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74AXP1G98

Low-power configurable multiple function gate

Rev. 2 — 13 November 2015

Product data sheet

1. General description

The 74AXP1G98 is a configurable multiple function gate with Schmitt-trigger inputs. The device can be configured as any of the following logic functions MUX, AND, OR, NAND, NOR, inverter and buffer. All inputs can be connected directly to V_{CC} or GND.

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; $C_{PD} = 2.7$ pF at $V_{CC} = 1.2$ V (typical)
- Low static power consumption; $I_{CC} = 1.0$ 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	
74AXP1G98GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AXP1G98GN	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74AXP1G98GS	-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]
74AXP1G98GM	R9
74AXP1G98GN	R9
74AXP1G98GS	R9

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

5. Functional diagram

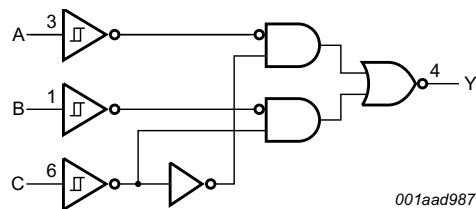
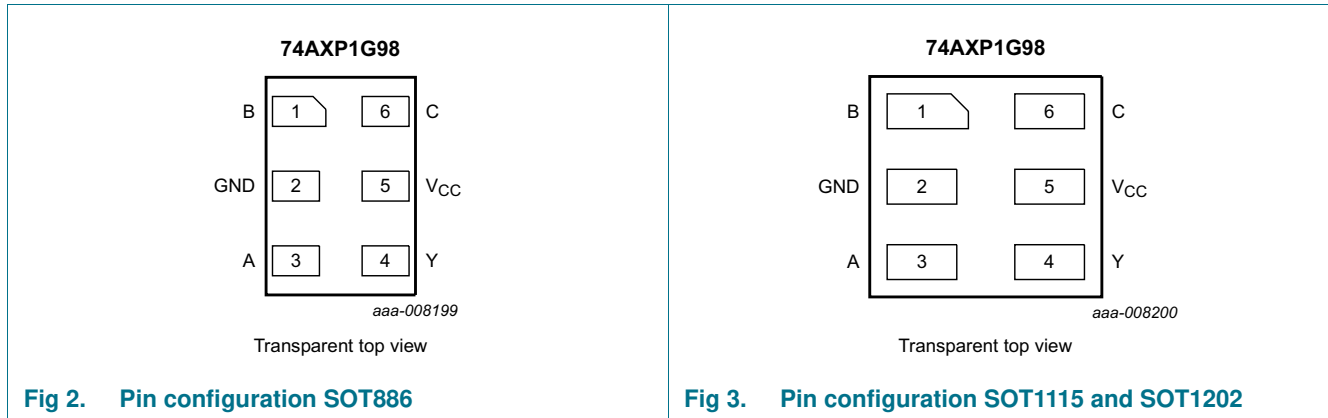


Fig 1. Logic symbol

6. Pinning information

6.1 Pinning



6.2 Pin description

Table 3. Pin description

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

7. Functional description

Table 4. Function table^[1]

