

74AXP1G97

Low-power configurable multiple function gate

Rev. 1 — 25 June 2013

Preliminary data sheet

1. General description

The 74AXP1G97 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. This device 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
- High noise immunity
- Complies with JEDEC standard:
 - ◆ JESD8-12A.01 (wide range: 0.8 V to 1.3 V)
 - ◆ JESD8-12A.01 (normal range: 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
- Low static power consumption; $I_{CC} = 0.6 \mu\text{A}$ (85 °C maximum)
- 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	
74AXP1G97GM	-40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AXP1G97GN	-40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74AXP1G97GS	-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]
74AXP1G97GM	RV
74AXP1G97GN	RV
74AXP1G97GS	RV

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

5. Functional diagram

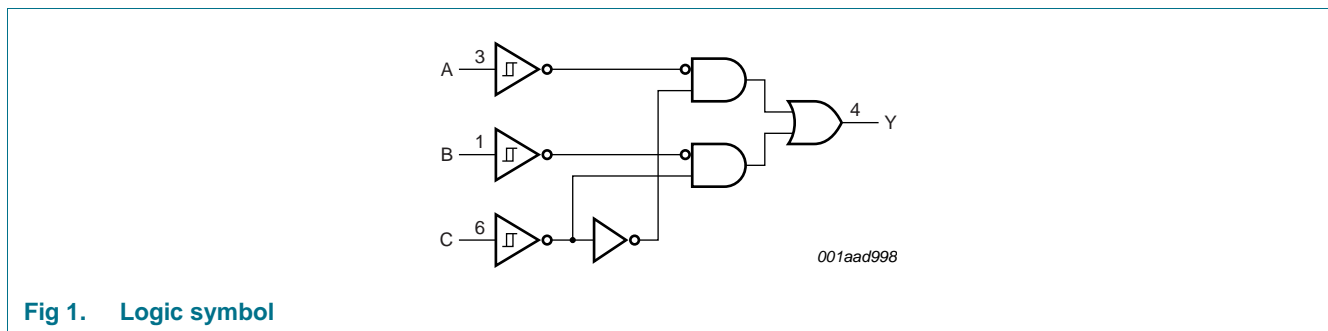
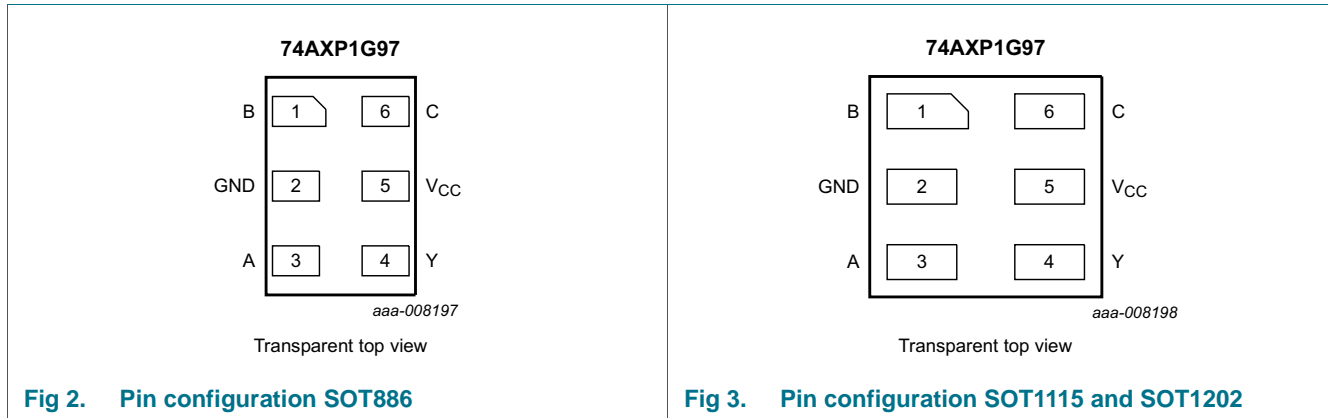


Fig 1. Logic symbol

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]

