### **74AXP1G97**

# Low-power configurable multiple function gate Rev. 1 — 25 June 2013 Prelin

Preliminary data sheet

#### **General description** 1.

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<sub>CC</sub> or GND. This device ensures very low static and dynamic power consumption across the entire V<sub>CC</sub> range from 0.7 V to 2.75 V. This device is fully specified for partial power down applications using I<sub>OFF</sub>. The I<sub>OFF</sub> circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

#### **Features and benefits** 2.

- 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<sub>CC</sub> = 0.6 μA (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<sub>CC</sub>
- I<sub>OFF</sub> circuitry provides partial power-down mode operation
- Multiple package options
- Specified from -40 °C to +85 °C



#### Low-power configurable multiple function gate

### 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 $\times$ 1.45 $\times$ 0.5 mm	SOT886			
74AXP1G97GN	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 $\times$ 1.0 $\times$ 0.35 mm	SOT1115			
74AXP1G97GS	–40 °C to +85 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 $\times$ 1.0 $\times$ 0.35 mm	SOT1202			

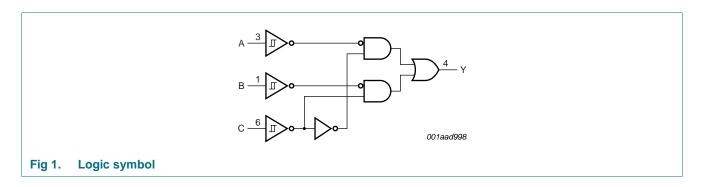
### 4. Marking

#### Table 2. Marking

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

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

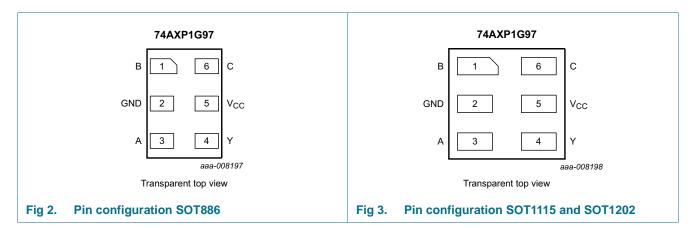
### 5. Functional diagram



Low-power configurable multiple function gate

### 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
В	1	data input
GND	2	ground (0 V)
A	3	data input
Υ	4	data output
V <sub>CC</sub>	5	supply voltage
С	6	data input

### 7. Functional description

Table 4. Function table[1]

Input	Output		
С	В	Α	Υ
L	L	L	L
L	L	Н	L
L	Н	L	Н
L	Н	Н	Н
Н	L	L	L
Н	L	Н	Н
Н	Н	L	L
Н	Н	Н	Н

<sup>[1]</sup> H = HIGH voltage level;

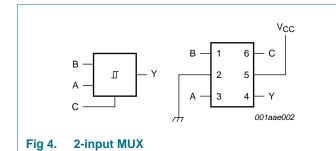
L = LOW voltage level.

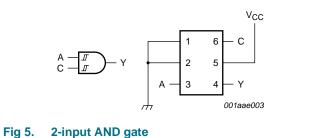
#### Low-power configurable multiple function gate

### 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





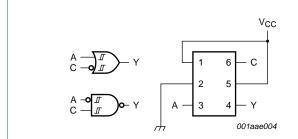


Fig 6. 2-input NAND gate with input A inverted or 2-input OR gate with input C inverted

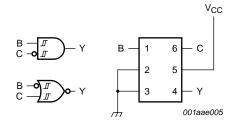
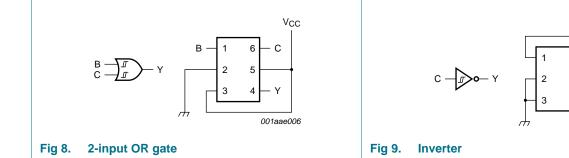
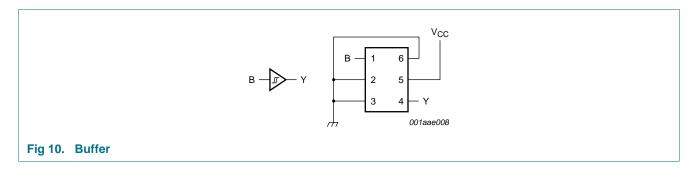