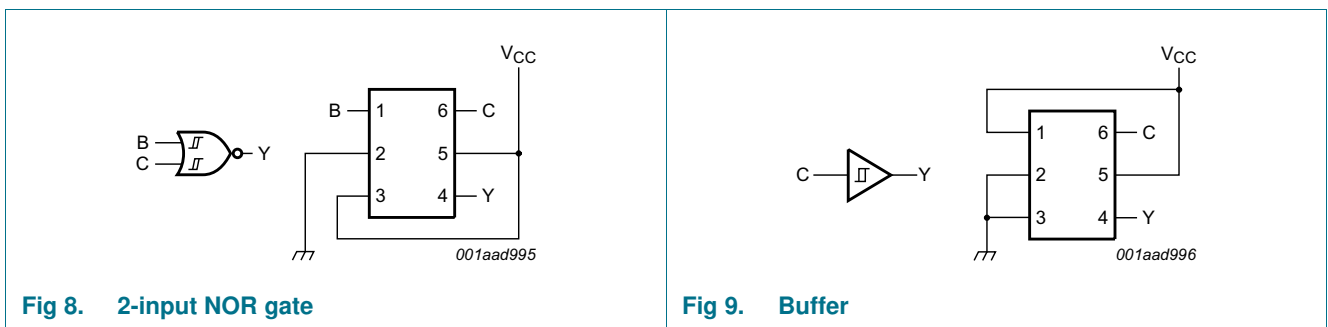
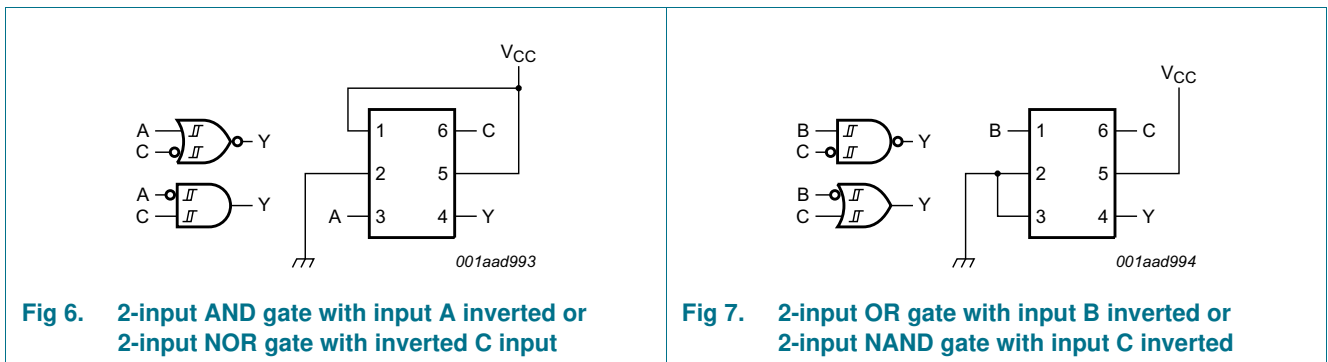
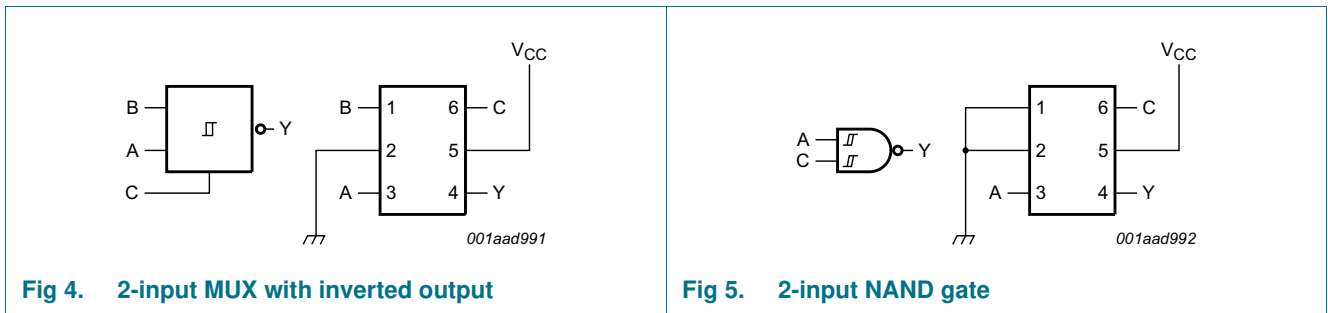
Input			Output
C	B	A	Y
L	L	L	H
L	L	H	H
L	H	L	L
L	H	H	L
H	L	L	H
H	L	H	L
H	H	L	H
H	H	H	L

[1] H = HIGH voltage level;
L = LOW voltage level.

7.1 Logic configurations

Table 5. Function selection table

Logic function	Figure
2-input MUX with inverted output	see Figure 4
2-input NAND	see Figure 5
2-input NOR with one input inverted	see Figure 6
2-input AND with one input inverted	see Figure 6
2-input NAND with one input inverted	see Figure 7
2-input OR with one input inverted	see Figure 7
2-input NOR	see Figure 8
Buffer	see Figure 9
Inverter	see Figure 10



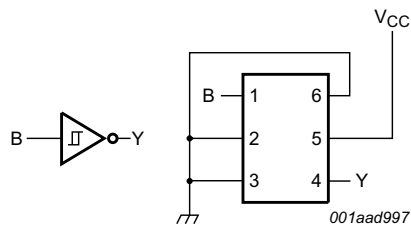


Fig 10. Inverter

8. Limiting values

Table 6. 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		[1] -0.5	+3.3	V
I_{OK}	output clamping current	$V_O < 0$ V	-50	-	mA
V_O	output voltage		[1] -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 7. 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