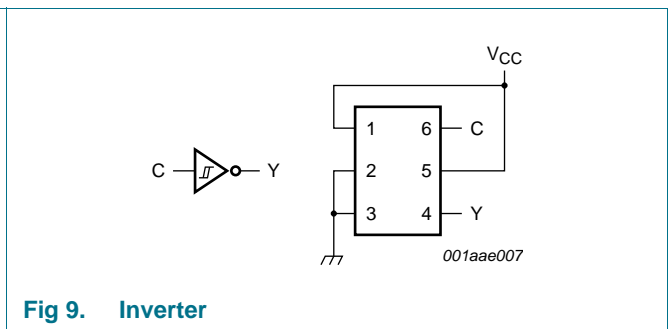
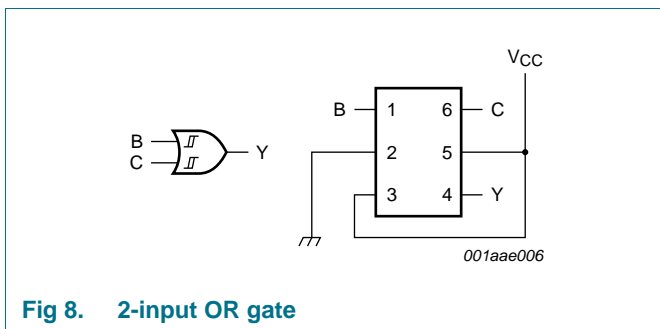
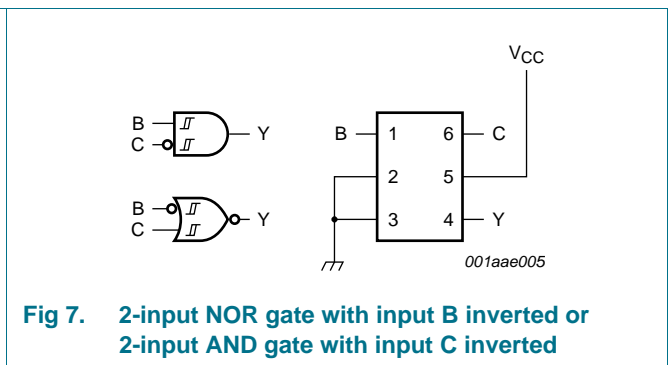
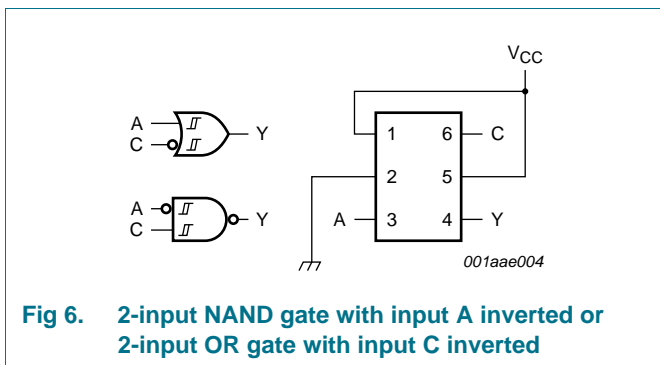
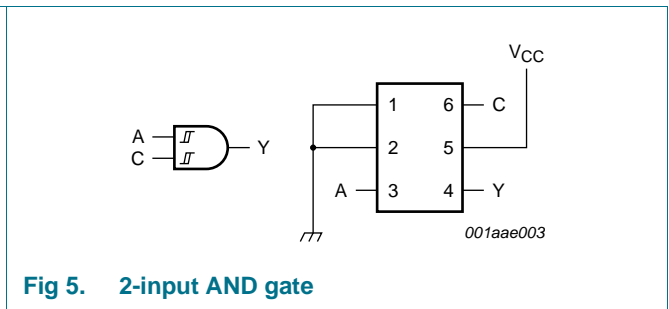
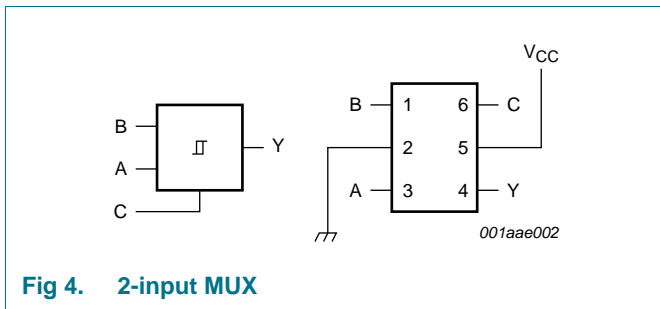
Input			Output
C	B	A	Y
L	L	L	L
L	L	H	L
L	H	L	H
L	H	H	H
H	L	L	L
H	L	H	H
H	H	L	L
H	H	H	H

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

7.1 Logic configurations

Table 5. Function selection table

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



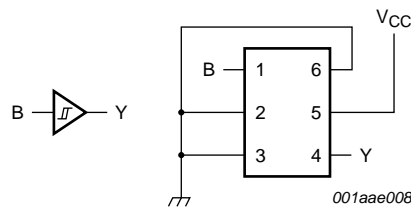


Fig 10. Buffer

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	$V_I < 0\text{ V}$	-50	-	mA
V_I	input voltage		[1] -0.5	3.3	V
I_{OK}	output clamping current	$V_O < 0\text{ V}$	-50	-	mA
V_O	output voltage	Active mode and Power-down mode	[1] -0.5	3.3	V
I_O	output current	$V_O = 0\text{ V to }V_{CC}$	-	± 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	$T_{amb} = -40\text{ °C to }+85\text{ °C}$	-	250	mW

