

# 74AXP1G97

## Low-power configurable multiple function gate

Rev. 4 — 17 February 2022

Product data sheet

## 1. General description

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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

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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
- 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
- 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 2000 V
  - CDM JESD22-C101E exceeds 1000 V
- 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
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
74AXP1G97GX	-40 °C to +85 °C	X2SON6	plastic thermal enhanced extremely thin small outline package; no leads; 6 terminals; body 1.0 × 0.8 × 0.32 mm	SOT1255-2

### 4. Marking

Table 2. Marking

Type number	Marking code <sup>[1]</sup>
74AXP1G97GM	RV
74AXP1G97GN	RV
74AXP1G97GS	RV
74AXP1G97GX	RV

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

### 5. Functional diagram

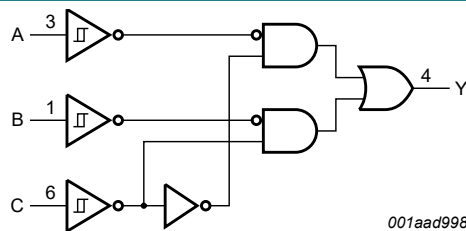
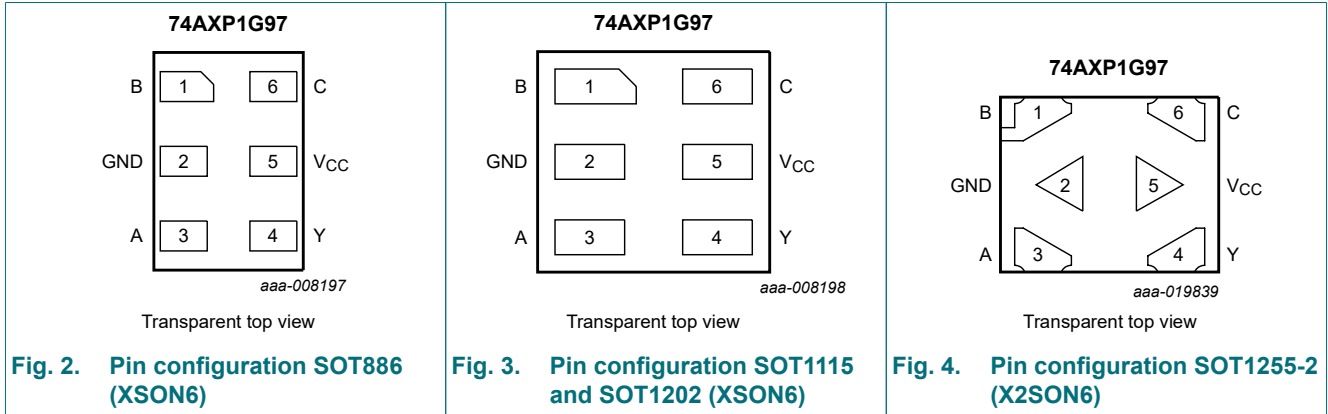


Fig. 1. Logic symbol

## 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 <sub>CC</sub>	5	supply voltage
C	6	data input

## 7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level.

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

7.1. Logic configurations

Table 5. Function selection table

Logic function	Figure
2-input MUX	see Fig. 5
2-input AND	see Fig. 6
2-input OR with one input inverted	see Fig. 7
2-input NAND with one input inverted	see Fig. 7
2-input AND with one input inverted	see Fig. 8
2-input NOR with one input inverted	see Fig. 8
2-input OR	see Fig. 9
Inverter	see Fig. 10
Buffer	see Fig. 11

**Fig. 5. 2-input MUX**

**Fig. 6. 2-input AND gate**

**Fig. 7. 2-input NAND gate with input A inverted or 2-input OR gate with input C inverted**

**Fig. 8. 2-input NOR gate with input B inverted or 2-input AND gate with input C inverted**

**Fig. 9. 2-input OR gate**

**Fig. 10. Inverter**

**Fig. 11. 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	$V_I < 0$ 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 $V_{CC}$	-	$\pm 20$	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.