10. Static characteristics

Table 8. Static characteristics

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

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +85 °C				Unit	
			Min	Typ 25 °C	Max 25 °C	Max 85 °C		
V _{T+}	positive-going threshold voltage	see Figure 11 and Figure 12						
		V _{CC} = 0.75 V to 0.85 V	0.3V _{CC}	-	0.8V _{CC}	0.8V _{CC}	V	
		V _{CC} = 1.1 V to 1.95 V	0.4V _{CC}	-	0.7V _{CC}	0.7V _{CC}	V	
		V _{CC} = 2.3 V to 2.7 V	0.9	-	1.7	1.7	V	
V _{T-}	negative-going threshold voltage	see Figure 11 and Figure 12						
		V _{CC} = 0.75 V to 0.85 V	0.2V _{CC}	-	0.7V _{CC}	0.7V _{CC}	V	
		V _{CC} = 1.1 V to 1.95 V	0.3V _{CC}	-	0.6V _{CC}	0.6V _{CC}	V	
		V _{CC} = 2.3 V to 2.7 V	0.7	-	1.5	1.5	V	
V _H	hysteresis voltage	see Figure 11 and Figure 12						
		V _{CC} = 0.75 V to 0.85 V	0.06V _{CC}	-	0.5V _{CC}	0.5V _{CC}	V	
		V _{CC} = 1.1 V to 1.95 V	0.1V _{CC}	-	0.4V _{CC}	0.4V _{CC}	V	
		V _{CC} = 2.3 V to 2.7 V	0.2	-	1.0	1.0	V	
V _{OH}	HIGH-level output voltage	I _O = -20 μA; V _{CC} = 0.7 V	-	0.69	-	-	V	
		I _O = -100 μA; V _{CC} = 0.75 V	0.65	-	-	-	V	
		I _O = -2 mA; V _{CC} = 1.1 V	0.825	-	-	-	V	
		I _O = -3 mA; V _{CC} = 1.4 V	1.05	-	-	-	V	
		I _O = -4.5 mA; V _{CC} = 1.65 V	1.2	-	-	-	V	
		I _O = -8 mA; V _{CC} = 2.3 V	1.7	-	-	-	V	
V _{OL}	LOW-level output voltage	I _O = 20 μA; V _{CC} = 0.7 V	-	0.01	-	-	V	
		I _O = 100 μA; V _{CC} = 0.75 V	-	-	0.1	0.1	V	
		I _O = 2 mA; V _{CC} = 1.1 V	-	-	0.275	0.275	V	
		I _O = 3 mA; V _{CC} = 1.4 V	-	-	0.35	0.35	V	
		I _O = 4.5 mA; V _{CC} = 1.65 V	-	-	0.45	0.45	V	
		I _O = 8 mA; V _{CC} = 2.3 V	-	-	0.7	0.7	V	
I _I	input leakage current	V _I = 0 V to 2.75 V; V _{CC} = 0 V to 2.75 V	[1]	-	0.001	±0.1	±0.5	μA
I _{OFF}	power-off leakage current	V _I or V _O = 0 V to 2.75 V; V _{CC} = 0 V	[1]	-	0.01	±0.1	±0.5	μA
ΔI _{OFF}	additional power-off leakage current	V _I or V _O = 0 V or 2.75 V; V _{CC} = 0 V to 0.1 V	[1]	-	0.02	±0.1	±0.5	μA
I _{CC}	supply current	V _I = 0 V or V _{CC} ; I _O = 0 A	[1]	-	0.01	0.3	0.6	μA
ΔI _{CC}	additional supply current	V _I = V _{CC} - 0.5 V; I _O = 0 A; V _{CC} = 2.5 V		-	2	100	150	μA

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

10.1 Waveform transfer characteristics

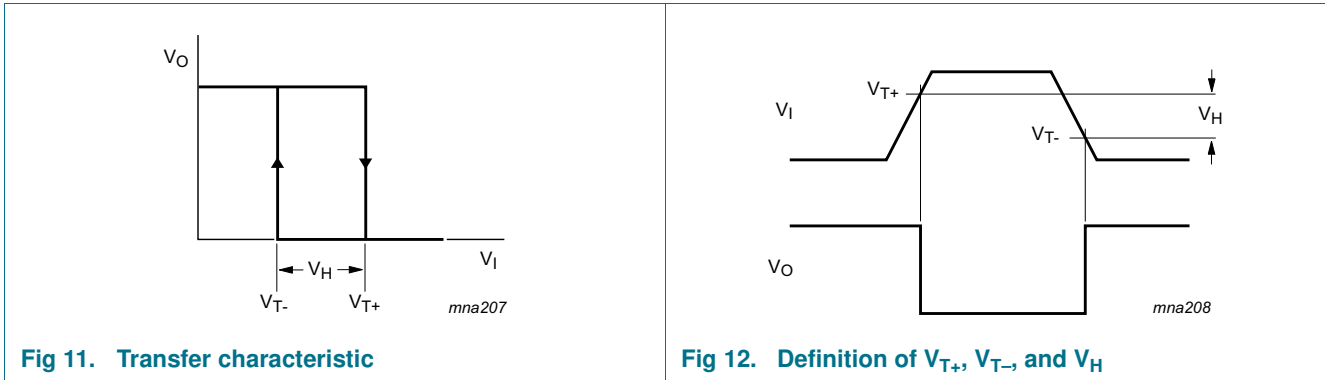


Fig 11. Transfer characteristic

Fig 12. Definition of V_{T+} , V_{T-} , and V_H

11. Dynamic characteristics

Table 9. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit, see Figure 19.