[1] The 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; $V_{CC} = 0\text{ V}$	0	2.75	V
T_{amb}	ambient temperature		-40	+85	°C

10. Static characteristics

Table 8. Static characteristics

$V_{CC} = 0.7\text{ V to }2.75\text{ V}$, unless otherwise specified; At recommended operating conditions; 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_{T+}	positive-going threshold voltage	see Figure 11 and Figure 12						
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.35V_{CC}$	-	$0.75V_{CC}$	$0.75V_{CC}$	V	
		$V_{CC} = 1.1\text{ V to }1.95\text{ V}$	$0.4V_{CC}$	-	$0.7V_{CC}$	$0.7V_{CC}$	V	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.9	-	1.7	1.7	V	
V_{T-}	negative-going threshold voltage	see Figure 11 and Figure 12						
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.25V_{CC}$	-	$0.65V_{CC}$	$0.65V_{CC}$	V	
		$V_{CC} = 1.1\text{ V to }1.95\text{ V}$	$0.3V_{CC}$	-	$0.6V_{CC}$	$0.6V_{CC}$	V	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.7	-	1.5	1.5	V	
V_H	hysteresis voltage	see Figure 11 and Figure 12						
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.1V_{CC}$	-	$0.5V_{CC}$	$0.5V_{CC}$	V	
		$V_{CC} = 1.1\text{ V to }1.95\text{ V}$	$0.1V_{CC}$	-	$0.4V_{CC}$	$0.4V_{CC}$	V	
		$V_{CC} = 2.3\text{ V to }2.7\text{ V}$	0.2	-	1.0	1.0	V	
V_{OH}	HIGH-level output voltage	$I_O = -20\text{ }\mu\text{A}$	$V_{CC}-0.05$				V	
		$I_O = -100\text{ }\mu\text{A}; V_{CC} = 0.75\text{ V}$	$V_{CC}-0.1$	-	-	-	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	$I_O = 20\text{ }\mu\text{A}$	-	-	0.05	0.05	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]	-	<tbid>	± 0.1	± 0.5	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 0\text{ V to }2.75\text{ V}; V_{CC} = 0\text{ V}$	-	-	± 0.1	± 0.5	μA	
ΔI_{OFF}	additional power-off leakage current	V_I or $V_O = 0\text{ V to }2.75\text{ V}; V_{CC} = 0\text{ V to }0.2\text{ V}$	-	-	± 0.1	± 0.5	μA	
I_{CC}	supply current	$V_I = 0\text{ V or }V_{CC}; I_O = 0\text{ A}$	[1]	-	<tbid>	0.3	0.6	μA
ΔI_{CC}	additional supply current	$V_I = V_{CC} - 0.5\text{ V}; I_O = 0\text{ A}; V_{CC} = 2.5\text{ V}$	-	-	100	150	μA	

