

# 74AXP1G86

## Low-power 2-input EXCLUSIVE-OR gate

Rev. 1 — 13 November 2015

Product data sheet

### 1. General description

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The 74AXP1G86 is a single 2-input EXCLUSIVE-OR 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

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- 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;  $I_{CC} = 0.6$   $\mu$ 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
74AXP1G86GM	–40 °C to +85 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74AXP1G86GN	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74AXP1G86GS	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74AXP1G86GX	–40 °C to +85 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.35 mm	SOT1226

4. Marking

Table 2. Marking

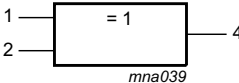
Type number	Marking code <sup>[1]</sup>
74AXP1G86GM	rH
74AXP1G86GN	rH
74AXP1G86GS	rH
74AXP1G86GX	rH

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

5. Functional diagram



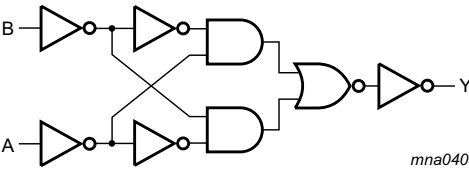
The logic symbol for the 74AXP1G86 is a rectangular box with two inputs labeled A and B on the left side. Input A is at pin 2 and input B is at pin 1. The output Y is on the right side at pin 4. The symbol is labeled mna038.



The IEC logic symbol for the 74AXP1G86 is a rectangular box with two inputs labeled 1 and 2 on the left side. The output is on the right side at pin 4. The box contains the text "= 1". The symbol is labeled mna039.

Fig 1. Logic symbol

Fig 2. IEC logic symbol



The logic diagram for the 74AXP1G86 shows two inputs A and B. Each input is connected to two inverters. The outputs of the inverters for input A are connected to the inputs of two 2-input AND gates. Similarly, the outputs of the inverters for input B are connected to the inputs of the same two 2-input AND gates. The outputs of these two AND gates are connected to the inputs of a 2-input OR gate. The output of the OR gate is connected to the output Y. The diagram is labeled mna040.

Fig 3. Logic diagram

6. Pinning information

6.1 Pinning

**74AXP1G86**

B 1 6 V<sub>CC</sub>

A 2 5 n.c.

GND 3 4 Y

aaa-016943

Transparent top view

**Fig 4. Pin configuration SOT886**

**74AXP1G86**

B 1 6 V<sub>CC</sub>

A 2 5 n.c.

GND 3 4 Y

aaa-016944

Transparent top view

**Fig 5. Pin configuration SOT1115 and SOT1202**

**74AXP1G86**

B 1 5 V<sub>CC</sub>

A 2 4 Y

3 GND

aaa-016945

Transparent top view

**Fig 6. Pin configuration SOT1226 (X2SON5)**

6.2 Pin description

Table 3. Pin description

Symbol	Pin		Description
	XSON6	X2SON5	
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 <sub>CC</sub>	6	5	supply voltage

7. Functional description

Table 4. Function table<sup>[1]</sup>

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

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

## 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	[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 $V_{CC}$	-	$\pm 20$	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	$\pm 0.1$	$\pm 0.5$	$\mu\text{A}$
$I_{OFF}$	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	$\pm 0.1$	$\pm 0.5$	$\mu\text{A}$
$\Delta I_{OFF}$	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	$\pm 0.1$	$\pm 0.5$	$\mu\text{A}$
$I_{CC}$	supply current	$V_I = 0\text{ V or }V_{CC}; I_O = 0\text{ A}$ [1]	-	0.01	0.3	0.6	$\mu\text{A}$
$\Delta I_{CC}$	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	$\mu\text{A}$

[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 13](#).