Symbol	Parameter	Conditions	$T_{amb} = 25\text{ }^{\circ}\text{C}$			$T_{amb} = -40\text{ }^{\circ}\text{C to } +85\text{ }^{\circ}\text{C}$		Unit
			Min	Typ ^[1]	Max	Min	Max	
t_{pd}	propagation delay	A, B, C to Y; see Figure 13 [2][3]						
		$V_{CC} = 0.75\text{ V to } 0.85\text{ V}$	3	13	64	2	166	ns
		$V_{CC} = 1.1\text{ V to } 1.3\text{ V}$	2.0	4.9	8.9	2.0	9.3	ns
		$V_{CC} = 1.4\text{ V to } 1.6\text{ V}$	1.7	3.7	6.0	1.6	6.4	ns
		$V_{CC} = 1.65\text{ V to } 1.95\text{ V}$	1.4	3.1	5.0	1.3	5.3	ns
		$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$	1.2	2.4	3.8	1.1	4.1	ns
t_t	transition time	$V_{CC} = 2.7\text{ V}$; see Figure 13 [4]	-	-	-	1.0	-	ns
C_I	input capacitance	$V_I = 0\text{ V or } V_{CC}$; $V_{CC} = 0\text{ V to } 2.75\text{ V}$	-	0.5	-	-	-	pF
C_O	output capacitance	$V_O = 0\text{ V}; V_{CC} = 0\text{ V}$	-	1.0	-	-	-	pF

Table 9. Dynamic characteristics ...continued
 Voltages are referenced to GND (ground = 0 V); for test circuit, see [Figure 19](#).

Symbol	Parameter	Conditions	T _{amb} = 25 °C			T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
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	-	2.6	-	-	-	pF
		V _{CC} = 1.1 V to 1.3 V	-	2.7	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V	-	2.8	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V	-	3	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	3.3	-	-	-	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 14](#) to [Figure 18](#).
- [4] t_i 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

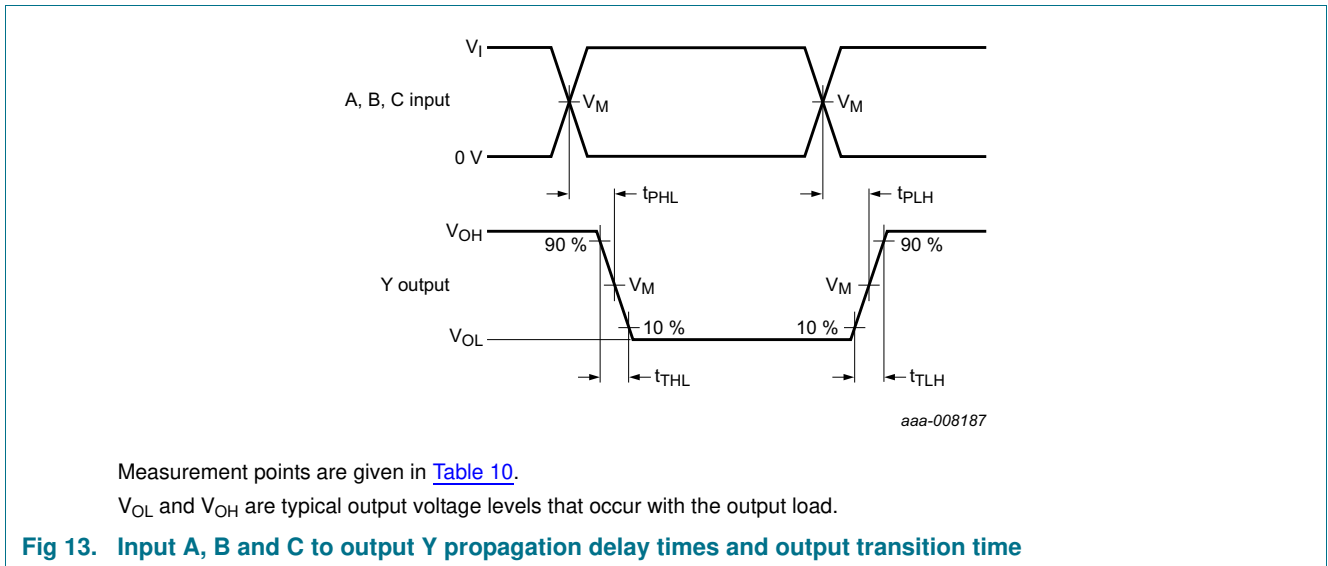
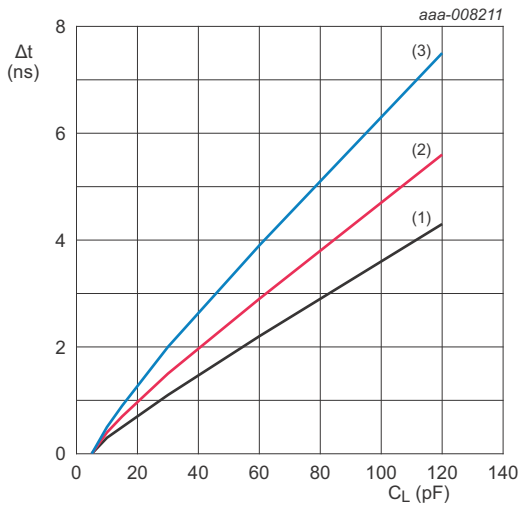