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

10.1 Waveform transfer characteristics

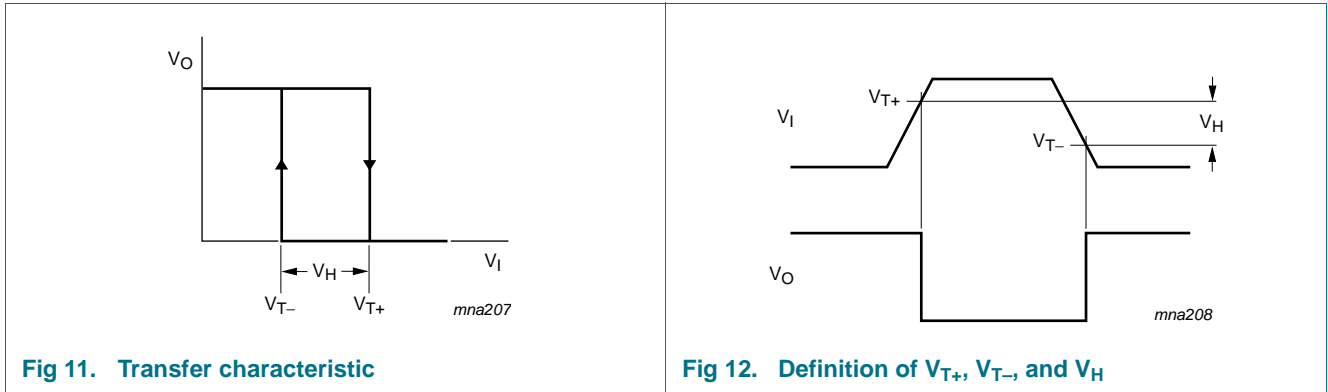


Fig 11. Transfer characteristic

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 °C			T _{amb} = -40 °C to +85 °C		Unit
			Min	Typ ^[1]	Max	Min	Max	
t _{pd}	propagation delay	A, B and C to Y; see Figure 13 [2][3]						
		V _{CC} = 0.75 V to 0.85 V	3.6	12.3	41	3.2	95	ns
		V _{CC} = 1.1 V to 1.3 V	2.4	4.5	7.5	2.1	8.0	ns
		V _{CC} = 1.4 V to 1.6 V	2.0	3.4	5.2	1.6	5.6	ns
		V _{CC} = 1.65 V to 1.95 V	1.7	2.8	4.3	1.4	4.6	ns
		V _{CC} = 2.3 V to 2.7 V	1.4	2.2	3.4	1.1	3.6	ns
t _t	transition time	V _{CC} = 2.7 V; see Figure 13 [4]	1.0	-	-	-	-	ns
C _I	input capacitance	V _I = 0 V or V _{CC} ; V _{CC} = 0 V to 2.75 V	-	1	-	-	-	pF
C _O	output capacitance	V _O = 0 V; V _{CC} = 0 V	-	2	-	-	-	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	-	3.0	-	-	-	pF
		V _{CC} = 1.1 V to 1.3 V	-	2.9	-	-	-	pF
		V _{CC} = 1.4 V to 1.6 V	-	3.0	-	-	-	pF
		V _{CC} = 1.65 V to 1.95 V	-	3.2	-	-	-	pF
		V _{CC} = 2.3 V to 2.7 V	-	3.7	-	-	-	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_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).
 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma(C_L \times V_{CC}^2 \times f_o)$ 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 graphs

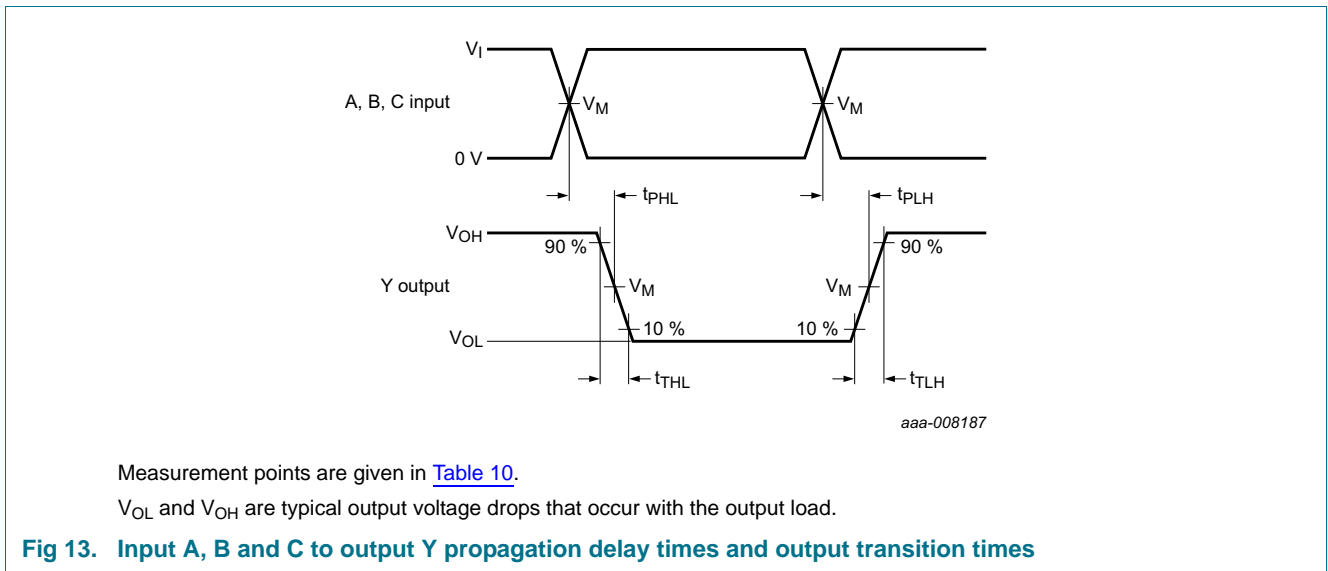
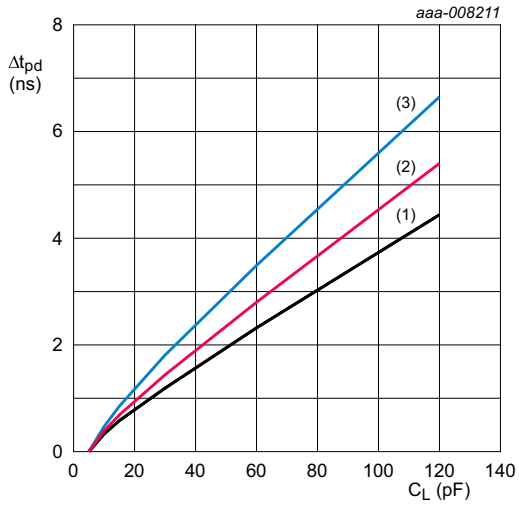


