

74AXP1G58

Low-power configurable multiple function gate

Rev. 3 — 16 September 2015

Product data sheet

1. General description

The 74AXP1G58 is a configurable multiple function gate with Schmitt-trigger inputs. The device can be configured as any of the following logic functions AND, OR, NAND, NOR, XOR, 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
- 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; $I_{CC} = 0.6$ 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			
	Temperature range	Name	Description	Version
74AXP1G58GM	–40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AXP1G58GN	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74AXP1G58GS	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74AXP1G58GX	–40 °C to +85 °C	X2SON6	plastic thermal extremely thin small outline package; no leads; 6 terminals; body 1 × 0.8 × 0.35 mm	SOT1255

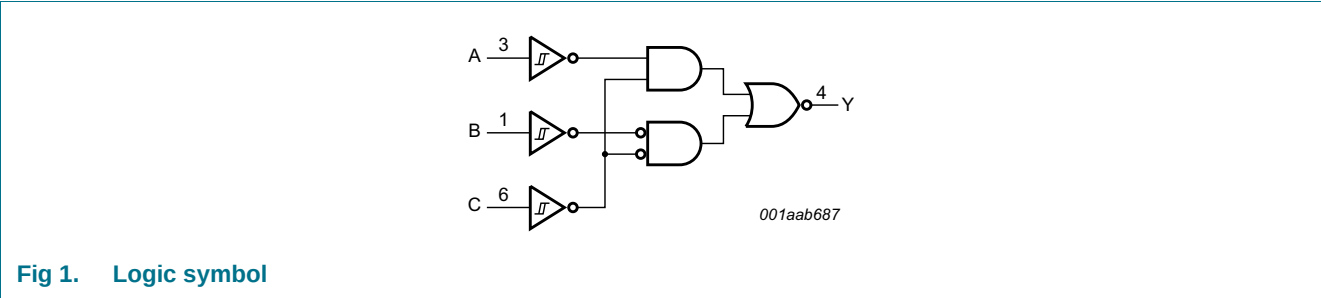
4. Marking

Table 2. Marking codes

Type number	Marking code ^[1]
74AXP1G58GM	RK
74AXP1G58GN	RK
74AXP1G58GS	RK
74AXP1G58GX	RK

[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

Transparent top view

Fig 2. Pin configuration SOT886

Transparent top view

Fig 3. Pin configuration SOT1115 and SOT1202

Transparent top view

Fig 4. Pin configuration SOT1255 (X2SON6)

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	H
L	H	L	L
L	H	H	H
H	L	L	H
H	L	H	H
H	H	L	L
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 NAND	see Figure 5
2-input NAND with both inputs inverted	see Figure 8
2-input AND with inverted input	see Figure 6 and Figure 7
2-input NOR with inverted input	see Figure 6 and Figure 7
2-input OR	see Figure 8
2-input OR with both inputs inverted	see Figure 5
2-input XOR	see Figure 9
Buffer	see Figure 10
Inverter	see Figure 11

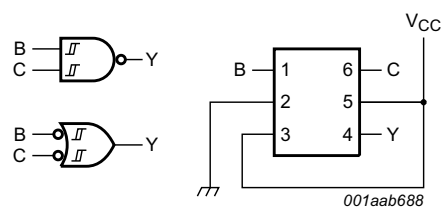


Fig 5. 2-input NAND gate or 2-input OR gate with both inputs inverted

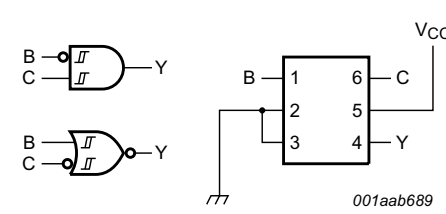


Fig 6. 2-input AND gate with inverted B input or 2-input NOR gate with inverted C input

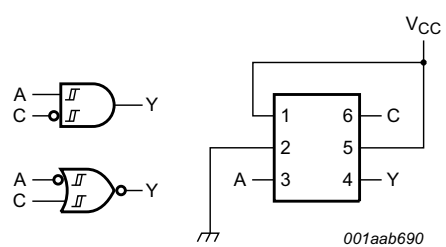


Fig 7. 2-input AND gate with inverted C input or 2-input NOR gate with inverted A input