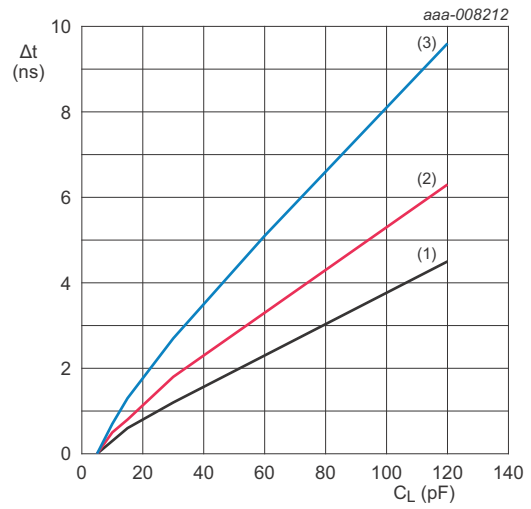
Table 10. Measurement points

Supply voltage	Input			Output
V _{CC}	V _M	V _I	t _r = t _f	V _M
0.75 V to 2.7 V	0.5V _{CC}	V _{CC}	≤ 3.0 ns	0.5V _{CC}



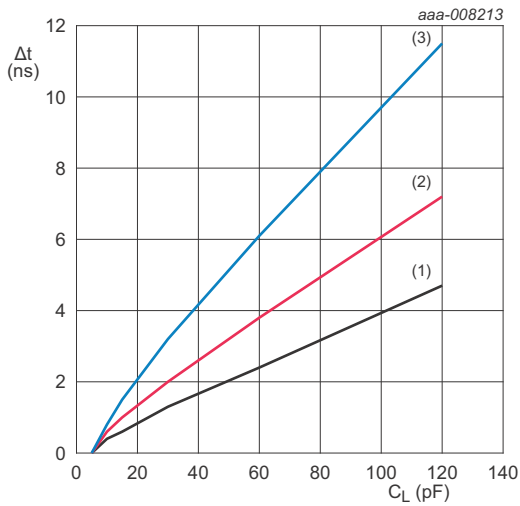
- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 2.7\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 2.5\text{ V}$
 - (3) Maximum: $V_{CC} = 2.3\text{ V}$

Fig 14. Additional t_{pd} versus load capacitance



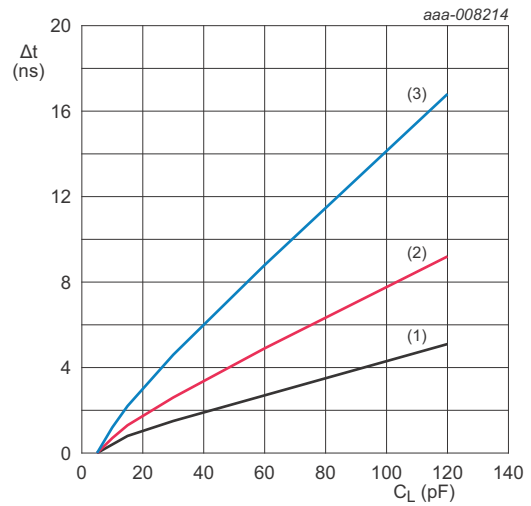
- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 1.95\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.8\text{ V}$
 - (3) Maximum: $V_{CC} = 1.65\text{ V}$