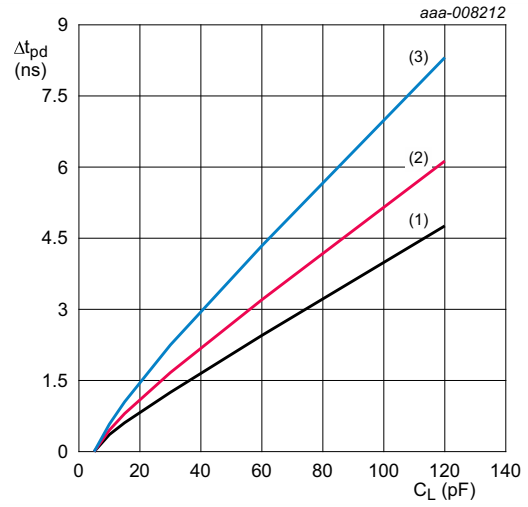
Table 10. Measurement points

Supply voltage	Output	Input		
V _{CC}	V _M	V _M	V _I	t _r = t _f
0.75 V to 2.75 V	0.5 × V _{CC}	0.5 × V _{CC}	V _{CC}	≤ 3.0 ns



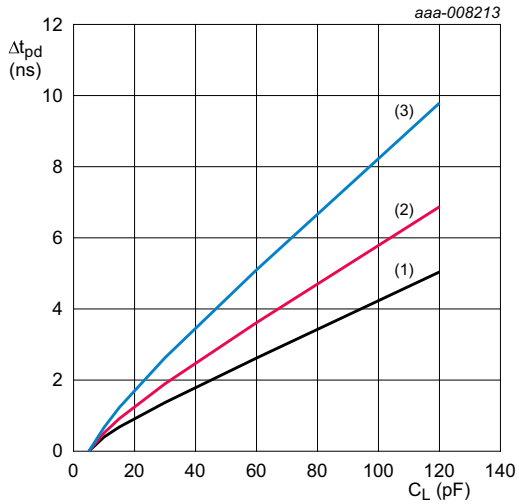
- T_{amb} = -40 °C to +85 °C unless otherwise specified.
- (1) Minimum: V_{CC} = 2.3 V to 2.7 V
 - (2) Typical: T_{amb} = 25 °C; V_{CC} = 2.5 V
 - (3) Maximum: V_{CC} = 2.3 V to 2.7 V

Fig 14. Additional propagation delay versus load capacitance



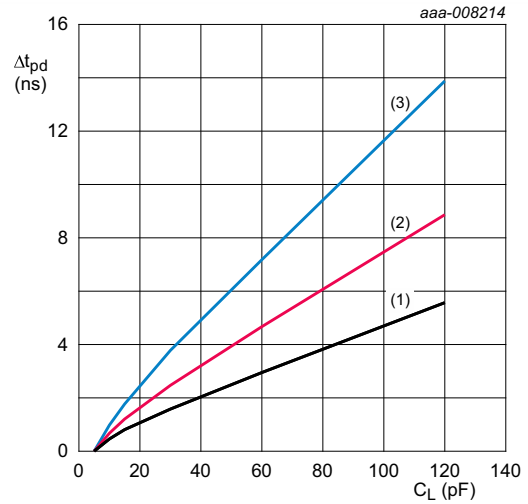
- T_{amb} = -40 °C to +85 °C unless otherwise specified.
- (1) Minimum: V_{CC} = 1.65 V to 1.95 V
 - (2) Typical: T_{amb} = 25 °C; V_{CC} = 1.8 V
 - (3) Maximum: V_{CC} = 1.65 V to 1.95 V