- [2] For SOT886 (XSON6) package:  $P_{tot}$  derates linearly with 3.3 mW/K above 74 °C.  
 For SOT1115 (XSON6) package:  $P_{tot}$  derates linearly with 3.2 mW/K above 71 °C.  
 For SOT1202 (XSON6) package:  $P_{tot}$  derates linearly with 3.3 mW/K above 74 °C.  
 For SOT1255-2 (X2SON6) package:  $P_{tot}$  derates linearly with 3.3 mW/K above 75 °C.

## 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 <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit	
			Min	Typ	Max	Min	Max		
V <sub>T+</sub>	positive-going threshold voltage	see Fig. 12 and Fig. 13							
		V <sub>CC</sub> = 0.75 V to 0.85 V	0.3V <sub>CC</sub>	-	0.8V <sub>CC</sub>	0.3V <sub>CC</sub>	0.8V <sub>CC</sub>	V	
		V <sub>CC</sub> = 1.1 V to 1.95 V	0.4V <sub>CC</sub>	-	0.7V <sub>CC</sub>	0.4V <sub>CC</sub>	0.7V <sub>CC</sub>	V	
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.9	-	1.7	0.9	1.7	V	
V <sub>T-</sub>	negative-going threshold voltage	see Fig. 12 and Fig. 13							
		V <sub>CC</sub> = 0.75 V to 0.85 V	0.2V <sub>CC</sub>	-	0.7V <sub>CC</sub>	0.2V <sub>CC</sub>	0.7V <sub>CC</sub>	V	
		V <sub>CC</sub> = 1.1 V to 1.95 V	0.3V <sub>CC</sub>	-	0.6V <sub>CC</sub>	0.3V <sub>CC</sub>	0.6V <sub>CC</sub>	V	
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.7	-	1.5	0.7	1.5	V	
V <sub>H</sub>	hysteresis voltage	see Fig. 12 and Fig. 13							
		V <sub>CC</sub> = 0.75 V to 0.85 V	0.06V <sub>CC</sub>	-	0.5V <sub>CC</sub>	0.06V <sub>CC</sub>	0.5V <sub>CC</sub>	V	
		V <sub>CC</sub> = 1.1 V to 1.95 V	0.1V <sub>CC</sub>	-	0.4V <sub>CC</sub>	0.1V <sub>CC</sub>	0.4V <sub>CC</sub>	V	
		V <sub>CC</sub> = 2.3 V to 2.7 V	0.2	-	1.0	0.2	1.0	V	
V <sub>OH</sub>	HIGH-level output voltage	I <sub>O</sub> = -20 μA; V <sub>CC</sub> = 0.7 V	-	0.69	-	-	-	V	
		I <sub>O</sub> = -100 μA; V <sub>CC</sub> = 0.75 V	0.65	-	-	0.65	-	V	
		I <sub>O</sub> = -2 mA; V <sub>CC</sub> = 1.1 V	0.825	-	-	0.825	-	V	
		I <sub>O</sub> = -3 mA; V <sub>CC</sub> = 1.4 V	1.05	-	-	1.05	-	V	
		I <sub>O</sub> = -4.5 mA; V <sub>CC</sub> = 1.65 V	1.2	-	-	1.2	-	V	
		I <sub>O</sub> = -8 mA; V <sub>CC</sub> = 2.3 V	1.7	-	-	1.7	-	V	
V <sub>OL</sub>	LOW-level output voltage	I <sub>O</sub> = 20 μA; V <sub>CC</sub> = 0.7 V	-	0.01	-	-	-	V	
		I <sub>O</sub> = 100 μA; V <sub>CC</sub> = 0.75 V	-	-	0.1	-	0.1	V	
		I <sub>O</sub> = 2 mA; V <sub>CC</sub> = 1.1 V	-	-	0.275	-	0.275	V	
		I <sub>O</sub> = 3 mA; V <sub>CC</sub> = 1.4 V	-	-	0.35	-	0.35	V	
		I <sub>O</sub> = 4.5 mA; V <sub>CC</sub> = 1.65 V	-	-	0.45	-	0.45	V	
		I <sub>O</sub> = 8 mA; V <sub>CC</sub> = 2.3 V	-	-	0.7	-	0.7	V	
I <sub>I</sub>	input leakage current	V <sub>I</sub> = 0 V to 2.75 V; V <sub>CC</sub> = 0 V to 2.75 V	[1]	-	0.001	±0.1	-	±0.5	μA
I <sub>OFF</sub>	power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V to 2.75 V; V <sub>CC</sub> = 0 V	[1]	-	0.01	±0.1	-	±0.5	μA
ΔI <sub>OFF</sub>	additional power-off leakage current	V <sub>I</sub> or V <sub>O</sub> = 0 V or 2.75 V; V <sub>CC</sub> = 0 V to 0.1 V	[1]	-	0.02	±0.1	-	±0.5	μA
I <sub>CC</sub>	supply current	V <sub>I</sub> = 0 V or V <sub>CC</sub> ; I <sub>O</sub> = 0 A	[1]	-	0.01	0.3	-	0.6	μA
ΔI <sub>CC</sub>	additional supply current	V <sub>I</sub> = V <sub>CC</sub> - 0.5 V; I <sub>O</sub> = 0 A; V <sub>CC</sub> = 2.5 V		-	2	100	-	150	μA