Fig 15. Additional t_{pd} versus load capacitance



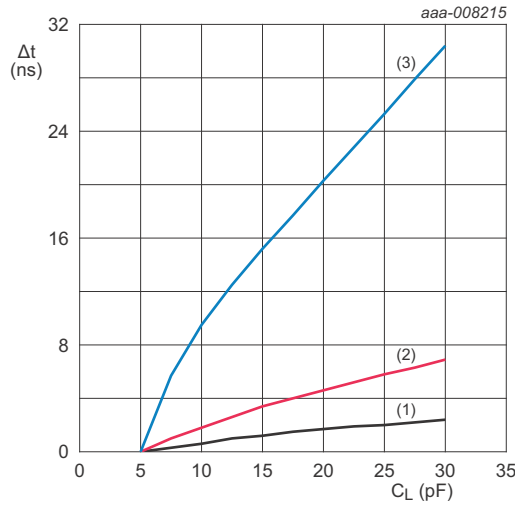
- $T_{amb} = -40\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$ unless otherwise specified.
- (1) Minimum: $V_{CC} = 1.6\text{ V}$
 - (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.5\text{ V}$
 - (3) Maximum: $V_{CC} = 1.4\text{ V}$

Fig 16. 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: $V_{CC} = 1.1\text{ V}$

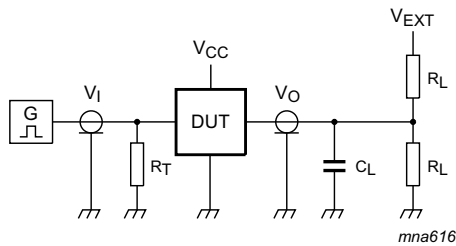
Fig 17. Additional t_{pd} versus load capacitance



T_{amb} = -40 °C to +85 °C unless otherwise specified.

- (1) Minimum: V_{CC} = 0.85 V
- (2) Typical: T_{amb} = 25 °C; V_{CC} = 0.8 V
- (3) Maximum: V_{CC} = 0.75 V

Fig 18. Additional t_{pd} versus load capacitance



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 19. Test circuit for measuring switching times

Table 11. 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 kΩ	0 V	0 V	2 × 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