Fig 15. Additional propagation delay versus load capacitance



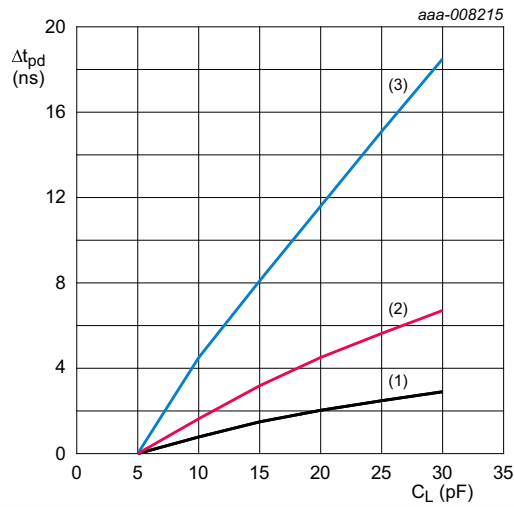
- T_{amb} = -40 °C to +85 °C unless otherwise specified.
- (1) Minimum: V_{CC} = 1.4 V to 1.6 V
 - (2) Typical: T_{amb} = 25 °C; V_{CC} = 1.5 V
 - (3) Maximum: V_{CC} = 1.4 V to 1.6 V

Fig 16. Additional propagation delay versus load capacitance



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

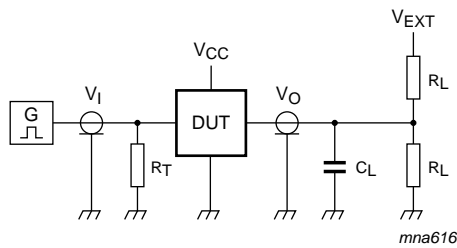
Fig 17. Additional propagation delay versus load capacitance



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

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

Fig 18. Additional propagation delay 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 2.75 V	5 pF	10 k Ω	0 V	0 V	$2 \times V_{CC}$

12. Package outline

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

SOT886

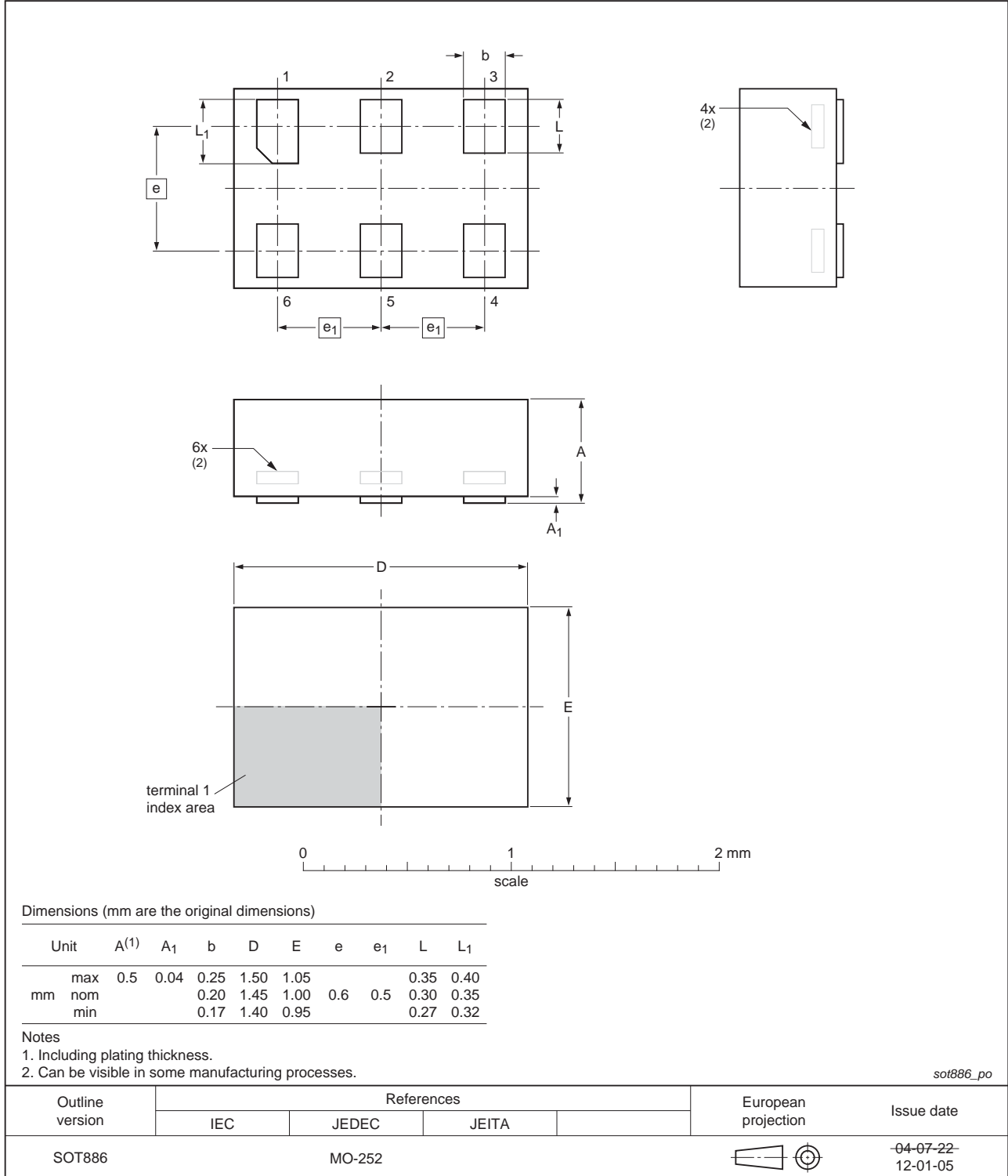


Fig 20. Package outline SOT886 (XSON6)

