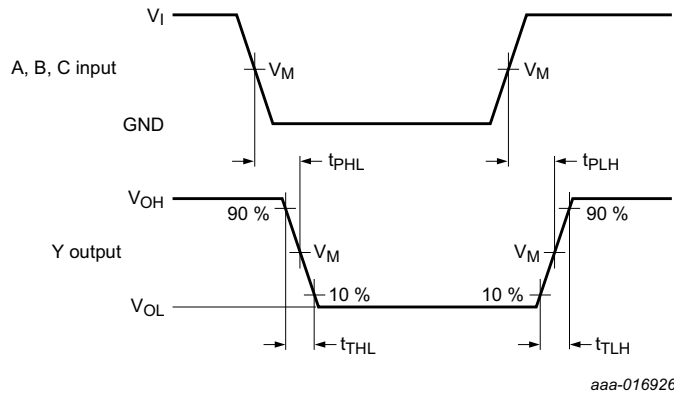
f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching.

12. Waveforms



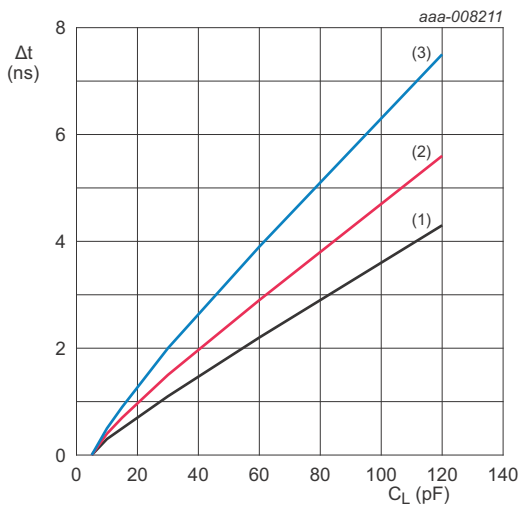
Measurement points are given in [Table 9](#).

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

Fig 6. The data input (A, B, C) to output (Y) propagation delays and output transition times

Table 9. Measurement points

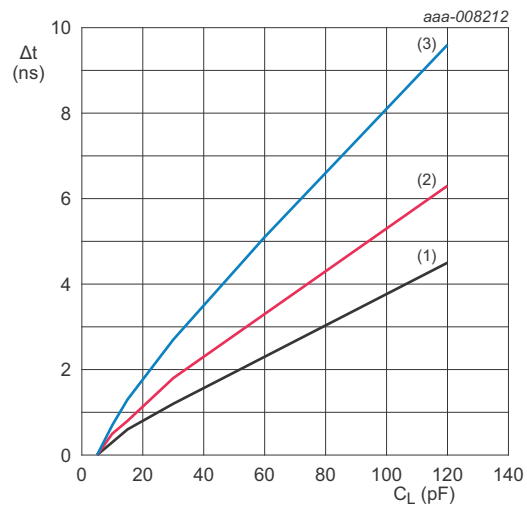
| Supply voltage | Input | | | Output |
|-----------------|---------------------|----------|---------------|---------------------|
| V_{CC} | V_M | V_I | $t_r = t_f$ | V_M |
| 0.75 V to 2.7 V | $0.5 \times V_{CC}$ | V_{CC} | ≤ 3.0 ns | $0.5 \times V_{CC}$ |



$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.

- (1) Minimum: $V_{CC} = 2.7$ V
- (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.5$ V
- (3) Maximum: $V_{CC} = 2.3$ V

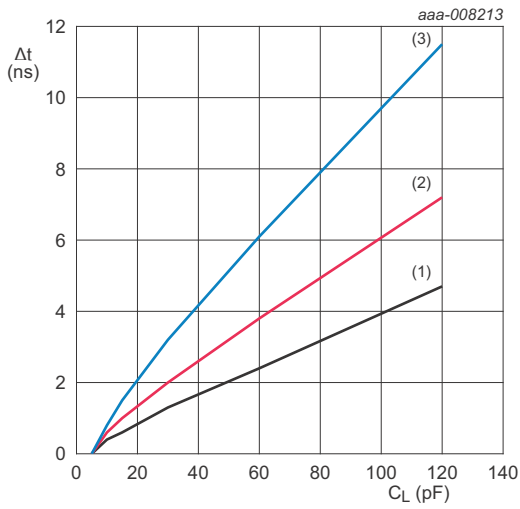
Fig 7. Additional t_{pd} versus load capacitance



$T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.