Fig 7. 2-input NOR gate with input B inverted or 2-input AND gate with input C inverted



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#### Low-power configurable multiple function gate



### 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 <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
$V_{I}$	input voltage		<u>[1]</u> –0.5	3.3	V
I <sub>OK</sub>	output clamping current	V <sub>O</sub> < 0 V	-50	-	mA
$V_{O}$	output voltage	Active mode and Power-down mode	<u>[1]</u> –0.5	3.3	V
Io	output current	$V_O = 0 V \text{ to } V_{CC}$	-	±20	mA
I <sub>CC</sub>	supply current		-	50	mA
$I_{GND}$	ground current		-50	-	mA
$T_{stg}$	storage temperature		-65	+150	°C
P <sub>tot</sub>	total power dissipation	$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +85  ^{\circ}\text{C}$	-	250	mW

<sup>[1]</sup> 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
VI	input voltage		0	2.75	V
Vo	output voltage	Active mode	0	$V_{CC}$	V
		Power-down mode; $V_{CC} = 0 \text{ V}$	0	2.75	V
T <sub>amb</sub>	ambient temperature		-40	+85	°C

### Low-power configurable multiple function gate

### 10. Static characteristics

Table 8. Static characteristics

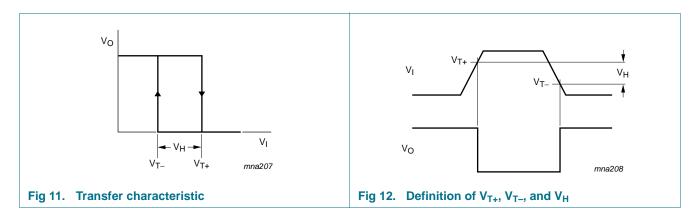
 $V_{CC} = 0.7 \text{ V}$  to 2.75 V, unless otherwise specified; At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		$T_{amb} = -40  ^{\circ}\text{C} \text{ to } +85  ^{\circ}\text{C}$				
				Min	Typ 25 °C	Max 25 °C	Max 85 °C	
V <sub>T+</sub>	positive-going	see Figure 11 and Figure 12				I		
	threshold voltage	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		$0.35V_{CC}$	-	0.75V <sub>CC</sub>	0.75V <sub>CC</sub>	V
		V <sub>CC</sub> = 1.1 V to 1.95 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	see Figure 11 and Figure 12						
	threshold voltage	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		0.25V <sub>CC</sub>	-	0.65V <sub>CC</sub>	0.65V <sub>CC</sub>	٧
		V <sub>CC</sub> = 1.1 V to 1.95 V		$0.3V_{CC}$	-	$0.6V_{CC}$	0.6V <sub>CC</sub>	٧
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.7	-	1.5	1.5	V
V <sub>H</sub>	hysteresis	see Figure 11 and Figure 12						
	voltage	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		0.1V <sub>CC</sub>	-	$0.5V_{CC}$	0.5V <sub>CC</sub>	V
		V <sub>CC</sub> = 1.1 V to 1.95 V		0.1V <sub>CC</sub>	-	$0.4V_{CC}$	$0.4V_{CC}$	V
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		0.2	-	1.0	1.0	V
√он	HIGH-level output voltage	$I_{O} = -20 \mu A$		V <sub>CC</sub> -0.05				V
		$I_O = -100 \mu A$ ; $V_{CC} = 0.75 V$		V <sub>CC</sub> -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
√oL	LOW-level	$I_O = 20 \mu A$		-	-	0.05	0.05	V
	output voltage	$I_O = 100 \mu A; V_{CC} = 0.75 V$		-	-	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
lı	input leakage current	$V_I = 0 \text{ V to } 2.75 \text{ V};$ $V_{CC} = 0 \text{ V to } 2.75 \text{ V}$	[1]	-	<tbd></tbd>	±0.1	±0.5	μΑ
OFF	power-off leakage current	$V_I$ or $V_O = 0$ V to 2.75 V; $V_{CC} = 0$ V		-	-	±0.1	±0.5	μА
M <sub>OFF</sub>	additional power-off leakage current	$V_{I}$ or $V_{O} = 0$ V to 2.75 V; $V_{CC} = 0$ V to 0.2 V		-	-	±0.1	±0.5	μΑ
CC	supply current	$V_I = 0 \text{ V or } V_{CC}; I_O = 0 \text{ A}$	<u>[1]</u>	-	<tbd></tbd>	0.3	0.6	μΑ
∆I <sub>CC</sub>	additional supply current	$V_I = V_{CC} - 0.5 \text{ V}; I_O = 0 \text{ A};$ $V_{CC} = 2.5 \text{ V}$		-	-	100	150	μΑ
	current	V <sub>CC</sub> = 2.5 V						