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

SOT1115

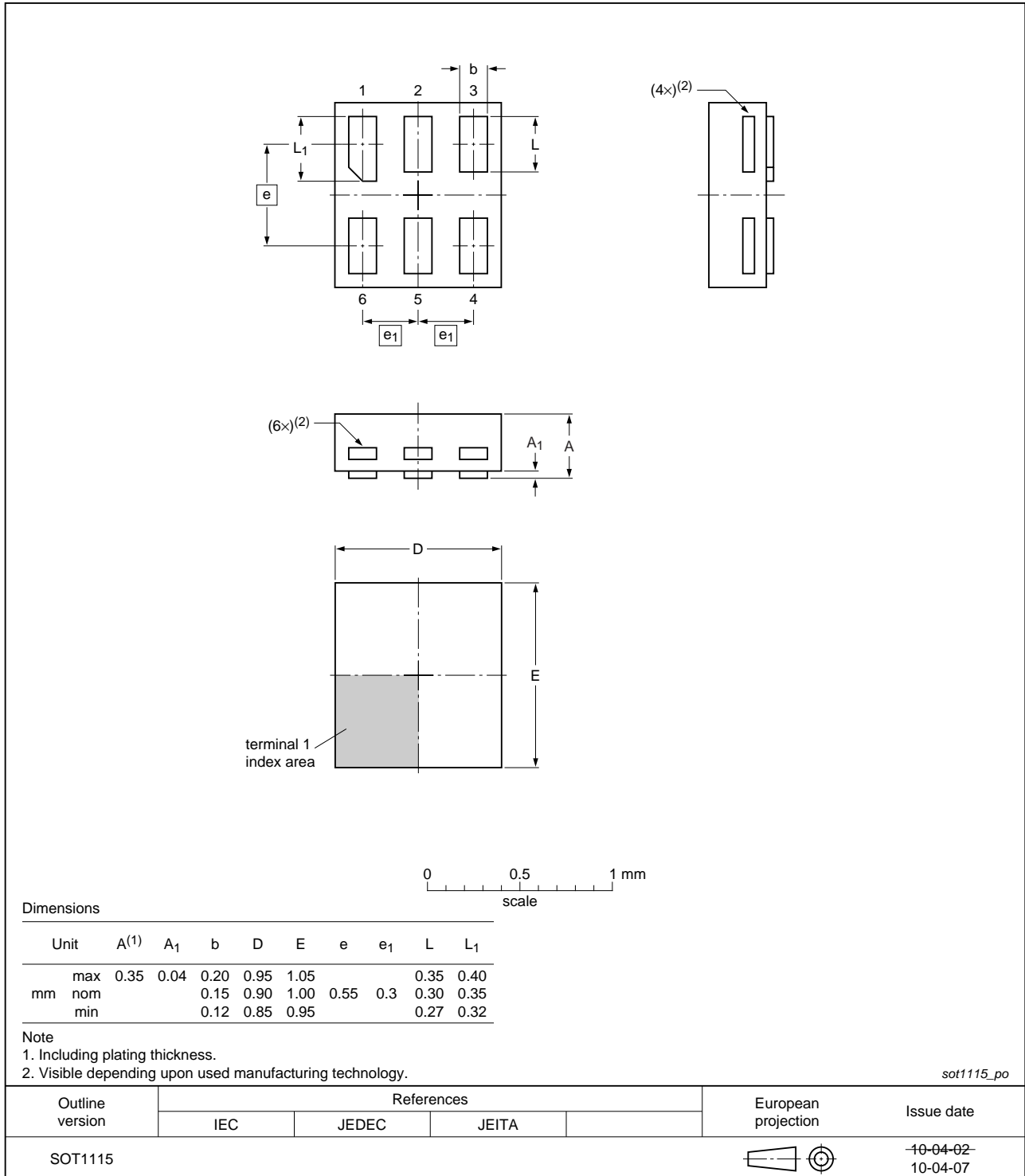


Fig 21. Package outline SOT1115 (XSON6)