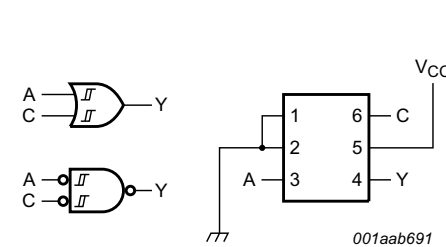


Fig 8. 2-input OR gate or 2-input NAND gate with both inputs inverted

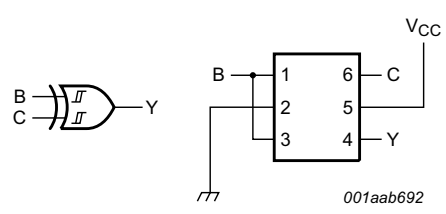


Fig 9. 2-input XOR gate

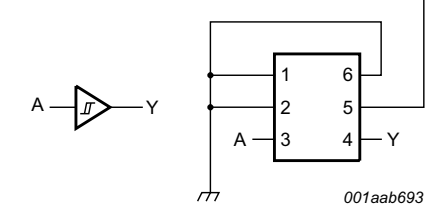


Fig 10. Buffer

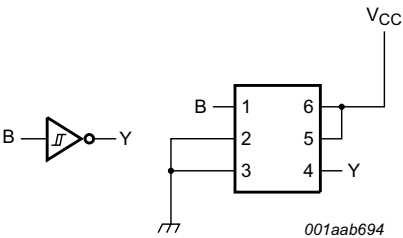


Fig 11. Inverter

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	$T_{amb} = -40\text{ °C to }+85\text{ °C}$				Unit
			Min	Typ 25 °C	Max 25 °C	Max 85 °C	
V_{T+}	positive-going threshold voltage	see Figure 12 and Figure 13					
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.3V_{CC}$	-	$0.8V_{CC}$	$0.8V_{CC}$	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 12 and Figure 13					
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.2V_{CC}$	-	$0.7V_{CC}$	$0.7V_{CC}$	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 12 and Figure 13					
		$V_{CC} = 0.75\text{ V to }0.85\text{ V}$	$0.06V_{CC}$	-	$0.5V_{CC}$	$0.5V_{CC}$	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	$I_O = -20\text{ }\mu\text{A}; V_{CC} = 0.7\text{ V}$	-	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	$V_I = 0\text{ V to }2.75\text{ V};$ [1] $V_{CC} = 0\text{ V to }2.75\text{ V}$	-	0.001	± 0.1	± 0.5	μA
I_{OFF}	power-off leakage current	V_I or $V_O = 0\text{ V to }2.75\text{ V};$ [1] $V_{CC} = 0\text{ V}$	-	0.01	± 0.1	± 0.5	μA
ΔI_{OFF}	additional power-off leakage current	V_I or $V_O = 0\text{ V or }2.75\text{ V};$ [1] $V_{CC} = 0\text{ V to }0.1\text{ V}$	-	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 $V_{CC} = 1.2\text{ V}$.

10.1 Waveform transfer characteristics

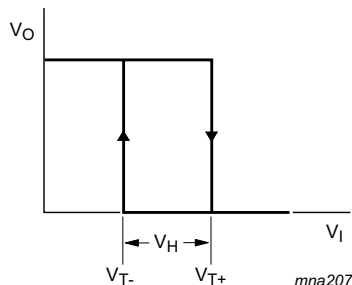
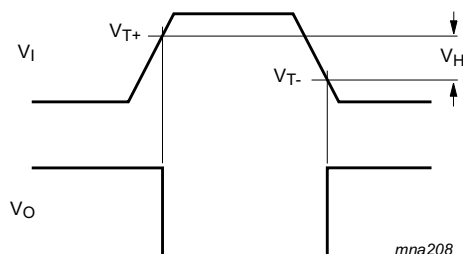


Fig 12. Transfer characteristic

Fig 13. 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 20](#).