<sup>[1]</sup> All typical values are measured at  $V_{CC}$  = 1.2 V.

#### Low-power configurable multiple function gate

#### 10.1 Waveform transfer characteristics



### 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 <sub>amb</sub> = 25 °C			$T_{amb} = -4$	Unit	
				Min	Typ[1]	Max	Min	Max	
t <sub>pd</sub>	propagation	A, B and C to Y; see Figure 13	[2][3]		'	•		'	
	delay	$V_{CC} = 0.75 \text{ V to } 0.85 \text{ V}$		3.6	12.3	41	3.2	95	ns
		$V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$		2.4	4.5	7.5	2.1	8.0	ns
		$V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$		2.0	3.4	5.2	1.6	5.6	ns
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		1.7	2.8	4.3	1.4	4.6	ns
		$V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$		1.4	2.2	3.4	1.1	3.6	ns
t <sub>t</sub>	transition time	$V_{CC} = 2.7 \text{ V}$ ; see Figure 13	[4]	1.0	-	-	-	-	ns
C <sub>I</sub>	input capacitance	$V_I = 0 \text{ V or } V_{CC};$ $V_{CC} = 0 \text{ V to } 2.75 \text{ V}$		-	1	-	-	-	pF
Co	output capacitance	$V_{O} = 0 \text{ V}; V_{CC} = 0 \text{ V}$		-	2	-	-	-	pF

#### Low-power configurable multiple function gate

 Table 9.
 Dynamic characteristics ...continued

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

Symbol	Parameter	Conditions			<sub>mb</sub> = 25 °	C	$T_{amb} = -40$ °C to +85 °C		Unit
				Min	Typ[1]	Max	Min	Max	
C <sub>PD</sub> power dissipation capacitance	$f_i = 1 \text{ MHz}; V_I = 0 \text{ V to } V_{CC}$	[5]							
	capacitance	V <sub>CC</sub> = 0.75 V to 0.85 V		-	3.0	-	-	-	pF
		V <sub>CC</sub> = 1.1 V to 1.3 V		-	2.9	-	-	-	pF
		$V_{CC} = 1.4 \text{ V to } 1.6 \text{ V}$		-	3.0	-	-	-	pF
		$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$		-	3.2	-	-	-	pF
		V <sub>CC</sub> = 2.3 V to 2.7 V		-	3.7	-	-	-	pF

- [1] All typical values are measured at nominal V<sub>CC</sub>.
- [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  $\mu W$ ).

$$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \Sigma (C_L \times V_{CC}^2 \times f_o)$$
 where:

f<sub>i</sub> = input frequency in MHz;

fo = output frequency in MHz;