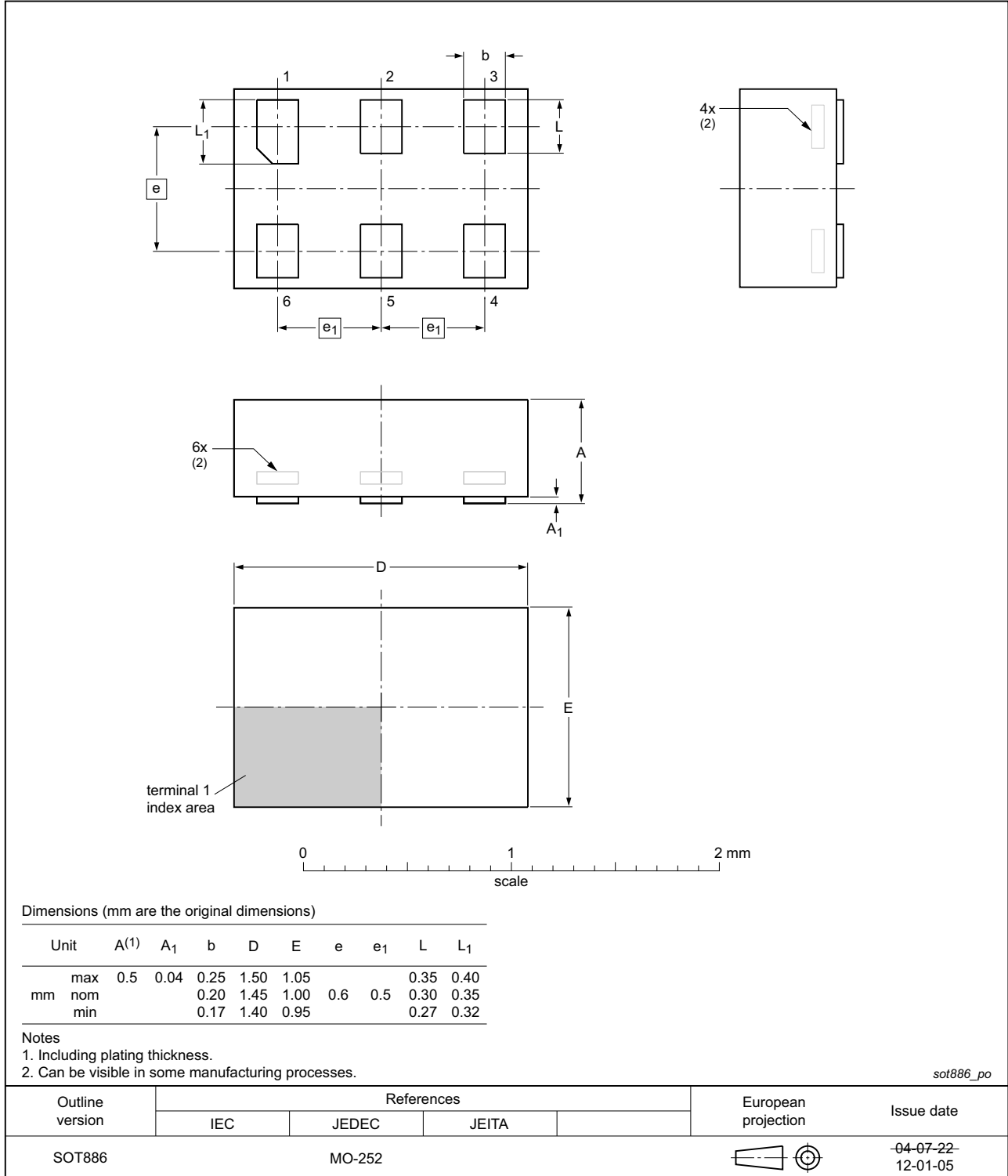


Fig 20. Package outline SOT886 (XSON6)

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

SOT1115

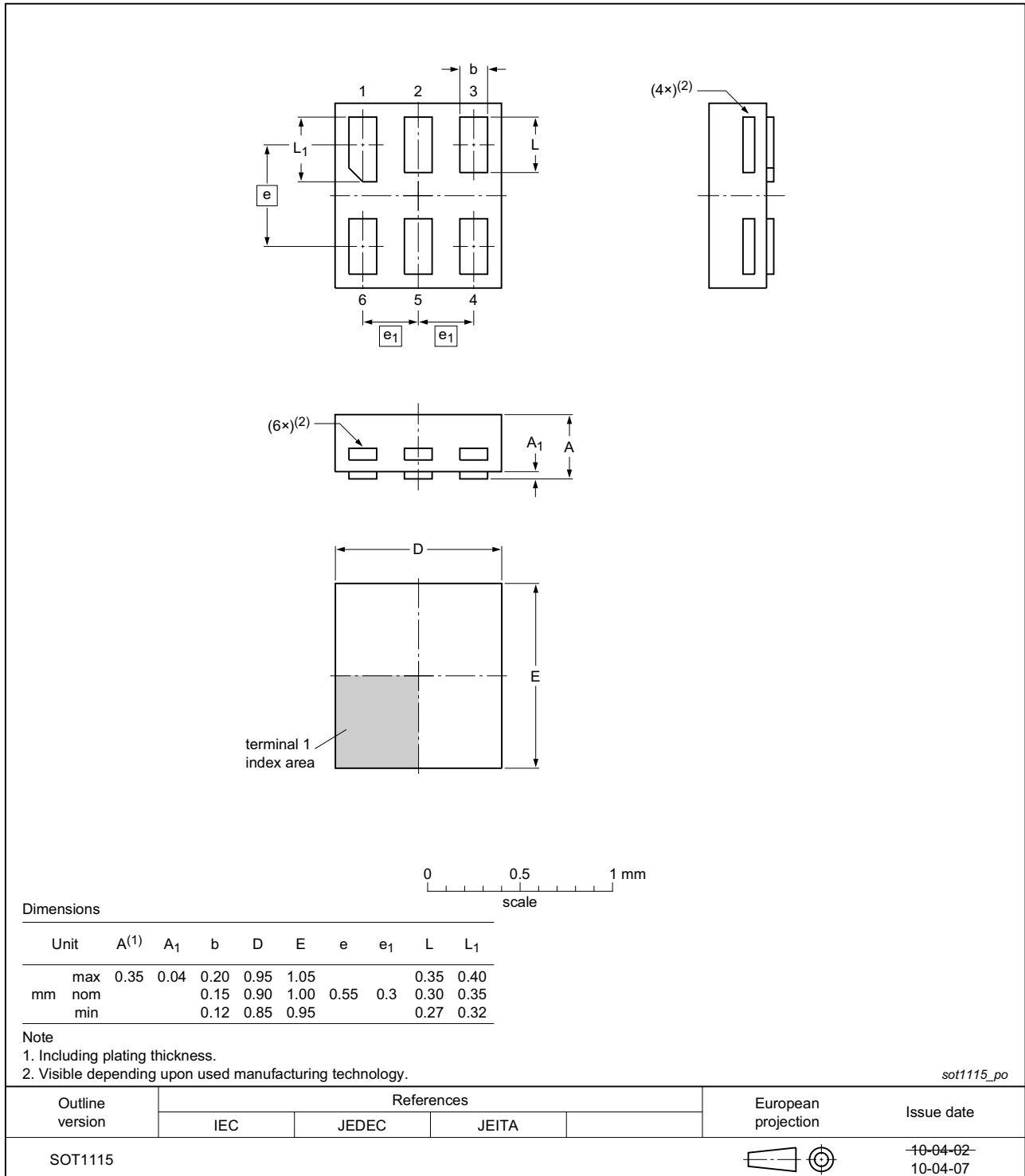


Fig 21. Package outline SOT1115 (XSON6)