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 and C to Y; see Figure 14 ^{[2][3]}						
		$V_{CC} = 0.75\text{ V to } 0.85\text{ V}$	3.0	14	46	1	152	ns
		$V_{CC} = 1.1\text{ V to } 1.3\text{ V}$	2.3	5.0	8.3	2.1	8.7	ns
		$V_{CC} = 1.4\text{ V to } 1.6\text{ V}$	1.9	3.7	5.6	1.7	6.0	ns
		$V_{CC} = 1.65\text{ V to } 1.95\text{ V}$	1.6	3.1	4.7	1.4	5.1	ns
		$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$	1.3	2.4	3.5	1.1	3.9	ns
t_t	transition time	$V_{CC} = 2.7\text{ V}$; see Figure 14 ^[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
C_{PD}	power dissipation capacitance	$f_i = 1\text{ MHz}$; $V_I = 0\text{ V to } V_{CC}$ ^[5]						
		$V_{CC} = 0.75\text{ V to } 0.85\text{ V}$	-	2.5	-	-	-	pF
		$V_{CC} = 1.1\text{ V to } 1.3\text{ V}$	-	2.6	-	-	-	pF
		$V_{CC} = 1.4\text{ V to } 1.6\text{ V}$	-	2.7	-	-	-	pF
		$V_{CC} = 1.65\text{ V to } 1.95\text{ V}$	-	2.9	-	-	-	pF
		$V_{CC} = 2.3\text{ V to } 2.7\text{ V}$	-	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 15](#) to [Figure 19](#).

[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;

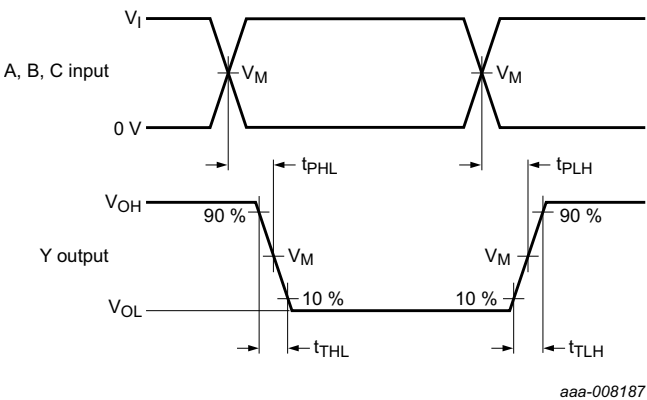
f_o = output frequency in MHz;

C_L = output load capacitance in pF;

V_{CC} = supply voltage in V;

N = number of inputs switching.

11.1 Waveforms and graphs

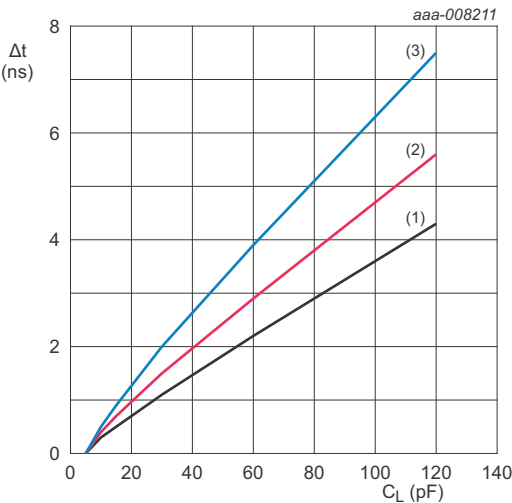


Measurement points are given in [Table 10](#).
 V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig 14. Input A, B and C to output Y propagation delay times and output transition times

Table 10. Measurement points

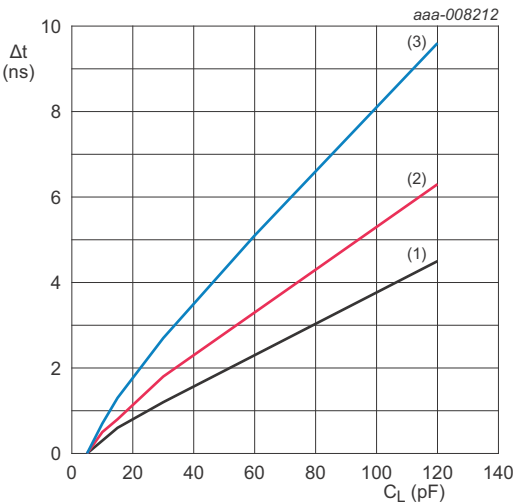
Supply voltage	Output	Input		
V_{CC}	V_M	V_M	V_I	$t_r = t_f$
0.75 V to 2.7 V	$0.5V_{CC}$	$0.5V_{CC}$	V_{CC}	≤ 3.0 ns