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = –40 °C to +85 °C		Unit
			Min	Typ <sup>[1]</sup>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A, B to Y; see <a href="#">Figure 7</a> <sup>[2][3]</sup>						
		V <sub>CC</sub> = 0.75 V to 0.85 V	3	15	72	2	164	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	1.7	5.2	10.8	1.7	11.3	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	1.3	3.7	6.8	1.3	7.4	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.1	3.0	5.4	1.1	6.0	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.9	2.3	3.8	0.8	4.3	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 2.7 V; see <a href="#">Figure 7</a> <sup>[4]</sup>	-	-	-	1.0	-	ns
C <sub>I</sub>	input capacitance	V <sub>I</sub> = 0 V or V <sub>CC</sub> ; V <sub>CC</sub> = 0 V to 2.75 V	-	0.5	-	-	-	pF
C <sub>O</sub>	output capacitance	V <sub>O</sub> = 0 V; V <sub>CC</sub> = 0 V	-	1.0	-	-	-	pF
C <sub>PD</sub>	power dissipation capacitance	f <sub>i</sub> = 1 MHz; V <sub>I</sub> = 0 V to V <sub>CC</sub> <sup>[5]</sup>						
		V <sub>CC</sub> = 0.75 V to 0.85 V	-	2.5	-	-	-	pF
		V <sub>CC</sub> = 1.1 V to 1.3 V	-	2.6	-	-	-	pF
		V <sub>CC</sub> = 1.4 V to 1.6 V	-	2.6	-	-	-	pF
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	2.7	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	3.0	-	-	-	pF

[1] All typical values are measured at nominal V<sub>CC</sub>.

[2] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.

[3] For additional propagation delay values at different load capacitances, see [Figure 8](#) to [Figure 12](#).

[4] t<sub>t</sub> is the same as t<sub>THL</sub> and t<sub>TLH</sub>.

[5] C<sub>PD</sub> is used to determine the dynamic power dissipation (P<sub>D</sub> 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<sub>i</sub> = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

C<sub>L</sub> = output load capacitance in pF;

V<sub>CC</sub> = supply voltage in V;

N = number of inputs switching.