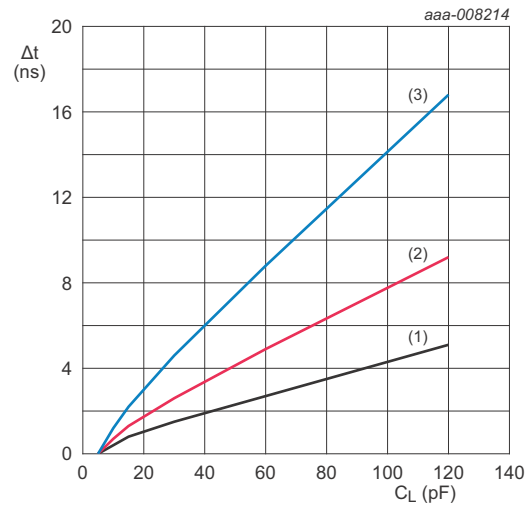
- (1) Minimum: $V_{CC} = 1.95$ V
- (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.8$ V
- (3) Maximum: $V_{CC} = 1.65$ V

Fig 8. Additional t_{pd} versus load capacitance



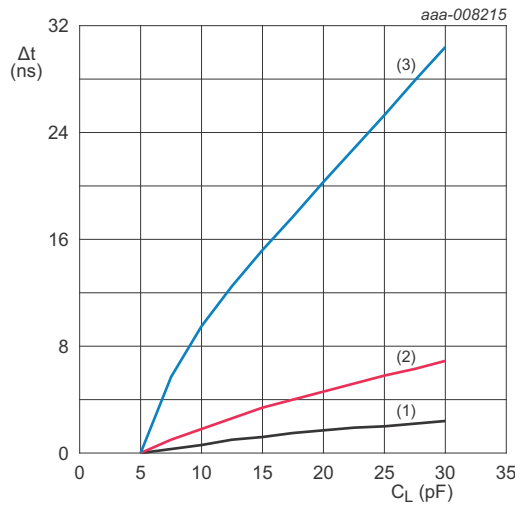
- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 1.6\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.5\text{ V}$
 - (3) Maximum: $V_{CC} = 1.4\text{ V}$

Fig 9. Additional t_{pd} versus load capacitance



- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 1.3\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.2\text{ V}$
 - (3) Maximum: $V_{CC} = 1.1\text{ V}$

Fig 10. Additional t_{pd} versus load capacitance



- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 0.85\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 0.8\text{ V}$
 - (3) Maximum: $V_{CC} = 0.75\text{ V}$

Fig 11. Additional t_{pd} versus load capacitance



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

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 12. Test circuit for measuring switching times

Table 10. Test data

| Supply voltage | Load | | V_{EXT} | | |
|-----------------|-------|---------------|--------------------|--------------------|--------------------|
| V_{CC} | C_L | R_L | t_{PLH}, t_{PHL} | t_{PZH}, t_{PHZ} | t_{PZL}, t_{PLZ} |
| 0.75 V to 2.7 V | 5 pF | 10 k Ω | 0 V | 0 V | $2 \times V_{CC}$ |