[1] Typical values are measured at V<sub>CC</sub> = 1.2 V.

10.1. Waveform transfer characteristics

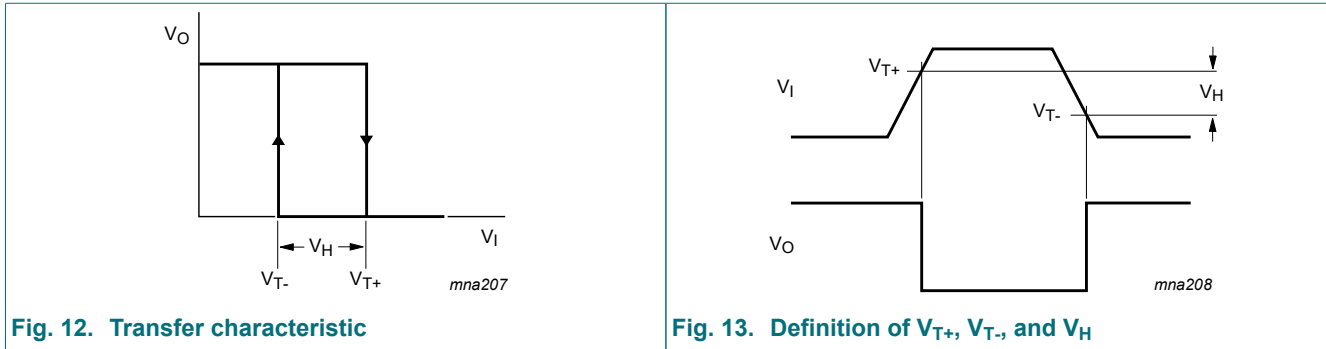


Fig. 12. Transfer characteristic

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 Fig. 20.

Symbol	Parameter	Conditions	T <sub>amb</sub> = 25 °C			T <sub>amb</sub> = -40 °C to +85 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A, B and C to Y; see Fig. 14 [2] [3]						
		V <sub>CC</sub> = 0.75 V to 0.85 V	3	14	45	3	148	ns
		V <sub>CC</sub> = 1.1 V to 1.3 V	2.3	5.0	8.1	2.1	8.5	ns
		V <sub>CC</sub> = 1.4 V to 1.6 V	1.9	3.7	5.4	1.7	5.8	ns
		V <sub>CC</sub> = 1.65 V to 1.95 V	1.6	3.1	4.3	1.4	4.7	ns
		V <sub>CC</sub> = 2.3 V to 2.7 V	1.3	2.4	3.3	1.1	3.5	ns
t <sub>t</sub>	transition time	V <sub>CC</sub> = 2.7 V; see Fig. 14 [4]	-	-	-	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> [5]						
		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	-	2.7	-	-	-	pF
		V <sub>CC</sub> = 1.65 V to 1.95 V	-	2.8	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V	-	3.2	-	-	-	pF