$T_{amb} = -40\text{ }^{\circ}\text{C}$ 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

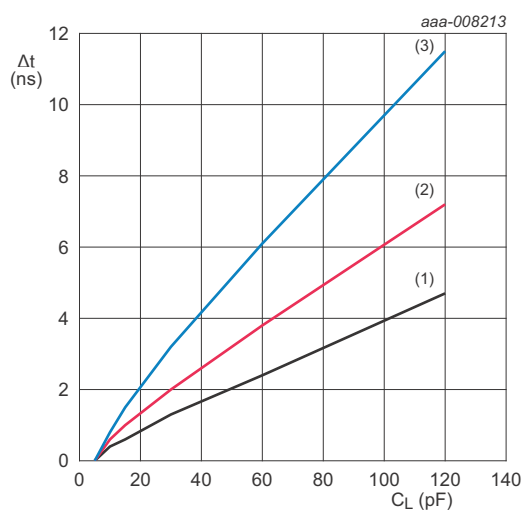
Fig 15. Additional t_{pd} versus load capacitance



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

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

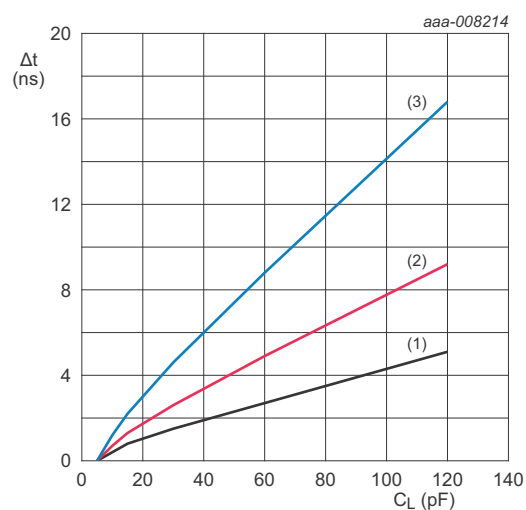
Fig 16. Additional t_{pd} versus load capacitance



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

- (1) Minimum: $V_{CC} = 1.6\text{ V}$
- (2) Typical: $T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 1.5\text{ V}$
- (3) Maximum: $V_{CC} = 1.4\text{ V}$

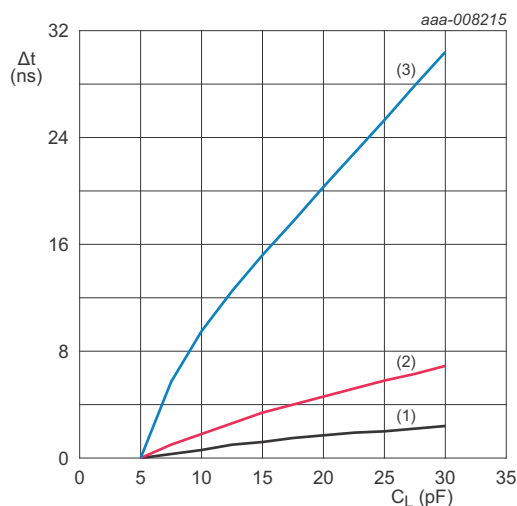
Fig 17. Additional t_{pd} versus load capacitance



$T_{amb} = -40\text{ }^{\circ}\text{C}$ 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: $V_{CC} = 1.1\text{ V}$

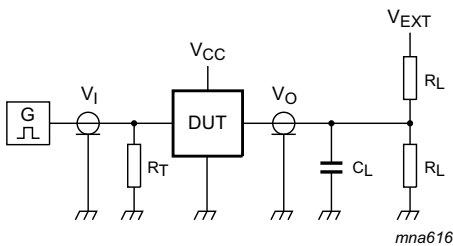
Fig 18. Additional t_{pd} versus load capacitance