13. Package outline

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

SOT886

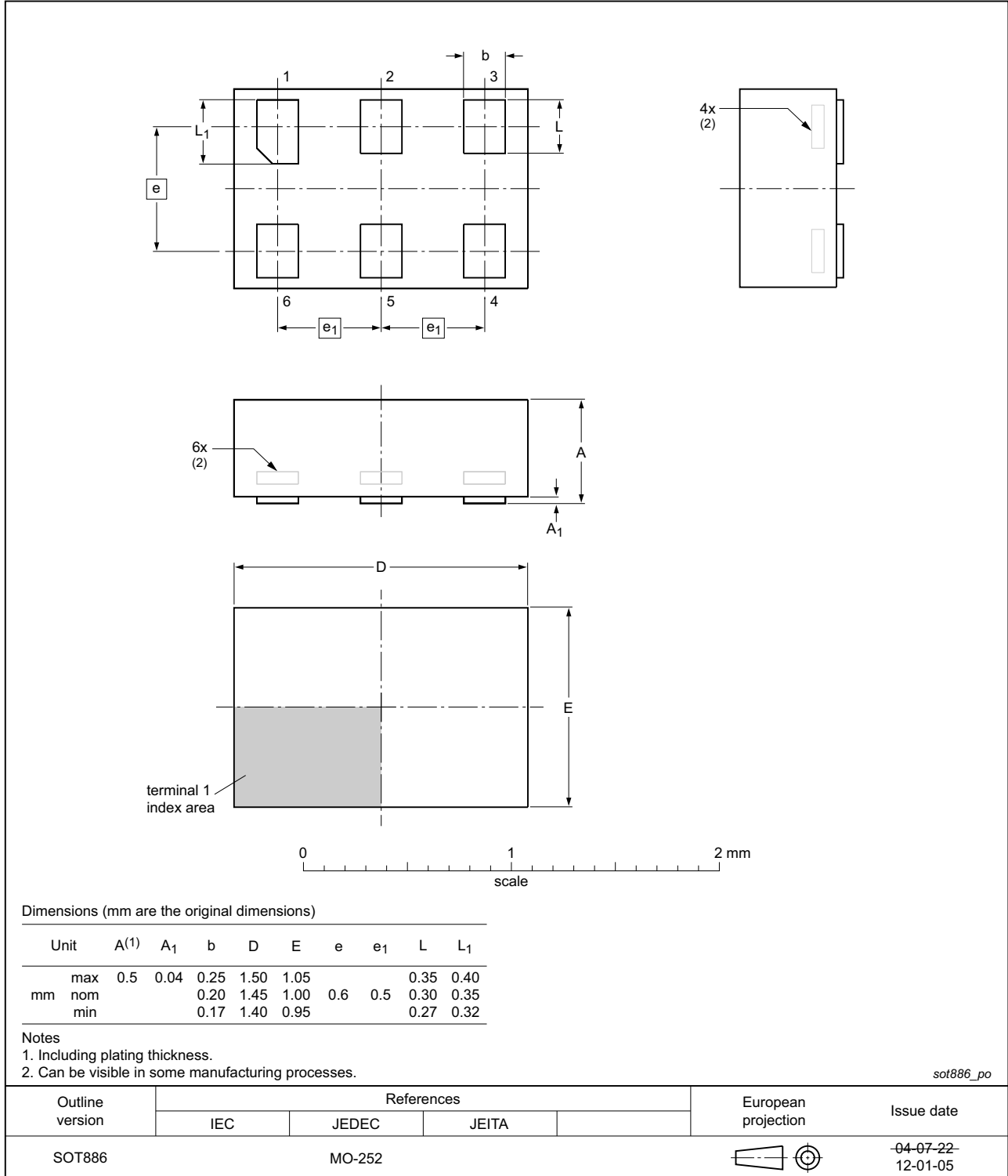


Fig 13. Package outline SOT886 (XSON6)