12. Waveforms

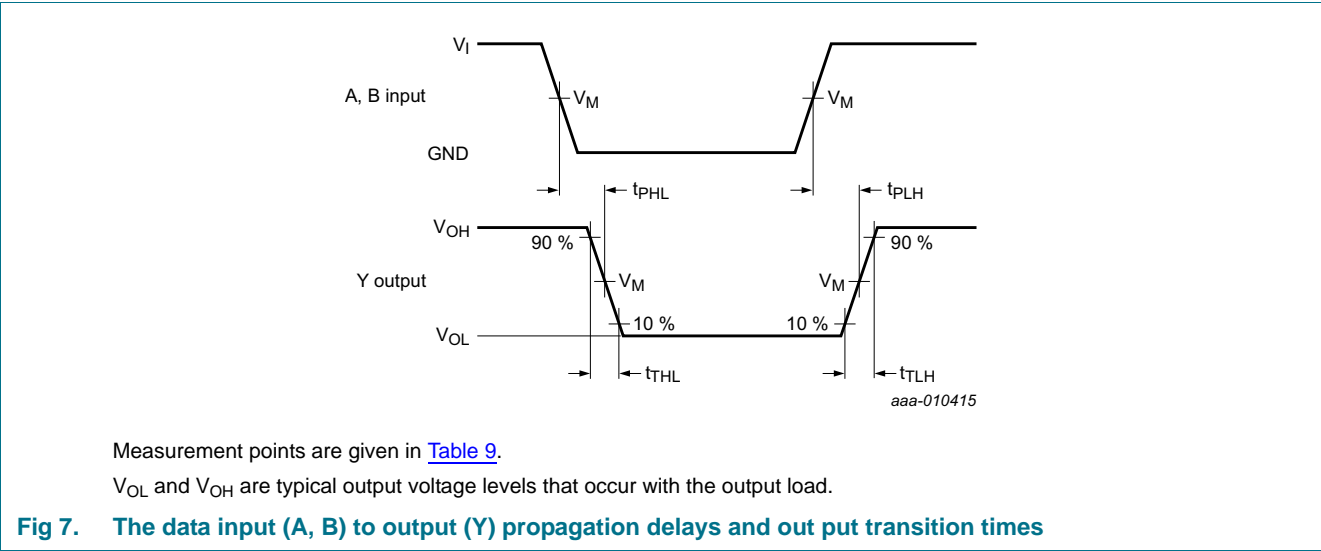
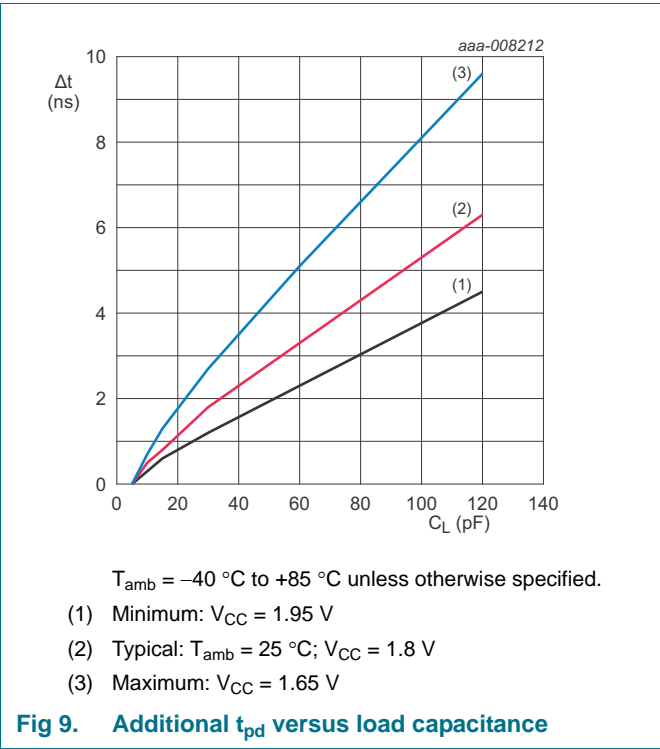
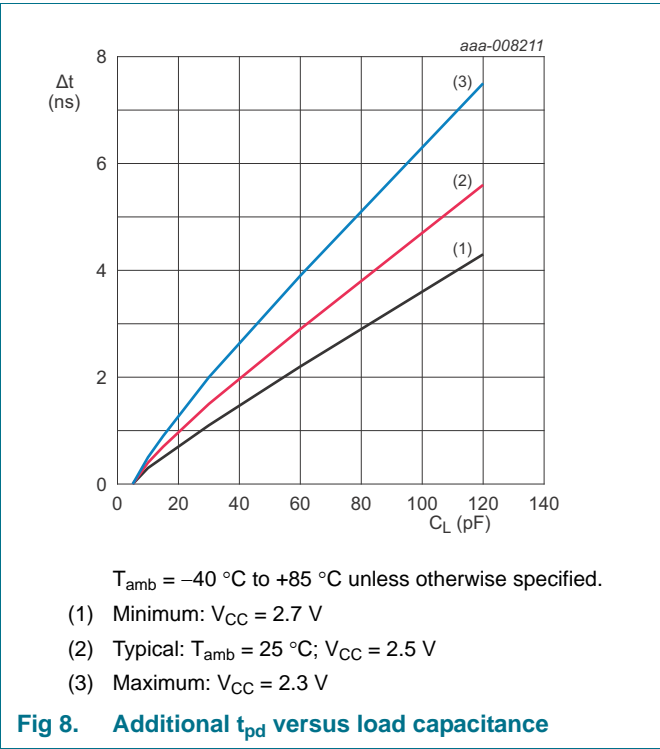
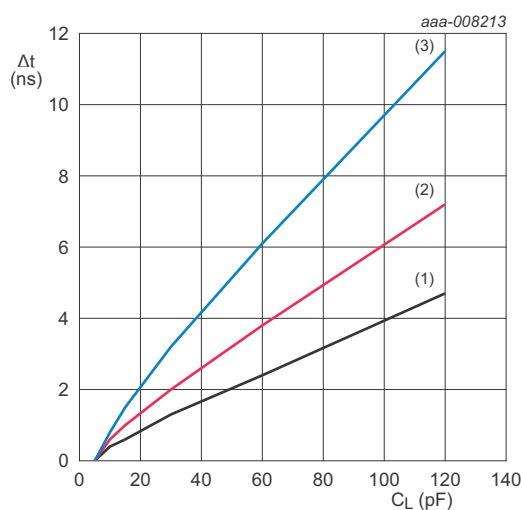