$T_{amb} = -40\text{ }^{\circ}\text{C}$ 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 19. 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 20. 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	$2V_{CC}$

12. Package outline

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm SOT886

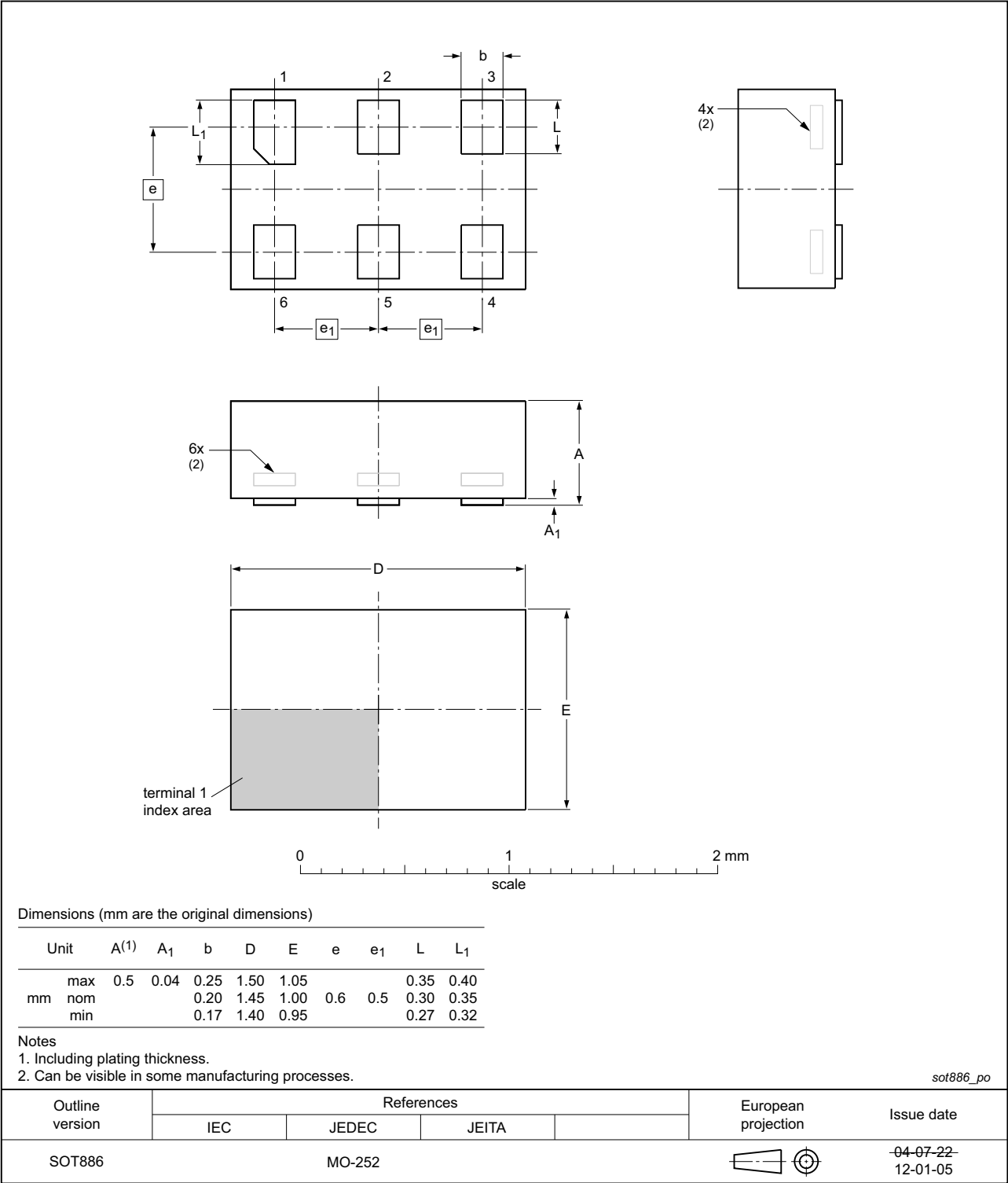


Fig 21. Package outline SOT886 (XSON6)