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

SOT1115

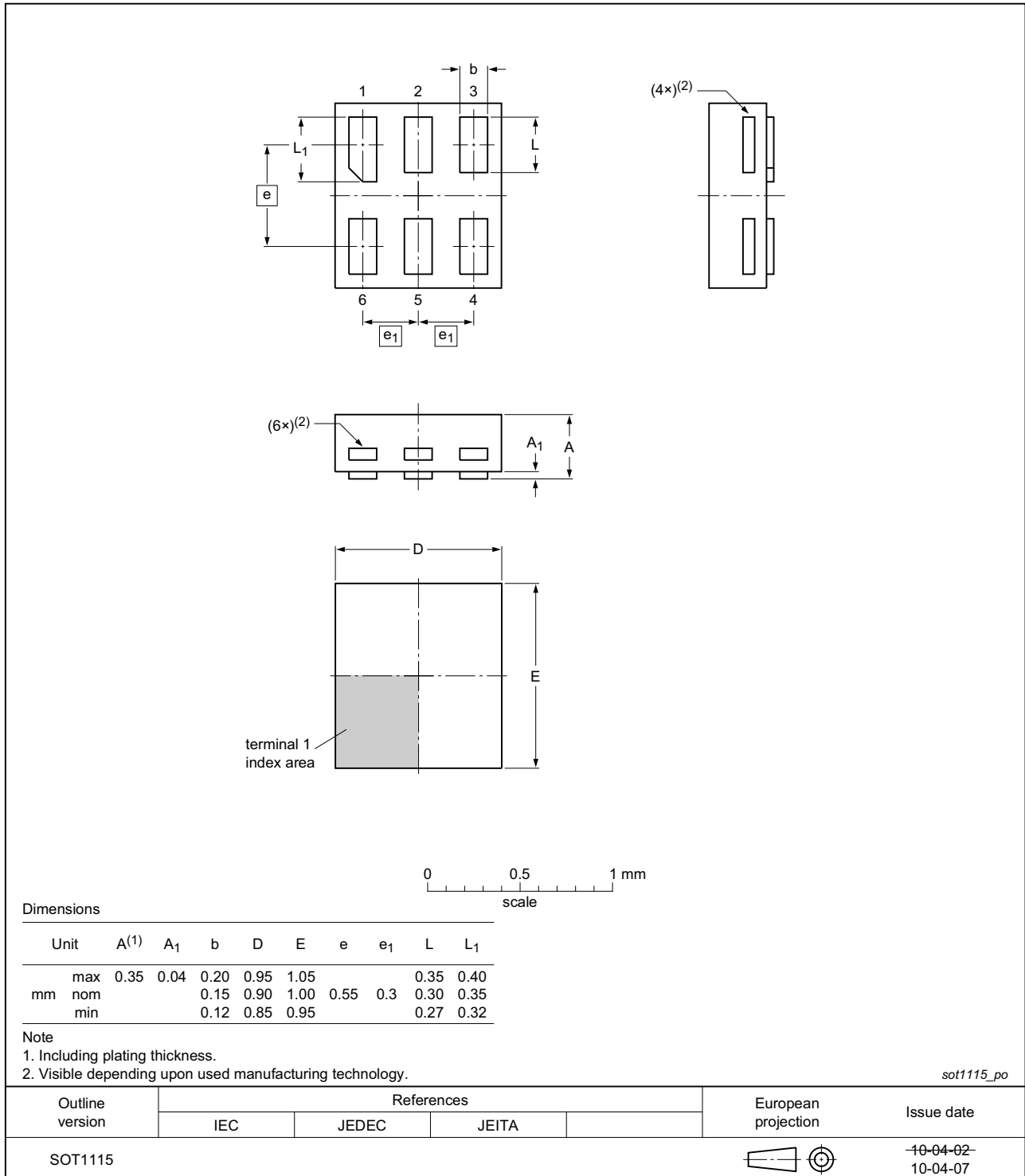


Fig 14. Package outline SOT1115 (XSON6)