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

 $V_{CC}$  = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

#### 11.1 Waveforms and graphs

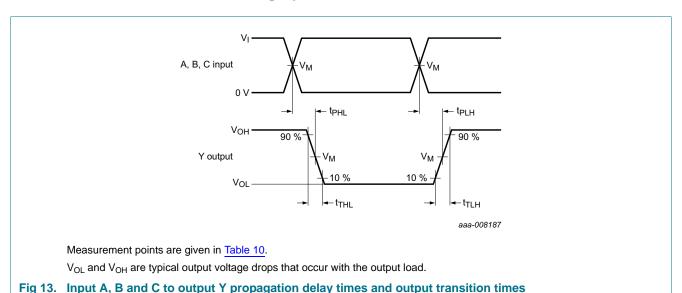


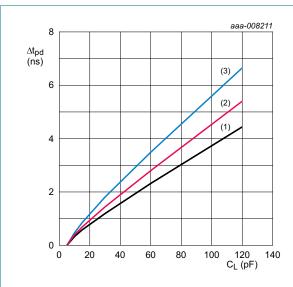
Table 10. Measurement points

Supply voltage	Output	Input				
V <sub>CC</sub>	V <sub>M</sub>	V <sub>M</sub>	V <sub>I</sub>	$t_r = t_f$		
0.75 V to 2.75 V	$0.5 \times V_{CC}$	$0.5 \times V_{CC}$	V <sub>CC</sub>	≤ 3.0 ns		

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#### Low-power configurable multiple function gate

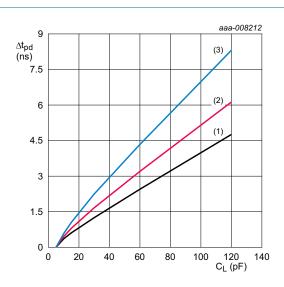


 $T_{amb}$  = -40 °C to +85 °C unless otherwise specified.

(1) Minimum:  $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ (2) Typical:  $T_{amb} = 25 \,^{\circ}\text{C}$ ;  $V_{CC} = 2.5 \,^{\circ}\text{V}$ 

(3) Maximum:  $V_{CC} = 2.3 \text{ V to } 2.7 \text{ V}$ 

Fig 14. Additional propagation delay versus load capacitance



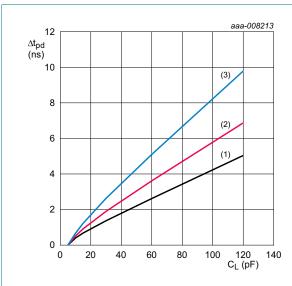
 $T_{amb}$  = -40 °C to +85 °C unless otherwise specified.

(1) Minimum:  $V_{CC} = 1.65 \text{ V}$  to 1.95 V

(2) Typical:  $T_{amb} = 25 \, ^{\circ}C$ ;  $V_{CC} = 1.8 \, V$ 

(3) Maximum:  $V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$ 

Fig 15. Additional propagation delay versus load capacitance



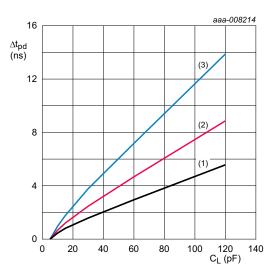
 $T_{amb} = -40 \, ^{\circ}\text{C}$  to +85  $^{\circ}\text{C}$  unless otherwise specified.

(1) Minimum:  $V_{CC} = 1.4 \text{ V}$  to 1.6 V

(2) Typical:  $T_{amb} = 25 \,^{\circ}\text{C}$ ;  $V_{CC} = 1.5 \,^{\circ}\text{V}$ 

(3) Maximum:  $V_{CC} = 1.4 \text{ V}$  to 1.6 V

Fig 16. Additional propagation delay versus load capacitance



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

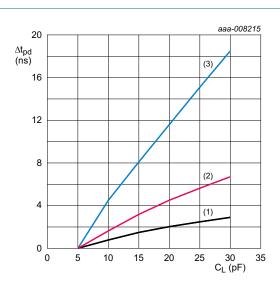
(1) Minimum:  $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$ 