Table 9. Measurement points

Supply voltage	Input			Output
V <sub>CC</sub>	V <sub>M</sub>	V <sub>I</sub>	t <sub>r</sub> = t <sub>f</sub>	V <sub>M</sub>
0.75 V to 2.7 V	0.5 × V <sub>CC</sub>	V <sub>CC</sub>	≤ 3.0 ns	0.5 × V <sub>CC</sub>

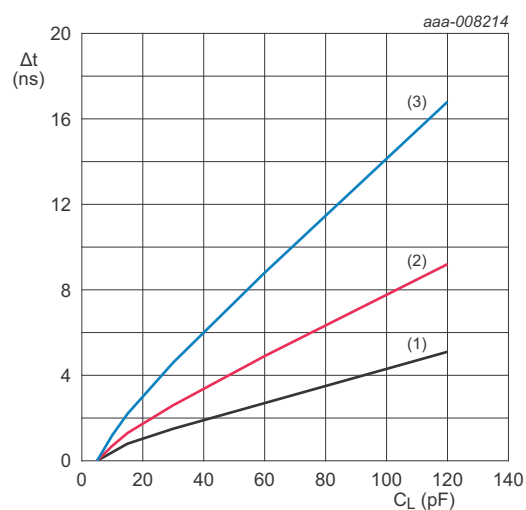




$T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+85\text{ }^{\circ}\text{C}$  unless otherwise specified.

- (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:  $V_{CC} = 1.4\text{ V}$

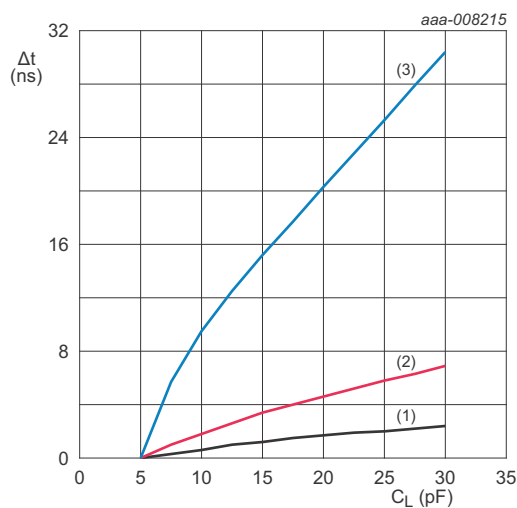
**Fig 10. Additional  $t_{pd}$  versus load capacitance**



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

- (1) Minimum:  $V_{CC} = 1.3\text{ V}$
- (2) Typical:  $T_{amb} = 25\text{ }^{\circ}\text{C}$ ;  $V_{CC} = 1.2\text{ V}$
- (3) Maximum:  $V_{CC} = 1.1\text{ V}$

**Fig 11. 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 12. 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 13. 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 $\Omega$	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 14. 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