[1] All typical values are measured at nominal V<sub>CC</sub>.  
 [2] For additional propagation delay values at different load capacitances see Fig. 15 to Fig. 19.  
 [3] t<sub>pd</sub> is the same as t<sub>PLH</sub> and t<sub>PHL</sub>.  
 [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.

### 11.1. Waveforms, graphs and test circuit

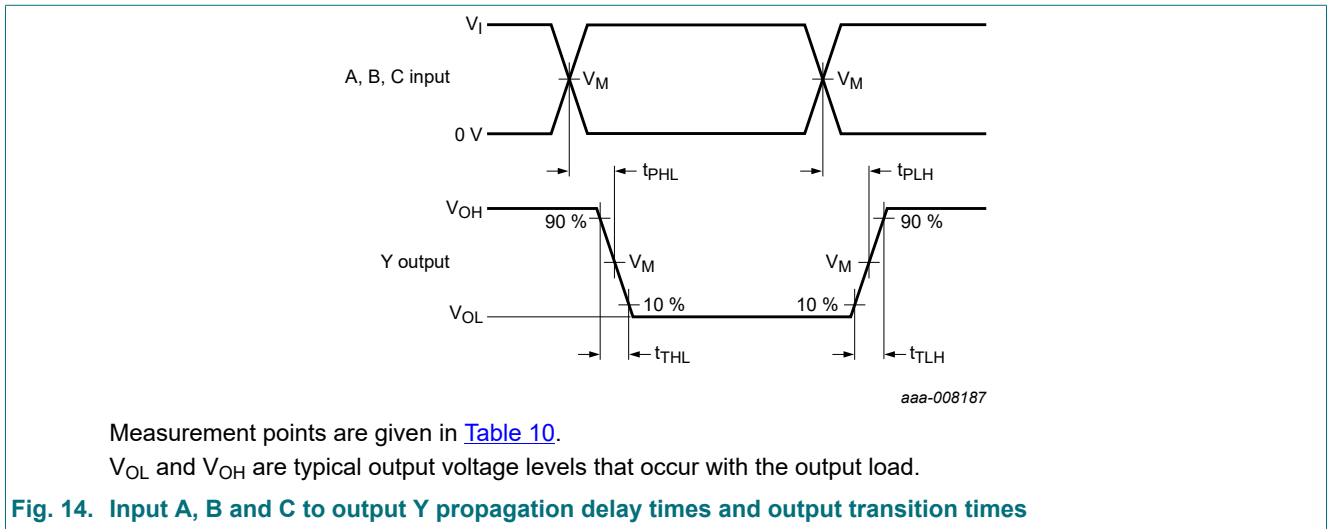
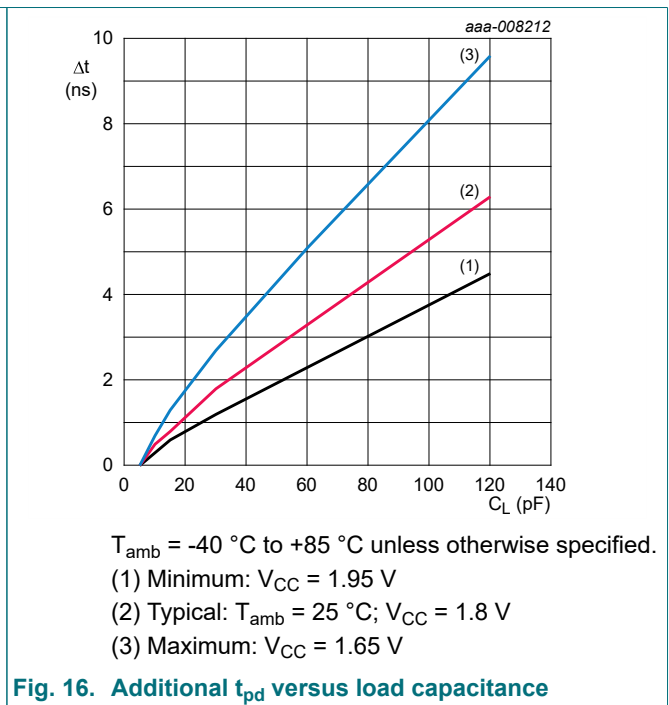
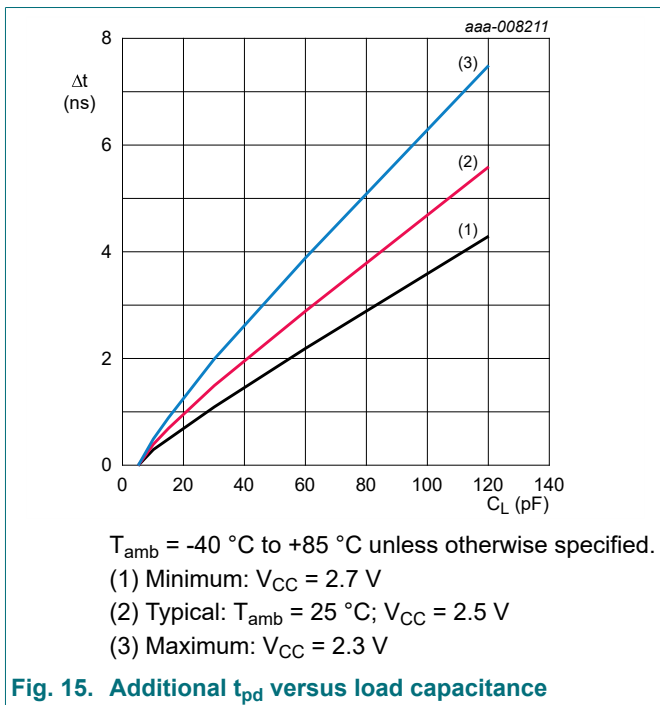
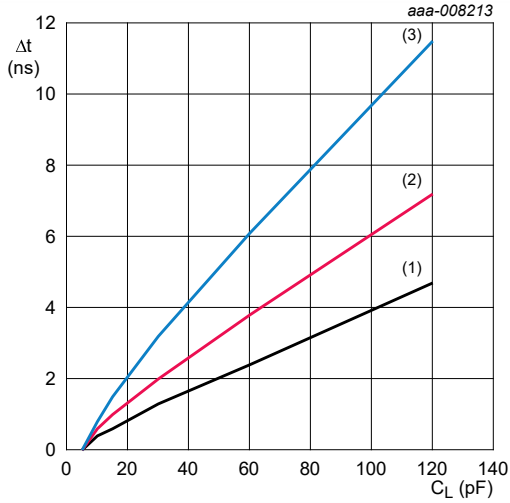