(2) Typical:  $T_{amb} = 25 \, ^{\circ}C$ ;  $V_{CC} = 1.2 \, V$ 

(3) Maximum:  $V_{CC} = 1.1 \text{ V to } 1.3 \text{ V}$ 

Fig 17. Additional propagation delay versus load capacitance

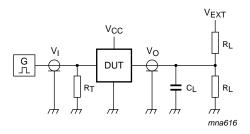
#### Low-power configurable multiple function gate



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

(1) Minimum:  $V_{CC} = 0.75 \text{ V}$  to 0.85 V(2) Typical:  $T_{amb} = 25 \,^{\circ}\text{C}$ ;  $V_{CC} = 0.8 \text{ V}$ (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<sub>L</sub> = Load resistance.

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to the output impedance  $Z_0$  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 <sub>EXT</sub>			
V <sub>CC</sub>	C <sub>L</sub> R <sub>L</sub>		t <sub>PLH</sub> , t <sub>PHL</sub> t <sub>PZH</sub> , t <sub>PHZ</sub> t <sub>PZL</sub> , t <sub>PL</sub>		t <sub>PZL</sub> , t <sub>PLZ</sub>	
0.75 V to 2.75 V	5 pF	10 kΩ	0 V	0 V	$2 \times V_{CC}$	

#### Low-power configurable multiple function gate

### 12. Package outline

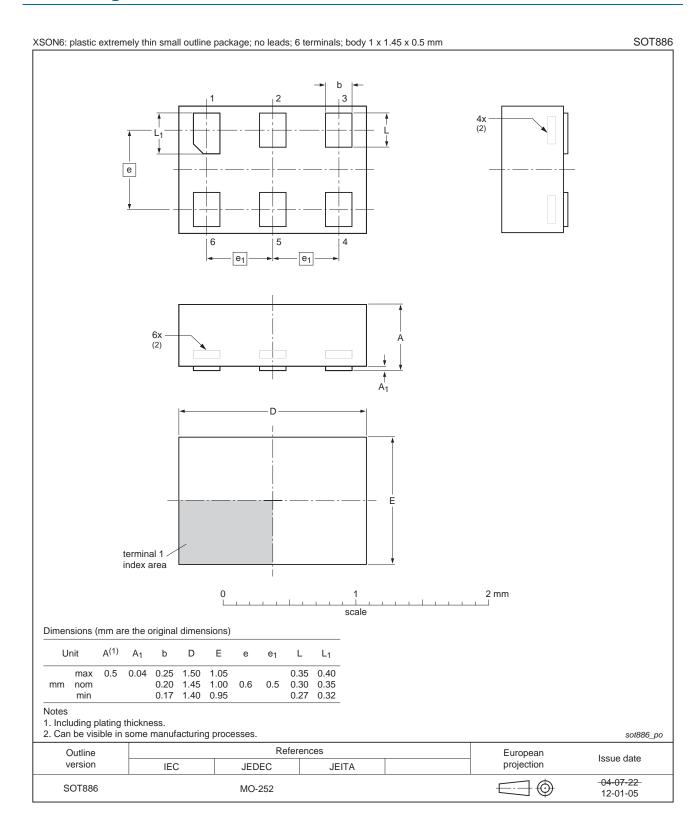


Fig 20. Package outline SOT886 (XSON6)

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#### Low-power configurable multiple function gate