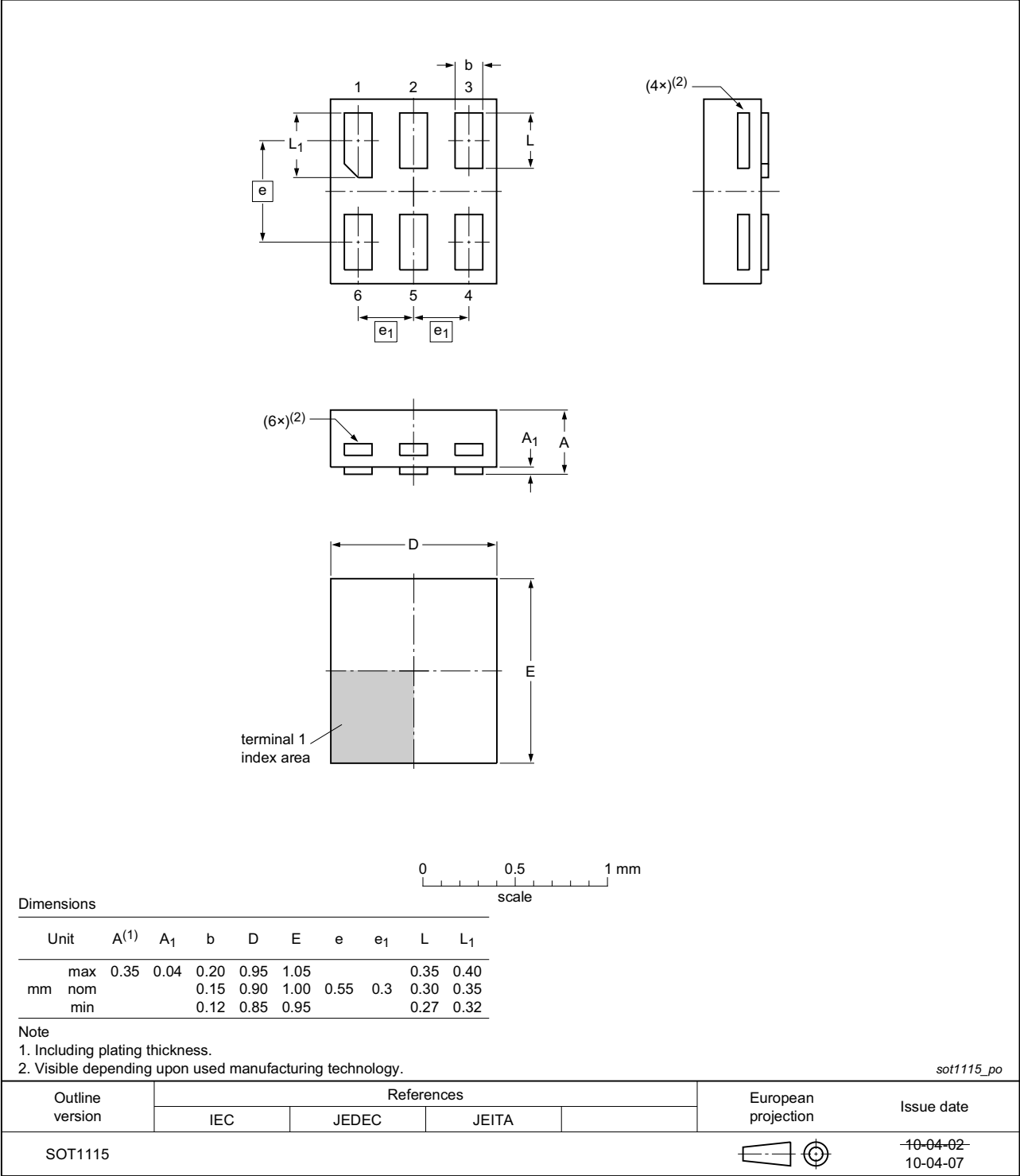


Fig 15. Package outline SOT1115 (XSON6)