Table 10. Measurement points

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



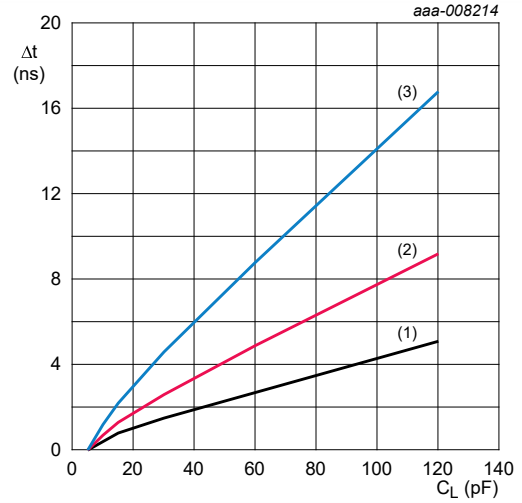




T<sub>amb</sub> = -40 °C to +85 °C unless otherwise specified.

- (1) Minimum: V<sub>CC</sub> = 1.6 V
- (2) Typical: T<sub>amb</sub> = 25 °C; V<sub>CC</sub> = 1.5 V
- (3) Maximum: V<sub>CC</sub> = 1.4 V

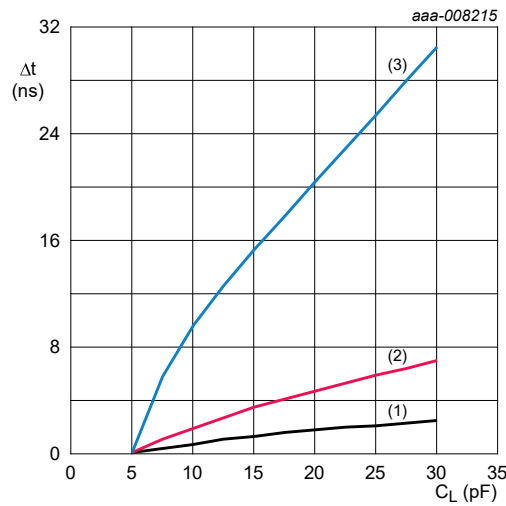
Fig. 17. Additional t<sub>pd</sub> versus load capacitance



T<sub>amb</sub> = -40 °C to +85 °C unless otherwise specified.

- (1) Minimum: V<sub>CC</sub> = 1.3 V
- (2) Typical: T<sub>amb</sub> = 25 °C; V<sub>CC</sub> = 1.2 V
- (3) Maximum: V<sub>CC</sub> = 1.1 V

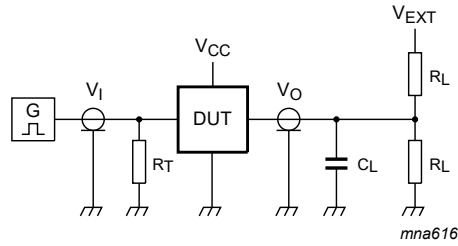
Fig. 18. Additional t<sub>pd</sub> versus load capacitance



T<sub>amb</sub> = -40 °C to +85 °C unless otherwise specified.

- (1) Minimum: V<sub>CC</sub> = 0.85 V
- (2) Typical: T<sub>amb</sub> = 25 °C; V<sub>CC</sub> = 0.8 V
- (3) Maximum: V<sub>CC</sub> = 0.75 V

Fig. 19. Additional t<sub>pd</sub> 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 k $\Omega$	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