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

SOT1202

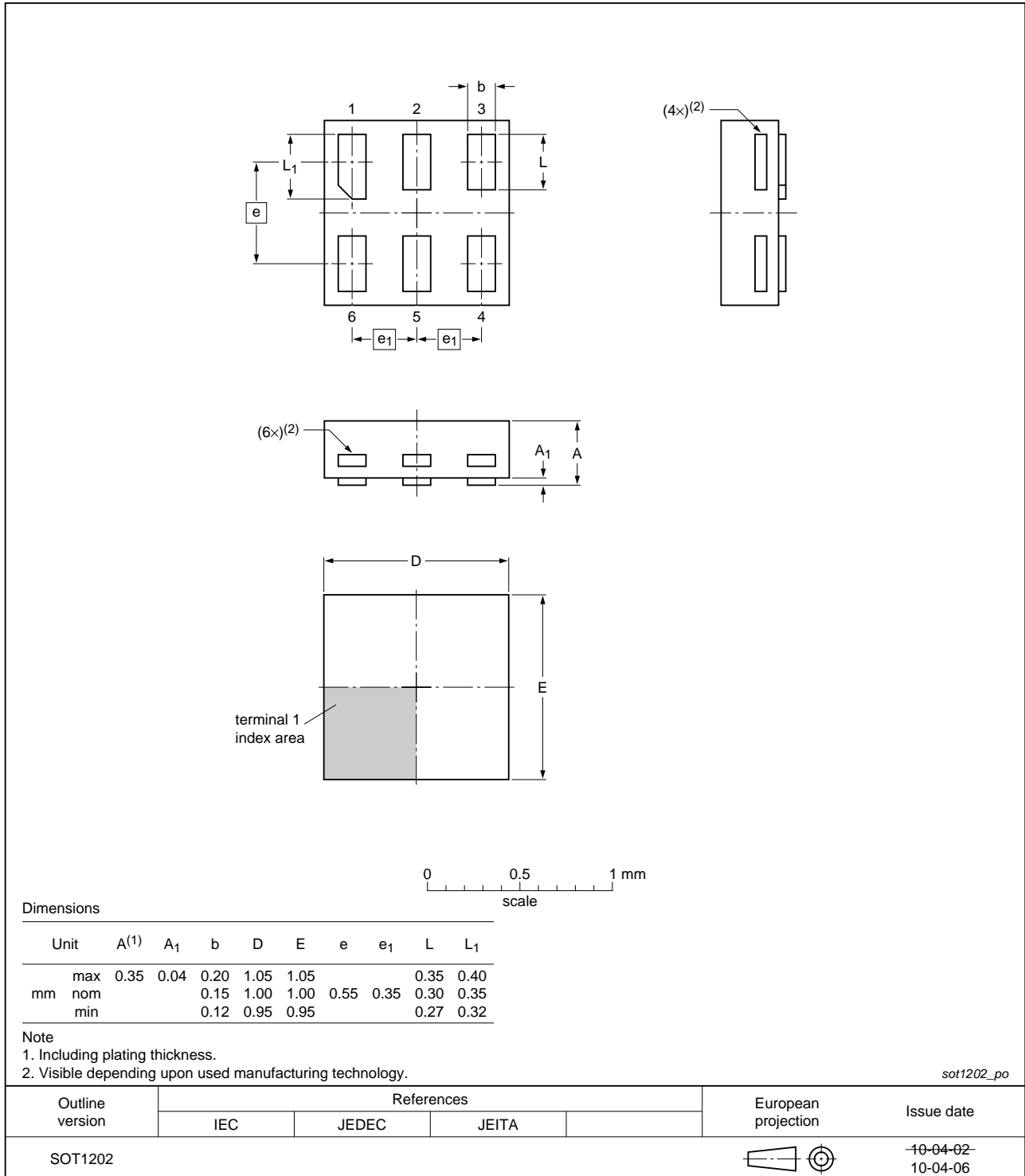


Fig 22. Package outline SOT1202 (XSON6)

13. Abbreviations

Table 12. Abbreviations

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

14. Revision history

Table 13. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74AXP1G97 v.1	20130625	Preliminary data sheet	-	-

15. Legal information

15.1 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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17. Contents

1 General description 1

2 Features and benefits 1

3 Ordering information 2

4 Marking 2

5 Functional diagram 2

6 Pinning information 3

6.1 Pinning 3

6.2 Pin description 3

7 Functional description 3

7.1 Logic configurations 4

8 Limiting values 5

9 Recommended operating conditions 5

10 Static characteristics 6

10.1 Waveform transfer characteristics 7

11 Dynamic characteristics 7

11.1 Waveforms and graphs 8

12 Package outline 11

13 Abbreviations 14

14 Revision history 14

15 Legal information 15

15.1 Data sheet status 15

15.2 Definitions 15

15.3 Disclaimers 15

15.4 Trademarks 16

16 Contact information 16

17 Contents 17

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