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

SOT1202

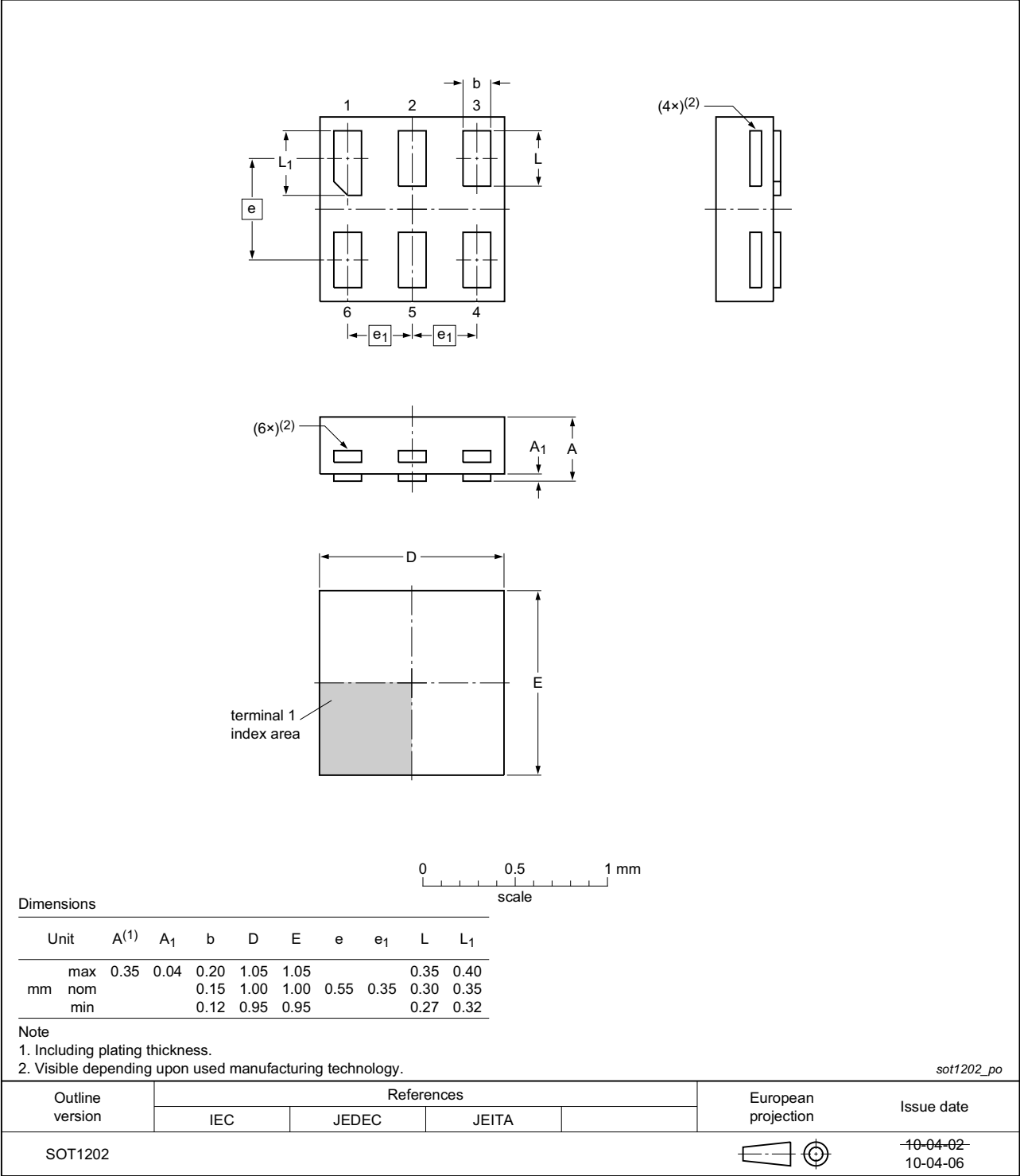


Fig 16. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads;  
5 terminals; body 0.8 x 0.8 x 0.35 mm