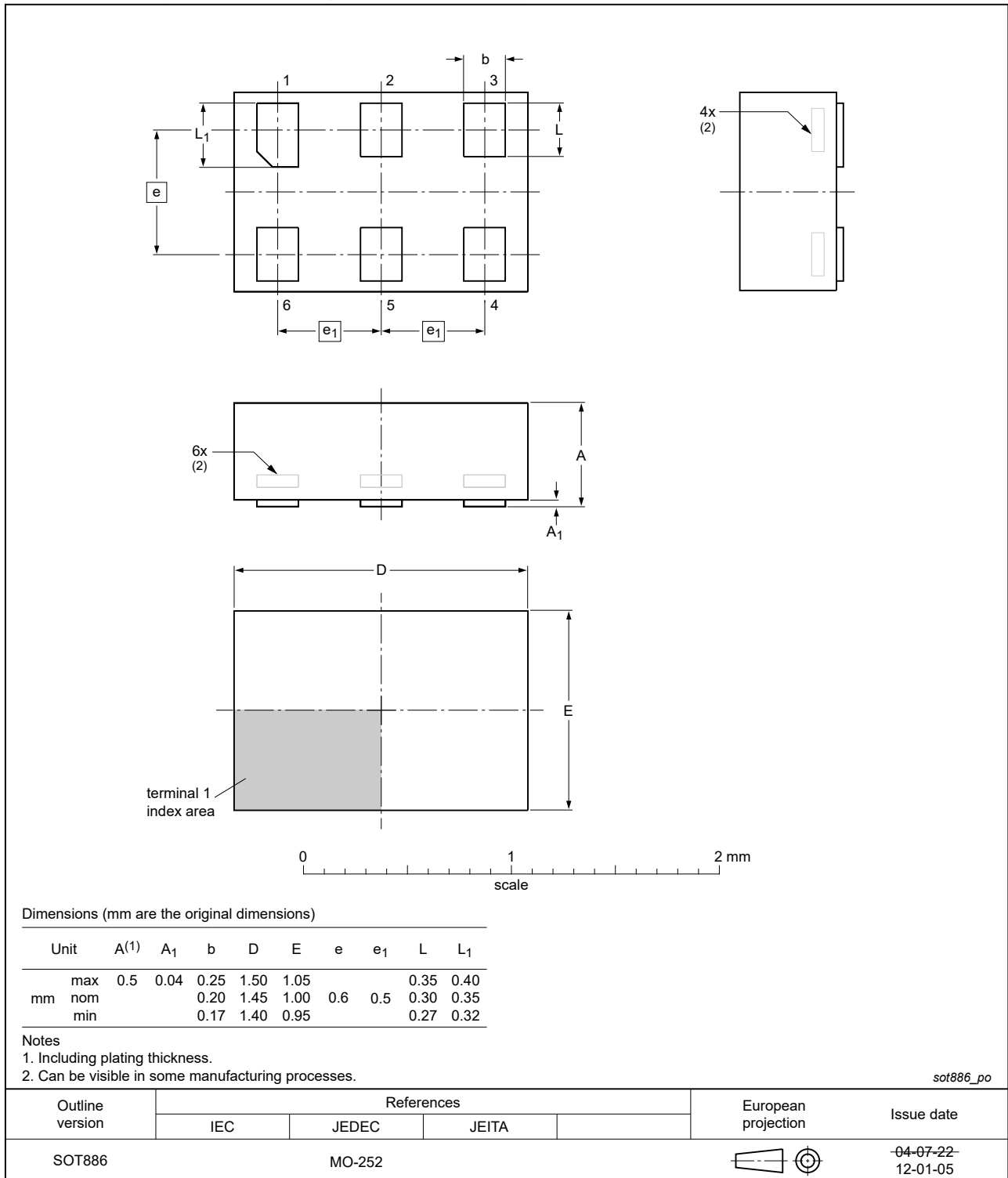


Fig. 21. Package outline SOT886 (XSON6)