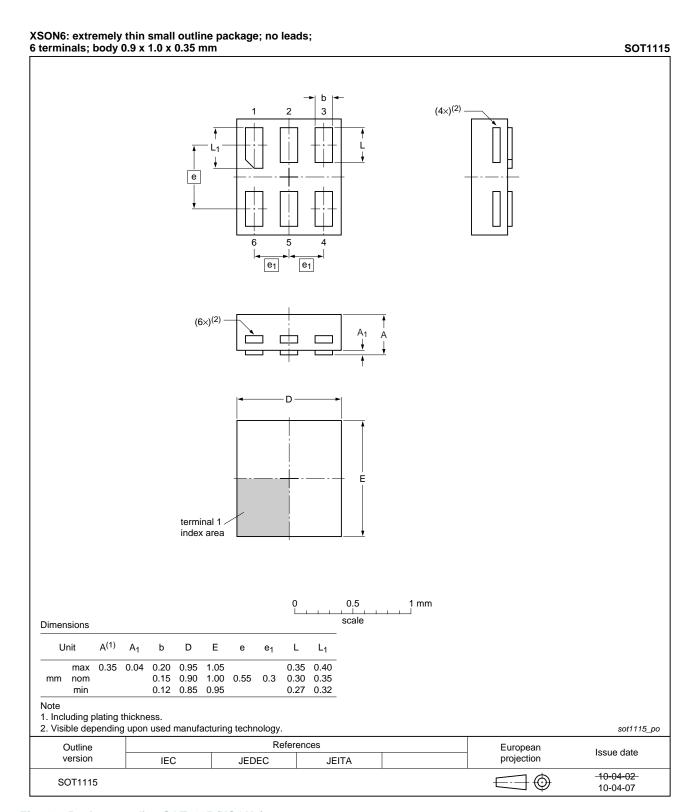


Fig 21. Package outline SOT1115 (XSON6)

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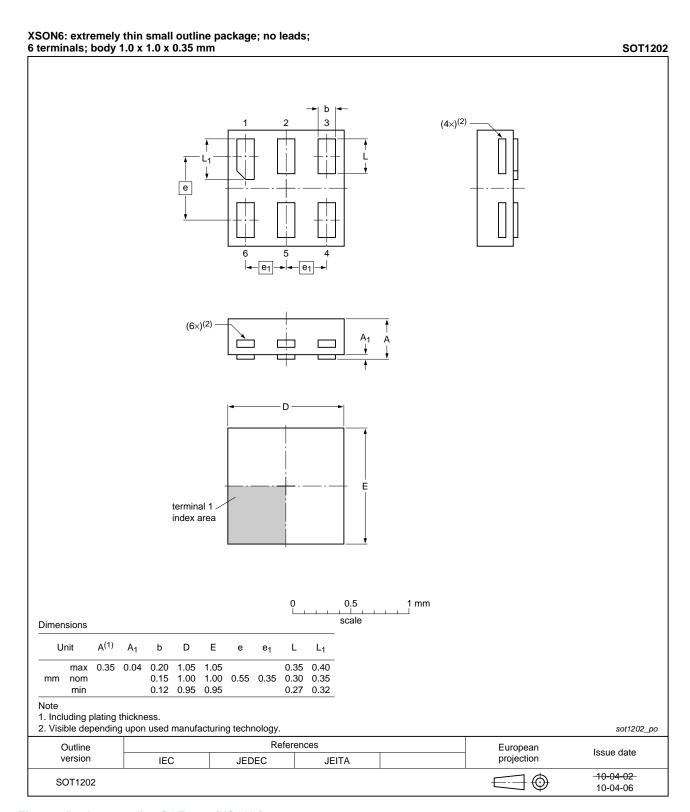


Fig 22. Package outline SOT1202 (XSON6)

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### Low-power configurable multiple function gate

### 13. Abbreviations

#### Table 12. Abbreviations

Acronym	Description
CDM	Charged Device Model
DUT	Device Under Test
ESD	ElectroStatic Discharge
НВМ	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	-	-

#### Low-power configurable multiple function gate

### 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 <a href="http://www.nxp.com">http://www.nxp.com</a>.

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#### Low-power configurable multiple function gate

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### Low-power configurable multiple function gate

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## **74AXP1G97** Packaging Information





Type Number	Orderable Part Number	Package Name
74AXP1G97GM	74AXP1G97GMH	XSON6
74AXP1G97GN	74AXP1G97GNH	XSON6
74AXP1G97GS	74AXP1G97GSH	XSON6