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

SOT1115

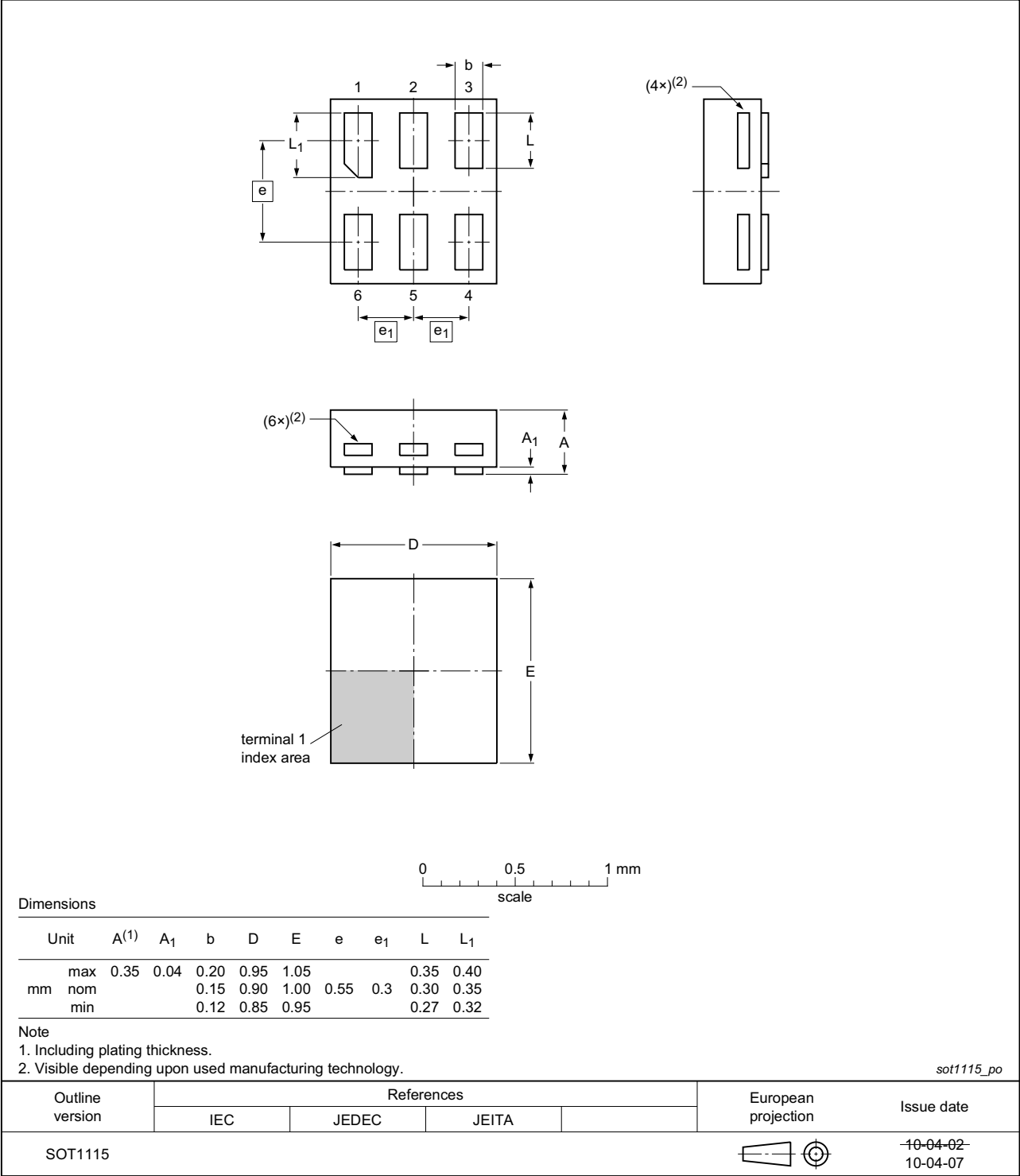


Fig 22. Package outline SOT1115 (XSON6)