**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 0.32 mm

SOT1255-2

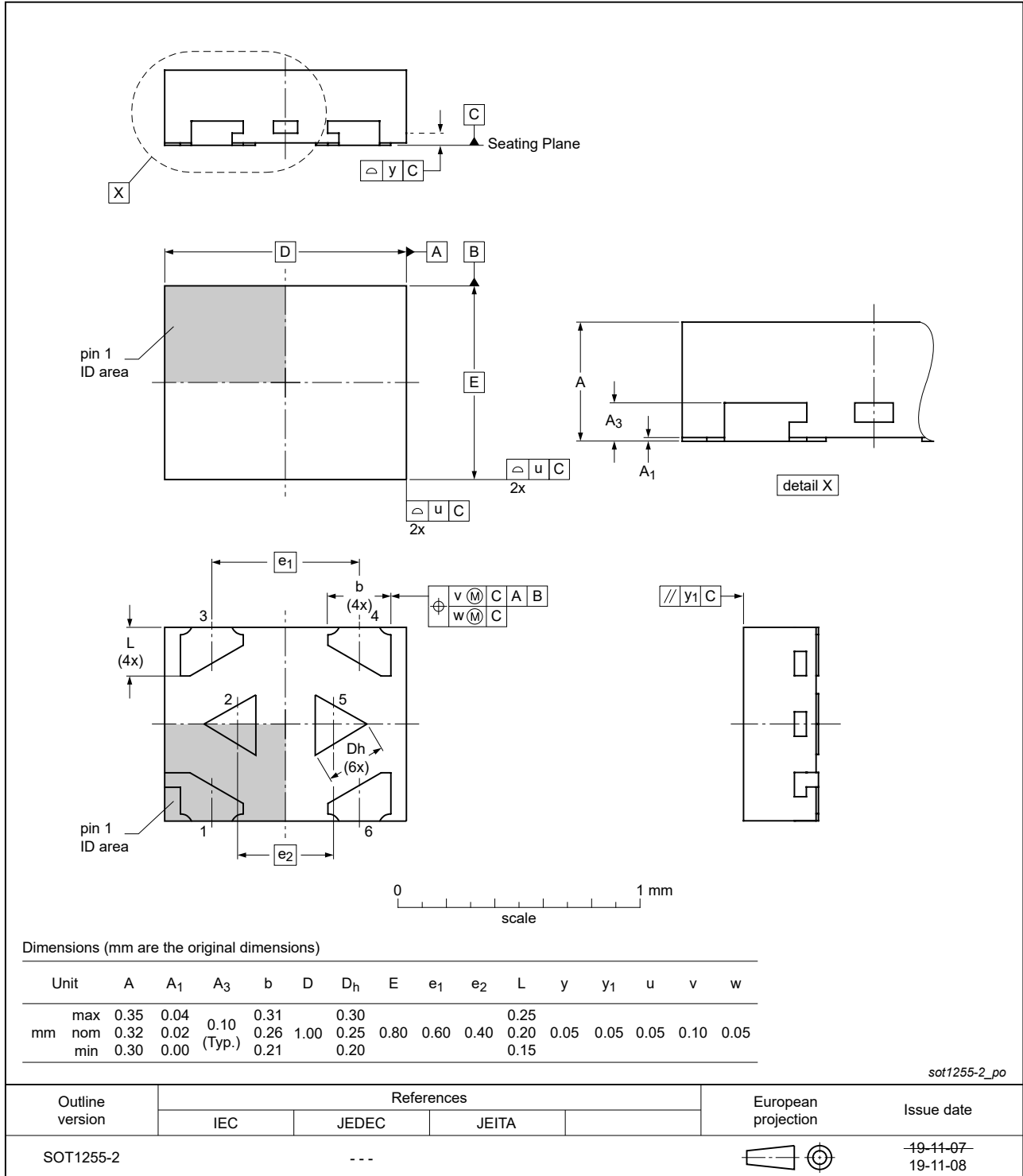


Fig. 24. Package outline SOT1255-2 (X2SON6)

## 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
74AXP1G97 v.4	20220217	Product data sheet	-	74AXP1G97 v.3
Modifications:	<ul style="list-style-type: none"> <li>The format of this data sheet has been redesigned to comply with the identity guidelines of Nexperia.</li> <li>Legal texts have been adapted to the new company name where appropriate.</li> <li>SOT1255 (X2SON6) package changed to SOT1255-2 (X2SON6) package.</li> <li><a href="#">Table 6</a>: Derating values for <math>P_{tot}</math> total power dissipation updated.</li> </ul>			
74AXP1G97 v.3	20150916	Product data sheet	-	74AXP1G97 v.2
Modifications:	<ul style="list-style-type: none"> <li>Added type number 74AXP1G97GX (SOT1255/X2SON6).</li> </ul>			
74AXP1G97 v.2	20140903	Product data sheet	-	74AXP1G97 v.1
Modifications:	<ul style="list-style-type: none"> <li>Specification status changed to product data sheet.</li> </ul>			
74AXP1G97 v.1	20130625	Preliminary data sheet	-	-

## 15. Legal information

### 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 <https://www.nexperia.com>.

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

For sales office addresses, please send an email to: [salesaddresses@nexperia.com](mailto:salesaddresses@nexperia.com)

Date of release: 17 February 2022