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

SOT1202

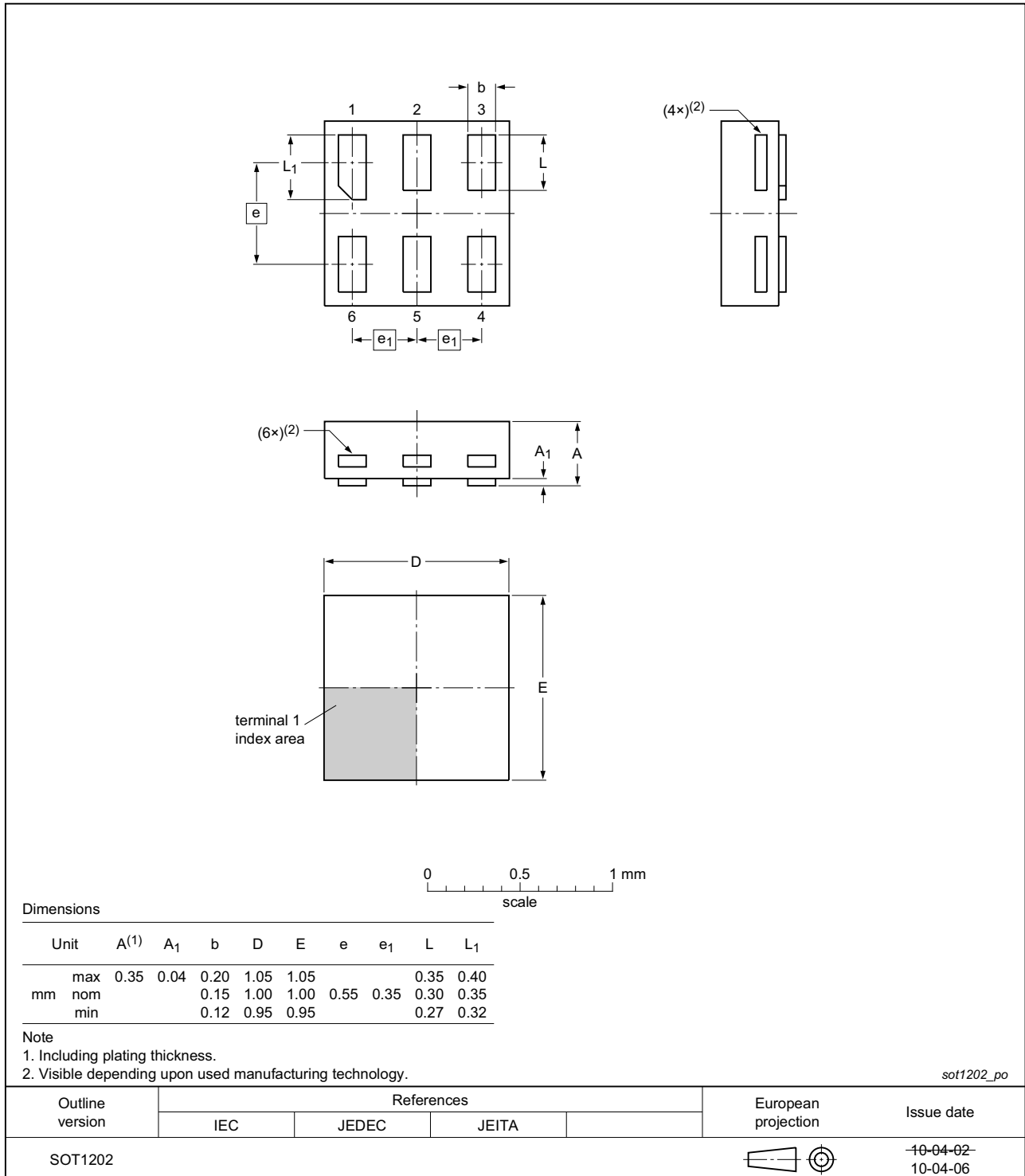


Fig 22. Package outline SOT1202 (XSON6)

14. Abbreviations

Table 12. Abbreviations

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

15. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AXP1G98 v.2	20151113	Product data sheet	-	74AXP1G98 v.1
Modifications:	• Specification status changed to product data sheet.			
74AXP1G98 v.1	20130625	Preliminary 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.
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.nexperia.com>.

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In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond

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17. Contact information

For more information, please visit: <http://www.nexperia.com>

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

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