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

SOT1202

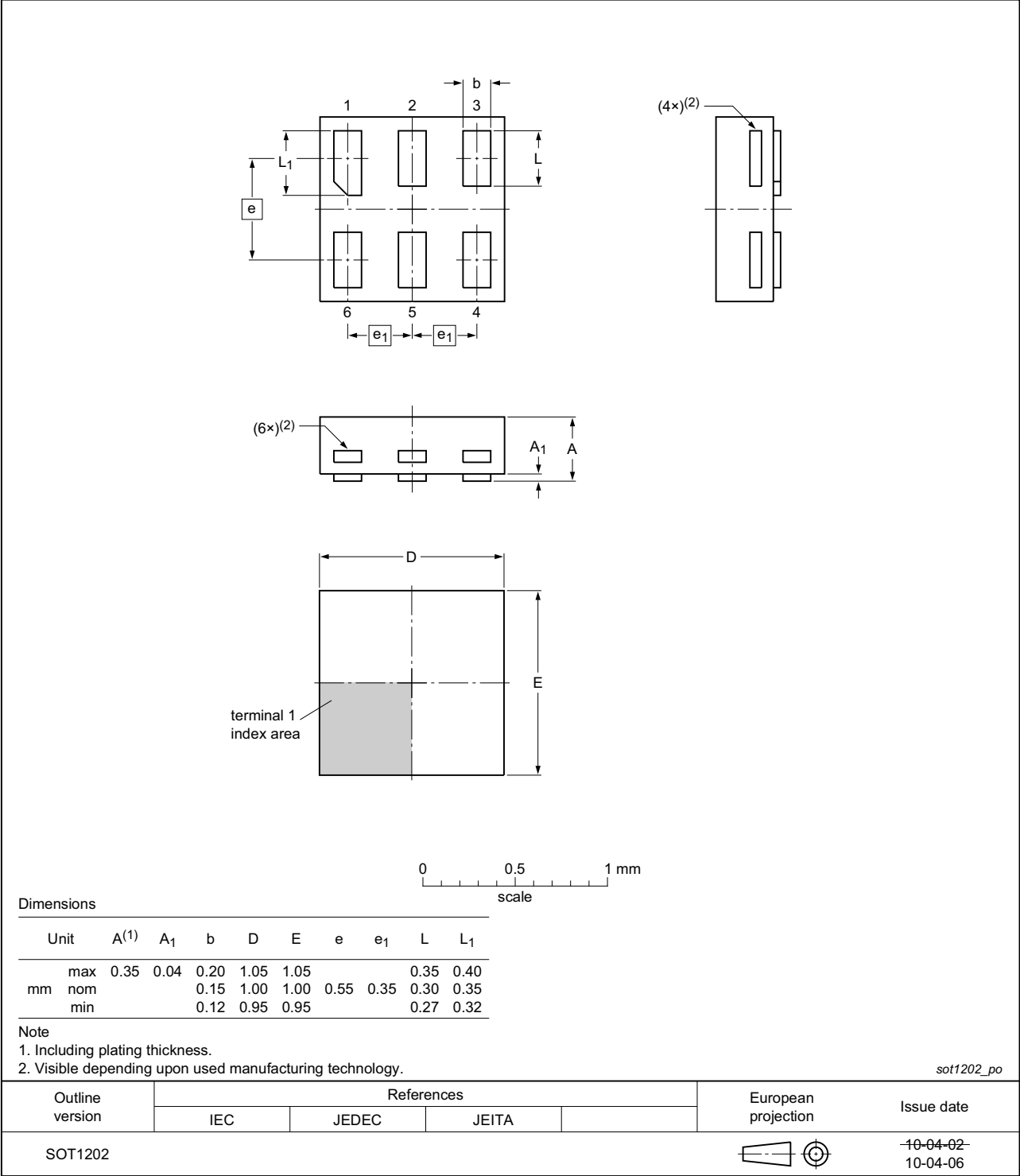


Fig 23. Package outline SOT1202 (XSON6)

X2SON6: plastic thermal enhanced extremely thin small outline package; no leads;
6 terminals; body 1.0 x 0.8 x 0.35 mm