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

SOT1202

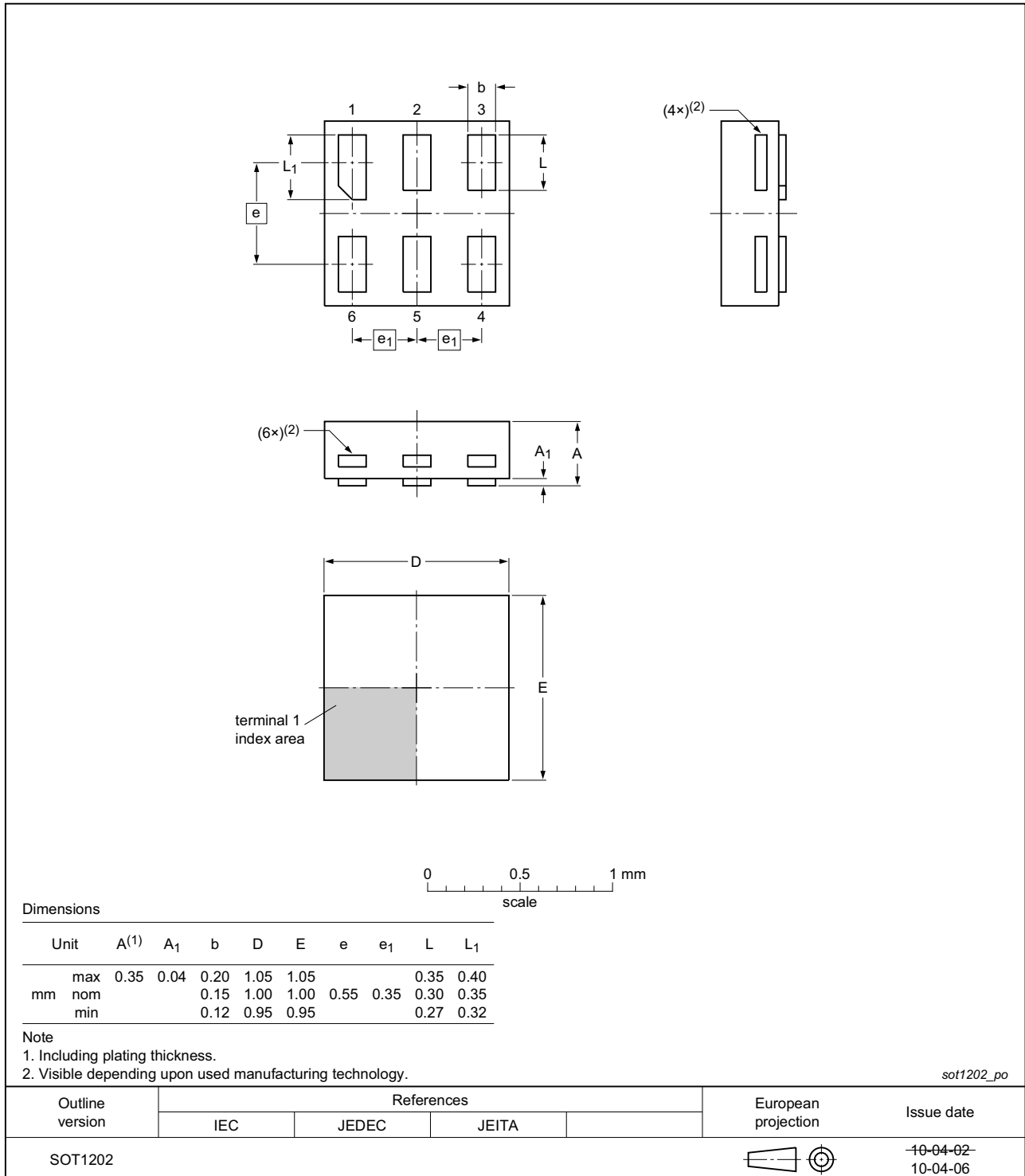


Fig 15. Package outline SOT1202 (XSON6)

14. Abbreviations

Table 11. Abbreviations

| Acronym | Description |
|---------|-------------------------|
| CDM | Charged Device Model |
| DUT | Device Under Test |
| ESD | ElectroStatic Discharge |
| HBM | Human Body Model |

15. Revision history

Table 12. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| 74AXP1G11 v.1 | 20151005 | Product data sheet | - | - |

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. |
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[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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