SOT1226

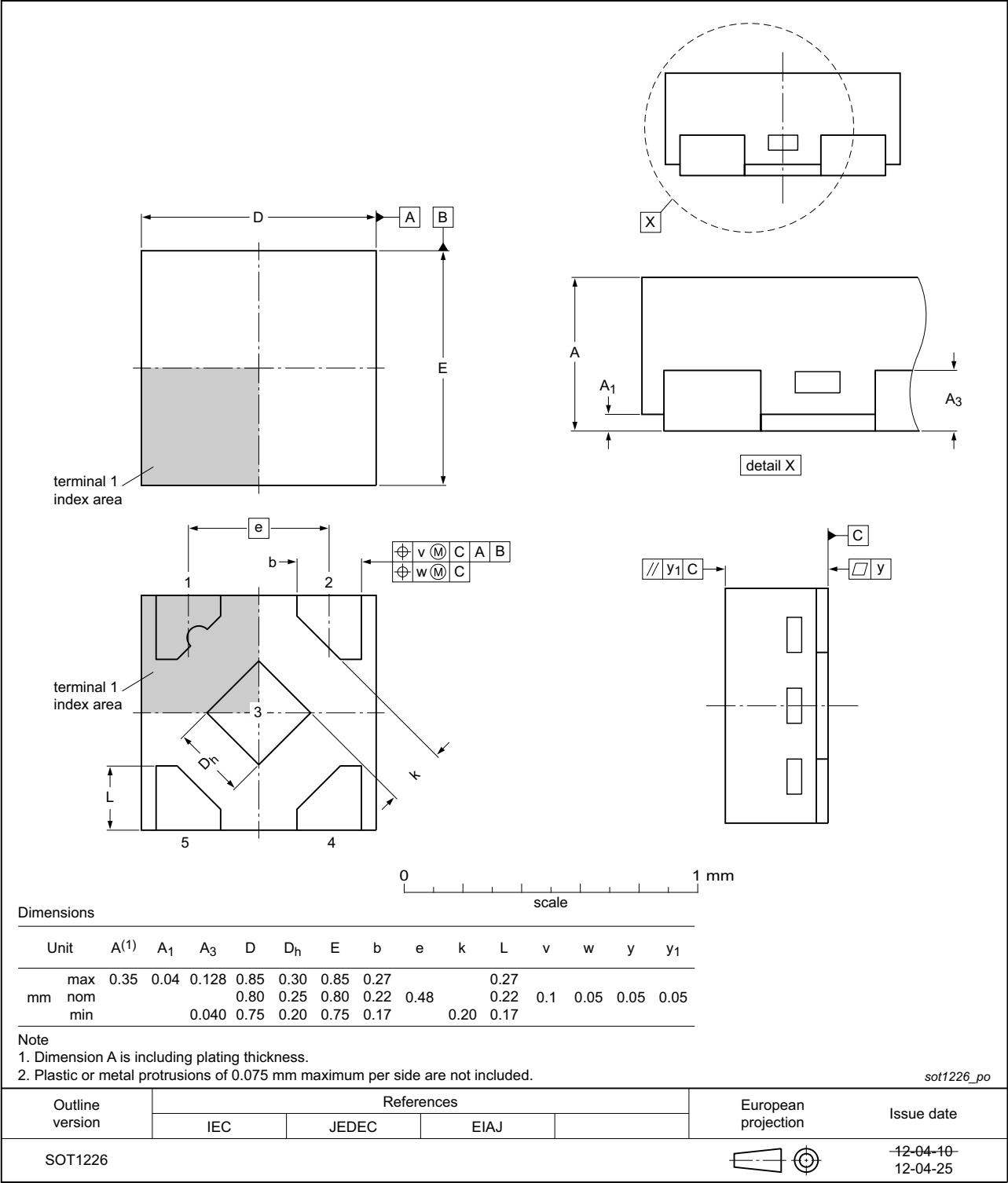


Fig 17. Package outline SOT1226 (X2SON5)

## 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
74AXP1G86 v.1	20151113	Product data sheet	-	-

## 16. Legal information

### 16.1 Data sheet status

Document status <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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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## 17. Contact information

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

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Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

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- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

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Конструкторский отдел помогает осуществить:

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- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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