SOT1255

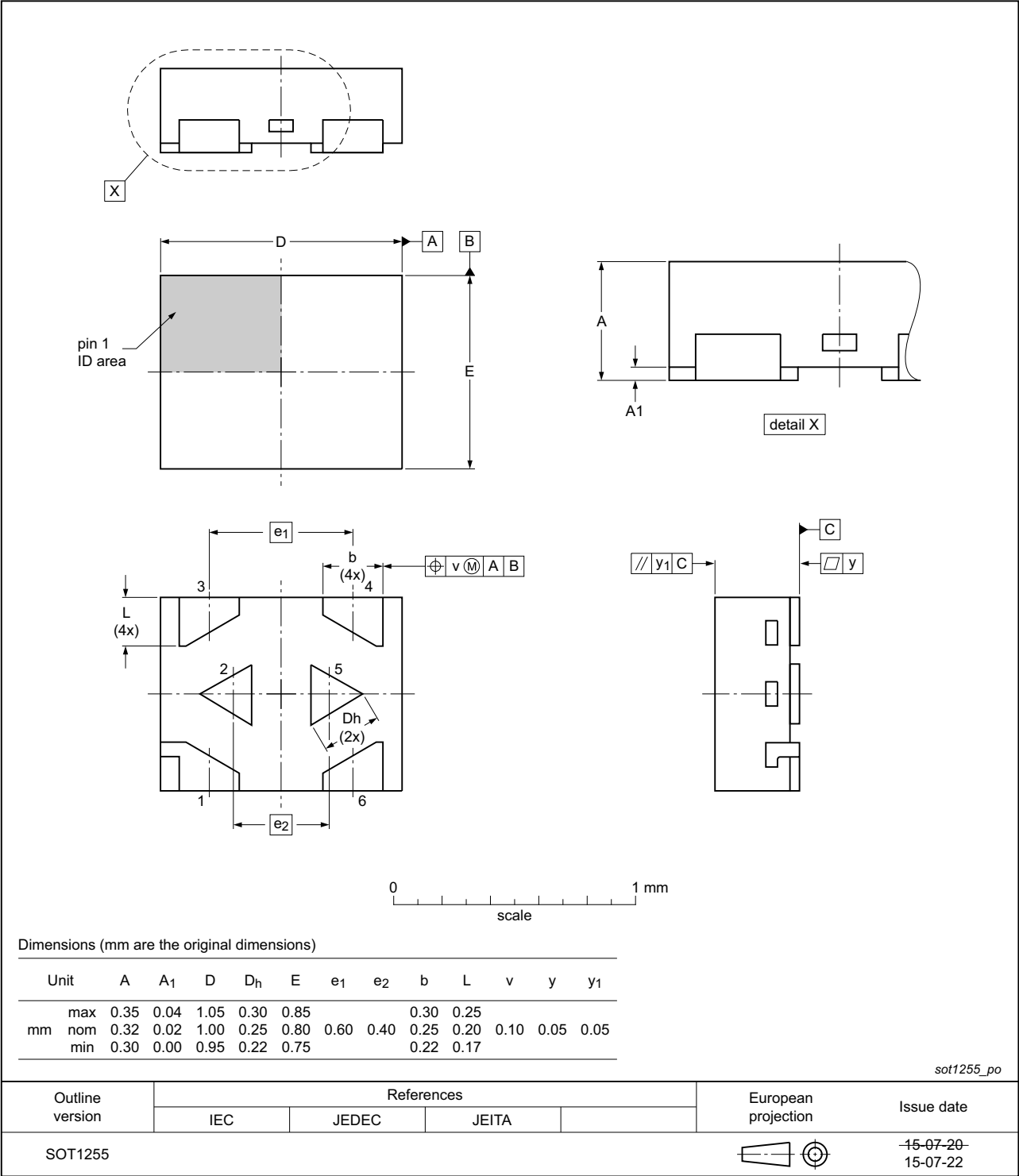


Fig 24. Package outline SOT1255 (X2SON6)

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
74AXP1G58 v.3	20150916	Product data sheet	-	74AXP1G58 v.2
Modifications:	• Added type number 74AXP1G58GX (SOT1255/X2SON6).			
74AXP1G58 v.2	20140724	Product data sheet	-	74AXP1G58 v.1
Modifications:	• Data sheet status changed to product data sheet.			
74AXP1G58 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.nexperia.com>.

15.2 Definitions

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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А